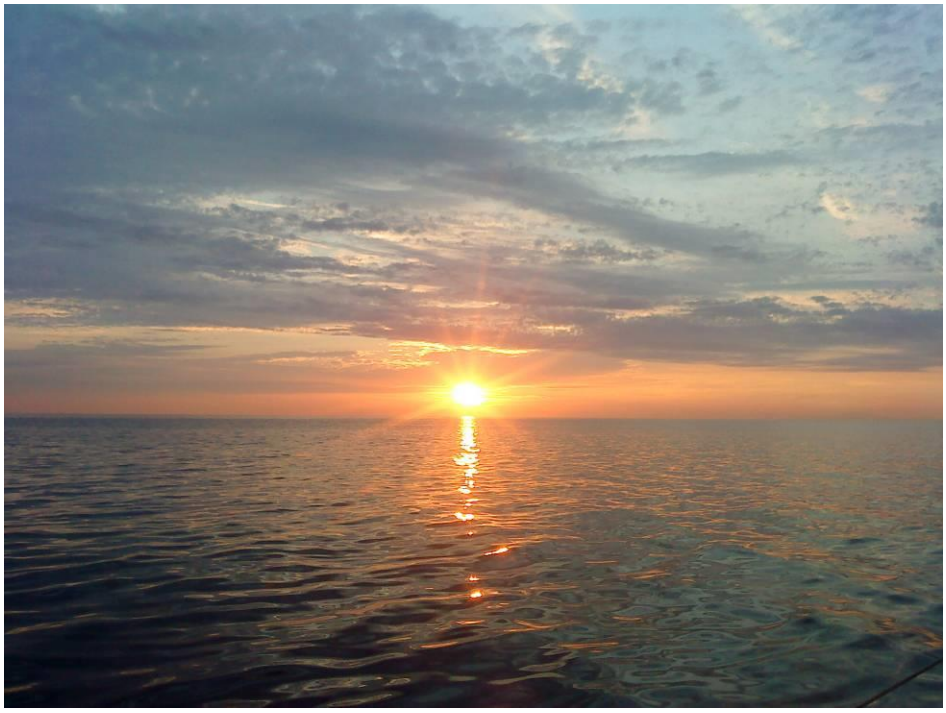
ADRIPLAN

ADRiatic Ionian maritime spatial PLANning



WP 1: Set up of MSP

AIP-1.2-1.1 – Initial Assessment

European Commission

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Contents

1 General framework

R. Mosetti, A. Barbanti

This report has to be considered a "work in progress document" in the sense that as the state of the ADRIPLAN project is evolving, it will be updated accordingly. This first version summarises the results and findings for the contextual analysis and initial assessment of the Adriatic-Ionian Macro-Region (AIR) as well as of the two focus areas. It constitutes a first guidance for developing a cross-border MSP. Thus this deliverable is a building block for the future work in those components where example cross-border marine spatial plans and a framework for the assessment of their performance will be developed. The contents comprises a comprehensive description of current state of maritime uses and environmental state of the AI region stressing the needs for cross-border MSP.

More precisely the borders, goals, operational objectives and targets, relevant policy frameworks, mayor human activities and bio-physical features were described moving from the maritime uses relevant for the study area to the environmental state through the descriptors of The Marine Strategy Framework Directive.

In addition, the strength and weaknesses were defined based on current experience, and the opportunities for cross-border MSP. Further most of the national processes are specific to the area and activities and therefore fully satisfy the first EU principle for MSP. The definition of objectives and the strong data and knowledge base showed the least deviations across the countries in the AI region. Further the principles on stakeholder participation and the achievement of a coherent marine spatial planning have been identified as fundamental for future MSP processes.

From this first analysis for a process of cross-border MSP we identified some key issues to be further explored in ADRIPLAN i) defining the regional basis for cross-border MSP, ii) testing the appropriateness of existing conventions, networks and institutions to facilitate cross-border MSP, iii) scoping the willingness of regional stakeholder groups to participate in a MSP process, iv) assessing the feasibility of a central data and knowledge base, and v) assessing the feasibility for a coherent planning and permitting system.

Going into details, the Initial assessment is based on the analysis of existing conditions of the different domains involved in the process of MSP. The report contains a recollection all information related to the topics as follows:

(i) Maritime uses: description of the human activities per sector, considering type, location, dimension and magnitude of the activity in AIR, as well as in the NA and SA;

(ii) Socio-economic aspects related to maritime uses;

(iii) Legal issues: international and national legislation on AIR;

(iv) planning regimes and tools: spatial planning, sectoral planning, permit issuing and concessions; the area of analysis consists in the inland, in the area related to the tools in forced from the coast line according to different sectors and level of planning.

(v) Environmental characteristics for AIR: spatial location of main environmental and ecological values present in the AIR and in the two Focus Areas. The main goal is to map the environmental, biophysical and ecological conditions of the planning areas. Environmental categories used to describe AIR, NA and SA are discussed within technical partners. The aim is to put the basis to a complete spatial description of AIR, aiming at covering with different level of precision (scale) the entire AIR.

There is a clear connection between ICZM and MSP. since the sea is included into the coastal zone. Since spatial planning of the managed area is one of the most important tools of integrated management of that area, then maritime spatial planning is a part of ICZM. This should also ensure that solutions of the developed spatial plans will be implemented in accordance with the principles of ICZM and by means of the ICZM decision making structure. On this matter in March 2011 the European Commission organised a consultation to gather

stakeholder feedback about the status and future of Maritime Spatial Planning (MSP) and Integrated Coastal Zone Management (ICZM). Respondents recognise the need for a close link between MSP and IZCM initiatives. A majority of the respondents (98 respondents, 43%) say that they would like to see coordination of MSP and ICZM but that the processes themselves should be kept separate. 52 respondents (23%) are in favour of a full linkage between ICZM and MSP. The separate question whether MSP and ICZM should be addressed through separate (legal) instruments yields 68% (115 respondents) against a separation of the two, with 38% (70 respondents) are in favour of separating the two tools. In this context, coordination and harmonization of approaches related to Integrated Coastal Zone Management (ICZM) and Marine Spatial Planning (MSP) need to be efficiently implemented.

2 Baseline knowledge on the Adriatic Sea

The following section presents the main morphological, physical, chemical and ecological features for the Adriatic – Ionian Macroregion (AIM) and for the two Focus Areas (Focus Area 1: northern Adriatic – FA1, and Focus Area 2: southern Adriatic and northern Ionian – FA2) (Figure 2-1).

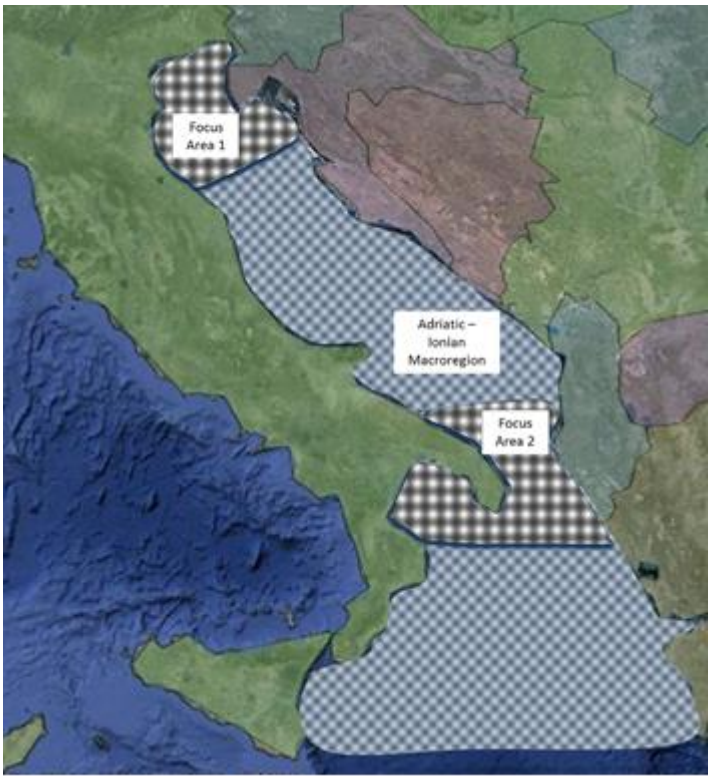


Figure 2-1 Map of ADRIPLAN study area.

2.1 Brief overview on state of Adriatic-Ionian basin: main ecological process and sources of pollution

R. Mosetti, P.K. Karachle, V. Vassilopoulou

The Adriatic Sea is a semi-enclosed basin that communicates with the Ionian Sea through the Otranto Strait. Its northern part is the largest shelf area of the entire Mediterranean, while the southern part is characterized by the presence of a circular pit (South Adriatic Pit) having the maximum depth of 1200 m. The Otranto Sill on the other hand, is up to 800 m deep. Eastern coast is characterized by large number of islands, bays and caps with a rather steep coast, while the western coastal area is very smooth with a gentle sloping bottom.

The southern boundary of the sea ends in the Strait of Otranto between Albania and Italy's Salento Peninsula. Immediately south of that strait the Ionian Sea begins (Figure 2-2).

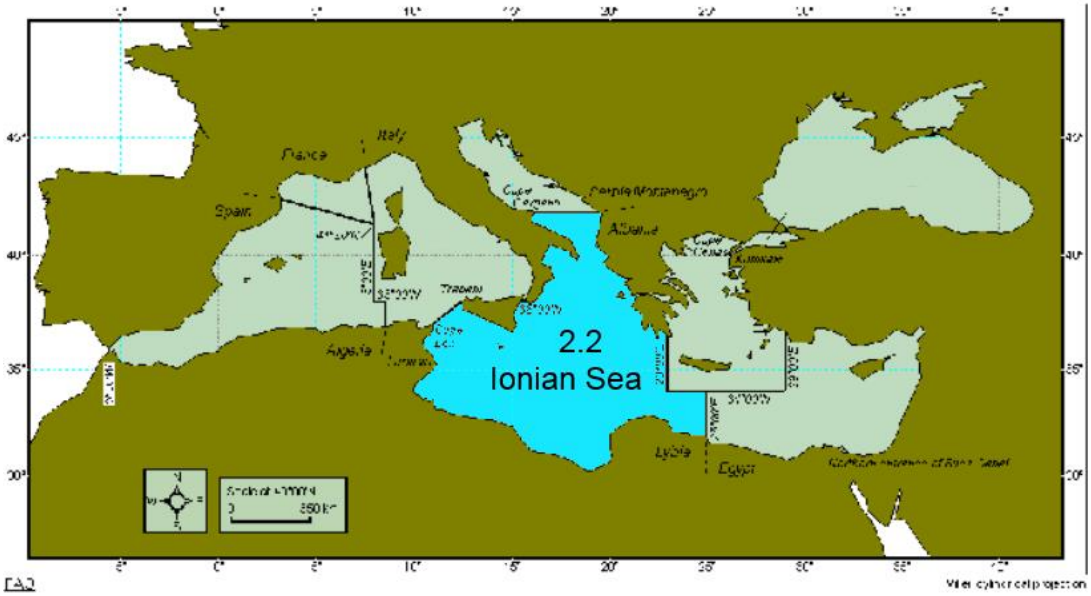


Figure 2-2 The boundaries of the Ionian Sea (source: www.fao.org, modified)

The Ionian Sea is the deepest sea of the Mediterranean Sea (Hersey, 1965) and lies immediately to the south of Otranto Strait which forms the boundary with the Adriatic Sea. Its dominant physiographic feature is the West Hellenic Trench (Ryan et al., 1970) that starts at the base of the complex continental margin of West Greece, southwest of the Greek Ionian islands and continues south of mainland Peloponnesos and the islands of Kithira Antikithira and Gavdos continuing further east into the Levantine Sea.

The southernmost exit of the Adriatic Sea (Ferentinos & Kastanos, 1989) connecting into the Ionian Sea forms at the southernmost limit of the Strait of Otranto (minimum width of 75 km and with sill depth of around 780m) separating the 1200m deep South Adriatic basin (Savini & Corselli, 2010) from the much deeper Ionian Sea. Effectively this is achieved through the submarine Kerkyra (Corfu) Fault Valley that starts forming NW of the Othonoi islands with water depths over 1000m deepening southwards. The orientation of the longitudinal axis of the Otranto Strait extends southwards along the longitudinal axis of the Kerkyra Fault Valley. The SE end of the shelf of the Adriatic Sea abruptly ends west of the Othonoi-Kerkyra islands.

The Greek part of the Adriatic Sea and the north Ionian Sea are typical coastal Mediterranean areas, where the air temperature and the rainfall are the main drivers for the sea temperature and salinity variations.The Greek part of Ionian Sea is composed by warm and high salinity water while the Italian part has colder and slightly lower salinity (D' Onghia et al. 2003).

Concerning the coastal morphology, the Adriatic and Ionian coastal landscapes hosts a diversity of geomorphological features that can be generally divided into two major groups providing a useful distinction for coastal management and planning: “cliffed and rocky coasts” and “coastal plains”. The two categories are not mutually exclusive, nor restricted to particular geographical areas of the Adriatic-Ionian Macroregion.

Cliffs and more gently sloping rocky shores are often composed of various types of limestone which form the basis for the landscapes of the hinterland. The eastern side of the Adriatic basin is characterised by the close proximity of the Dinaric Alps, while in the western side the main orographic reliefs (the Apennine) are more distant from the coast. The combination of thin limestone soils, climate and the long history of grazing and burning of the natural vegetation has helped to create the low shrubby drought- and grazing-resistant vegetation which covers large areas of the coastline.

Deltas and narrow coastal plains, generally occupied by wetlands and lagoons define the landscape of the north-western coastal area. It includes the Po Delta, a human-controlled environment, as the excavation of artificial channels started from the 17th century. This

alluvial territory has always been interested by natural subsidence problems, made worse in the '40 and '50 by the extraction of natural gas, finally stopped by Italian government in 1961. Currently the Delta is completely below sea level (except for banks, sandbars and fossil dunes) and water management is operated with a huge system of drainage.

There are more than 20 other rivers flowing into the Adriatic Sea in Italy alone, also forming alluvial coastlines, including the lagoons of Venice, Grado and Caorle, all of high ecological relevance. There are also smaller eastern Adriatic alluvial coasts—in the deltas of the Dragonja, Bojana and Neretva rivers. The dunes associated with these sedimentary areas may also be extensive, often supporting a shrub vegetation similar to that of the hinterland.

A part from the peculiar geomorphology of lagoons and delta, the Italian Adriatic coasts are relatively low, smooth and regular, in particular in the north-western part of the basin, while further south along Apulia coast long sandy or pebble beaches are alternated with mountainous promontory (Gargano) or sea-sculpted rocky cliffs.

On the other side, the Croatian coast is characterized by an irregular bottom that increases sharply in the offshore direction and a high number of islands, along the Istria and Dalmatia coasts. The Dalmatian islands, which are long and narrow (the long axis lying parallel with the coast of the mainland), rise rather abruptly from the sea, with the exception of a few larger and flater islands like Brac or Krk.

The east Adriatic shore's Croatian part is the most indented Mediterranean coastline, characterised by a karst topography, developed from the Adriatic Carbonate Platform's exposure to weathering. Similarly, karst developed in Apulia from the Apulian Carbonate Platform. The largest part of the eastern coast consists of carbonate rocks, while flysch (a particular type of sedimentary rock) is significantly represented in the Gulf of Trieste coast, especially along Slovenia's coast where the 80m Strunjan cliff—the highest cliff on the entire Adriatic and the only one of its type on the eastern Adriatic coast—is located, on the Kvarner Gulf coast opposite Krk, and in Dalmatia north of Split. Rocks of the same type are found in Albania and on the western Adriatic coast.

The Albanian coastal zone is characterized by versatile structures such as cliffs, grottoes, caves, slopes, natural harbours, bays and wetland areas. The alluvial plains and wetland areas of the northern coast between Shkodra and Vlora have been considerably altered to support human settlement and activities, while the rugged constitution of the southern coast has so far preserved its wild character.

Considering this general framework for the AIM coastal zones, fundamental issues for Maritime Spatial Planning has to be addressed. Indeed, many of the antrophic pressures coming from maritime activities can lead to different impacts on the coasts, adding to those of human activities often developed together in the narrow shoreline strip. Moreover, the population density on the coast is very high: half of the population of EU countries with a sea border is located in coastal regions and this number keeps increasing (Eurostat 2013) while all the Adriatic and Ionian countries face a strong seasonal increase due to tourist activity.

Main freshwater sources are on the western and northern coast, the Po river being the largest one of the entire Adriatic with an average discharge of 1500 m3/sec.

Basin-wide thermohaline circulation is cyclonic and driven by an interplay of the longitudinal and transversal density and pressure gradient (Figure 2-3). Both pressure gradients are controlled by salinity; northern and western shore being characterized by the presence of a relatively fresh water coming from the river run-off. The salinity influence is reinforced by the temperature gradient during the summer time when warmer water can be found along the shallow northern and western shores. During the winter the thermal conditions weakens the longitudinal and transversal pressure gradients, however rather rarely invert the general cyclonic circulation. Annual negative heat balance and the prevalence of the freshwater discharge (precipitation plus rainfall) over evaporation makes of the Adriatic on one hand, a source of the cold and dense water while on the other, it releases freshwater to the Eastern Mediterranean.

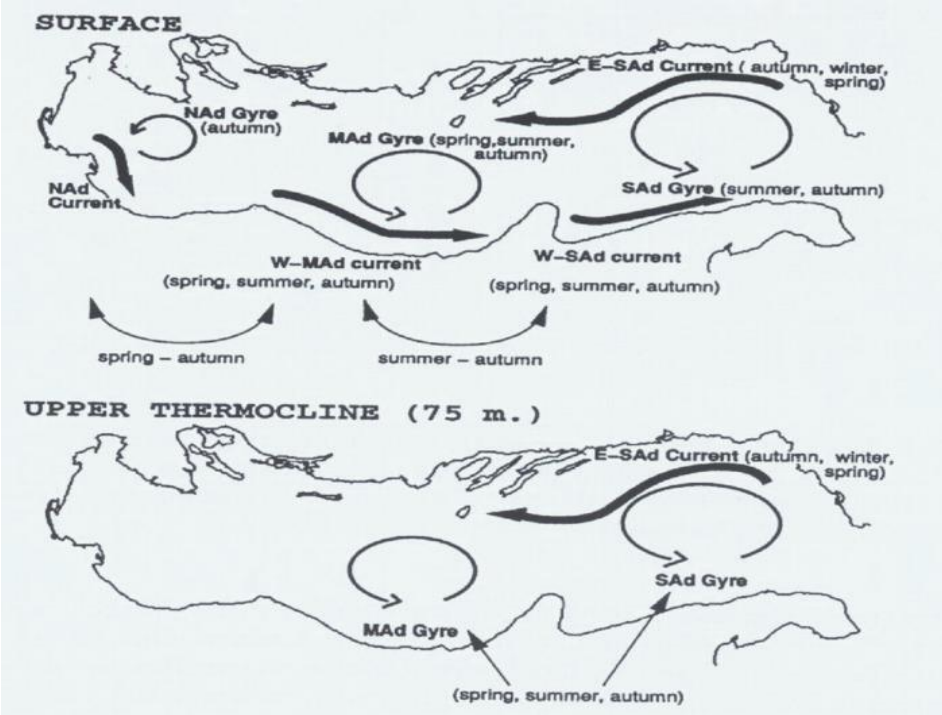


Figure 2-3 General circulation scheme of the Adriatic Sea (from: Artegiani et al. 1993).

During the winter, Adriatic Sea area is under influence of passages of synoptic perturbations that generate sequences of relatively warm and humid SE wind (called scirocco, jugo in Croatian), and cold and dry NE wind bringing continental air masses. This catabatic wind called bora (bura in Croatian) is responsible for the vertical mixing of the water column and generates strong heat losses due to both sensible and latent heat air-sea heat exchange. Summer season is characterized by the permanence of the Azorian high over the area, winds are relatively weak and diurnal sea-breeze regime is well pronounced in the coastal area. In open sea weak etesian winds have been observed.

Coastal circulation differs between the eastern and western coast due partly to the coastal topography so that the western coastal current is rather narrow, swift and continuous, controlled by the freshwater discharge. Mesoscale instabilities are formed along the coastal front resulting in the formation of eddies that detach from the alongshore stream and contribute to the exchange between the coastal and open sea areas. Eastern circulation branch is slightly larger and occupies the area outside the Croatian island belts. No instabilities have been observed whatsoever except for the wind induced filaments occurring at location of straits between some islands and trapped at the open sea bathymetric features. In bays and channels between islands and the shore the thermohaline circulation is generally less important with respect to time-varying flow. The temporal variability on synoptic time-scales forced mainly by local winds are very prominent, while tidal currents are generally weak. Thus, water exchange and residence times in semi-enclosed bays are determined by the intensity and duration of local wind forcing.

Rather good knowledge of the wind-driven circulation within the Croatian coastal area exists especially in the vicinity of large cities and/or industries so the area of Zadar, Sibenik and Rijeka are very well studied. Also, coastal circulation along the western coast of Istria is rather well known. In the Split area for example it has been shown that bora is the most frequent wind with a frequency exceeding 30% especially in the period October - December. In the same period, the sirocco is of a slightly lower frequency and thus the two winds determine major portion of the current field variance. It was shown from intensive studies in the Split area (Kastela Bay) that the local wind forcing accounts for about 70% of the variance in the low-frequency current variability at the bay inlet. Vertically the wind-forced flow field can be described by a two layer structure, drift currents prevail close to the sea surface while upwind currents predominate in deeper layers. In front of Dubrovnik there are no islands and the shelf

is rather smooth and thus the alongshore flow is determined either by local winds and to a larger extent than at the rest of the coast, by a remote forcing. Moving northward the relative importance of bora becomes prevailing and thus its influence on the coastal circulation predominates. In Rijeka Bay the northernmost basin of the Croatian coast, the cyclonic flow prevails with an out-of-phase behaviour of the two inlets. Both bora, more frequent wind, as well as sirocco enhance this circulation pattern however generating either transient and quasi-steady water exchange pattern. Vertically in this case the flow structure is a barotropic-like with a negligible vertical shear. Coastal circulation along the western Istrian coast is driven by the general basin-wide cyclonic circulation. However, important contributions are evident from the local wind forcing. Bora has a strong importance also because of the large curl in the wind field that can result in diverging coastal current associated to two counter-rotating gyres. The divergence area seems to be near Rovinj where the bora wind attains a minimum. Recently during a summer season, the occurrence of a semi-permanent counter-current flowing southward in some years has been observed and the phenomenon was named Istrian Coastal Counter Current. It has not yet been clear what is a mechanism responsible for the generation of this coastal current reversal and whether this circulation change has an impact on ecological conditions in the Northern Adriatic especially in relation to mucilage events.

The formation of mucilage in the Adriatic Sea has been recorded since 1729 and occurred at irregular intervals in time from at least the 19th century until the first-half of the 20th century. In the summer of 1988, apparently after more than 30 years, mucilage re-appeared throughout the Northern Adriatic Sea. The phenomenon was observed again in 1989, 1990, 1991, 1997, 2000, 2001, 2002 and 2004 with different temporal and spatial distribution. Mucilage is constituted by organic gelatinous material which forms aggregates characterised by varying sizes and shapes and by their vertical distribution along the water column. Researches of this phenomenon have been dominated by the idea that organic matter is copiously exuded or released by diatoms or dinoflagellates during phosphorus (P)-limited conditions, during scarce riverine inputs, unbalanced nutrient availability, low grazing pressure, and or massively released by lysis during virus infection. Bacteria also play multifaced, varied and dominant roles in the production of long-lived organic matter. In either case, the sudden appearance of the huge mucilage carbon pool suggests the dissolved organic matter (DOM) as its proximal source; it is a sufficiently large and seasonally variable pool with potential for transformation into particle or gel phases. Essential environmental conditions for the accumulation of organic matter to form mucilage at nuisance levels include the development of stable vertical stratification of the water column. In fact, mucilage episodes generally occur during summer causing significant impacts on recreational uses of coastal waters.

Both toxic and non toxic harmful algae bloom events (HABs) occur in the Adriatic Sea. Of the toxic species Dinophysis spp. is the most serious problem because of its impact on mussel mariculture but more recently Ostreopsis, causing healty problems along the Thyrrenian coasts, is detected in the Adriatic Sea.

Seasonal hypoxia occurs in several regions of the Adriatic Sea. These include waters affected by discharge of the rivers, open waters of the NAS extending over 1999s of square kilometers, the central Adriatic Depression in years when dense winter water is not formed, and some bordering estuaries and bays, including Krka estuary, Pula and Split harbors, Rogoznica and Mljet "lakes". Hypoxia can cause mass mortalities of marine life, altered migrations of demersal fish and invertebrates, loss of biodiversity, disruption of reproductive cycles, and loss of structure and function of benthic ecosystems in the Adriatic, Hypoxia occurs as the result of biological production, organic matter degradation, and physical processes that restrict reaeration from the atmosphere.

Coastal systems are subjected to high nutrient loading that supports high phytoplankton production and to high organic matter input. Vertical flux and decomposition of organic matter of autochthonous or allochthonous origin coupled with physical oceanographic conditions that prevent flushing of bottom waters culminate in reduced dissolved oxygen concentrations.

Mucilage events, oxygen depletion of bottom water, harmful algal bloom, outbreaks of gelatinous zooplankton, invasion of non indigenous species may be indicative of a pattern of environmental stress that threatens the health of coastal ecosystem of the Adriatic. This basin supports extensive and economically viable fisheries. In recent years, annual landing have

been about 100,000 tons. Clupeid fishes, which occupy a lower trophic level and feed primarily on zooplankton, dominate much of fishery. Total catches of small pelagic fishes have ranged from 40,000 to 100,000 tones over the past 20 years. Such wide fluctuations reflect year to year variations in recruitment which may be related to the abundance of their food supply.

The sustainability of the fisheries of the Adriatic Sea are threatened by over fishing and changes in water quality that may be related to high nutrient loads. Three species contribute to the yields of the small pelagic fishery: anchovy (Engraulis encrasicolus), sardine (Sardina pilchardus) and sprat (Sprattus sprattus). The Croatian fishery mainly targets sardines for the canning industry. S.pilchardus inhabits the whole Mediterranean but the main spawning areas are along the Croatian coast (Lastovo-Palagruža, Biševo-Vis-Svetac-Pelagrin, Dugi Otok, Istria), but eggs can be found almost in the whole basin. Thermal fronts have been associated with spawning activity. In the southern Adriatic a special trawl fishery close to the coast yields a few hundred tons of sardine larvae highly appreciated by national market. A positive correlation in primary production and a negative correlation of mean water temperature with yearly class strength of sardines three years later have been observed.

As in many coastal environment throughout the world, the watersheds of the Adriatic Sea are regions of rapid population growth and changing land use patterns that have lead to the increases in nutrient loading and changes in freshwater flow patterns to coastal waters that have been especially pronounced during the last 100 years. The Adriatic region is characterized by intensive land-based and sea-based activities, including urban growth and development, agriculture, commercial and recreational fisheries, tourism, and multinational commerce. Changes in these activities are widely believed to have elicited significant degradation of water quality, manifested as mucilage events, oxygen depletion of bottom water, harmful algal bloom, outbreaks of gelatinous zooplankton, invasion of non-indigenous species, loss of habitat and instability of fishery. Individually, these phenomena may not be caused for concern. But taken as a whole, they may be indicative of a pattern of environmental stress that threatens the health of coastal ecosystem of the Adriatic.

2.1.1 Focus Area 1

The typical near surface circulation in the northern Adriatic inferred from hydrographic (Artegiani et al., 1997; Hopkins et al., 1999; Malanotte-Rizzoli and Bergamasco, 1983) and drifter (Poulain, 2001; Poulain et al., 2001; Ursella et al., 2006) includes (1) a Eastern Adriatic Current (EAC) flowing towards the northwest along the Croatian coast, veering across the basin following approximately the 50-m isobath south of the Istrian Peninsula, and joining the Western Adriatic Current (WAC); (2) a cyclonic gyre, the North Adriatic Gyre (NAG), occupying most of the northernmost shallow area; (3) a WAC flowing southeastward along the Italian coast south of the Po delta area; and (4) smaller anticyclonic features tugged between the above-mentioned structures, one near the Istrian coast and the other south of the Po delta. As revealed by numerical simulations (Kuzmic and Orlic, 1987; Bergamasco and Gacic, 1996; Pullen et al., 2003) and by drifter data (Ursella et al., 2006), this circulation is strongly influenced by the local wind forcing. During Bora events, the across-basin flow, the double vortex (the large NAG to the NW and the small anticyclone near southern Istria) and the WAC are reinforced. In contrast, during Sirocco southeasterly winds, the EAC flows to the NW as far as the end of the basin, veers cyclonically and continues to the SE as a weak WAC. Besides this wind-driven variability, the currents also show variations at shorter scales of a few days and a few kilometers, related to barotropic and baroclinic instability processes. These mesoscale structures are mostly visible under weak wind conditions.

The wind-driven variability described above for the near-surface currents can also be seen in the distribution of water mass properties such as the sea surface temperature (SST), the near-surface chlorophyll concentration (<Chl>) and the sea surface salinity. Indeed as described in Barale et al. (1986), Mauri and Poulain (2001) and Mauri et al. (2006), the SST and <Chl> fields respond significantly to the wind forcing and to the advection by the currents, resulting in patterns such as the cold, low-salinity and nutrient-rich Po River plume being advected across the basin and the cold, low-salinity and nutrient-rich Western Coastal Layer (WCL)

collocated with the WAC near the Italian coast. Salinity in the northern Adriatic ranges from about near zero near the mouth of the rivers to a maximum of about 38.4 in the southeastern area where salty modified Levantine Intermediate Water (LIW) is inflowing (Artegiani et al., 1997).

The Adriatic SST has been studied by various authors, mainly using satellite-derived measurements. Using Advanced Very High Resolution Radiometer (AVHRR) images in the early 1980's, Phillipe and Harang (1982) described the thermal front associated with the WCL in winter, with Po-influenced cold water inshore and relatively warmer Adriatic water offshore. They also showed a persistent front crossing the northern Adriatic south and southwest of Istria, separating colder water to the north from warmer water to the south. This front is referred to as the Istrian front in this paper. These SST frontal structures are also present in the results of Gacic et al. (1997), Bohm et al. (2003) and Barale et al. (2006). In summer, the SST gradient is essentially reversed with colder (upwelled) water to the east and warmer waters in the open sea and along the Italian coast. A cold-offshore flowing filament rotted south of the Istrian Peninsula (in Kvarner Bay), and therefore collocated with the winter Istrian front, was documented Borzelli et al. (1999). Due to its continental nature, the northern Adriatic experiences large SST variations at seasonal scale, with temperature minima near 8°C in winter and temperature reaching 28°C in summer (Gacic et al., 1997; Bohm et al., 2003; Barale et al., 2006).

Outside the areas directly influenced by the river discharge, including the WCL and the Po river plume occasionally extending across the basin, the chlorophyll-like pigment concentration in the northern Adriatic (in its central and southeast sectors) vary seasonal between a maximum in winter (<Chl> > 1 mg/m^3) and a minimum in summer (<Chl> < 0.5 mg/m^3). This seasonal variability was studied using satellite data by Bohm et al. (2003), Barale et al. (2006) for the whole Adriatic basin using Sea-viewing wide field-of-view (SeaWiFS) satellite data. The variability of the near-surface chlorophyll concentration in the northern Adriatic derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) for the period 2002-2005 was studied statistically by Mauri et al. (2006). Chlorophyll concentration values and patterns in both the open sea and in the Italian coastal waters were shown to be influenced by both the river discharge and the local wind forcing. As seen in SeaWiFS images in late summer 1997 (Mauri and Poulain, 2001), during Bora and under stratified conditions, the nutrient-rich Po water can expand in most areas of the northern Adriatic north off the Po River delta where <Chl> is in excess of 1 mg/m^3 (Poulain et al., 2007).

During winter the mean temperature in the basin is of 11.56 °C (12.23 °C is the median). A thermal gradient is present both along the longitudinal and transversal axis, with mean temperature below 7 °C in the north and above 13 °C in the south-eastern area. This is also due to the cyclonic circulation of the basin, that brings in warmer waters from the southern basin, while the northernmost waters, subjected to large heat losses due to Bora winds (strong katabatic winds coming from NE), are transported to the south-east along the Italian coast (Dorman et al., 2006) (Figure 2-4). Colder waters are also found in the sea region in the proximity of the Dalmatian islands and eastern coast, an area that is directly exposed to the cold Bora wind action. During spring time the situation is more variable.

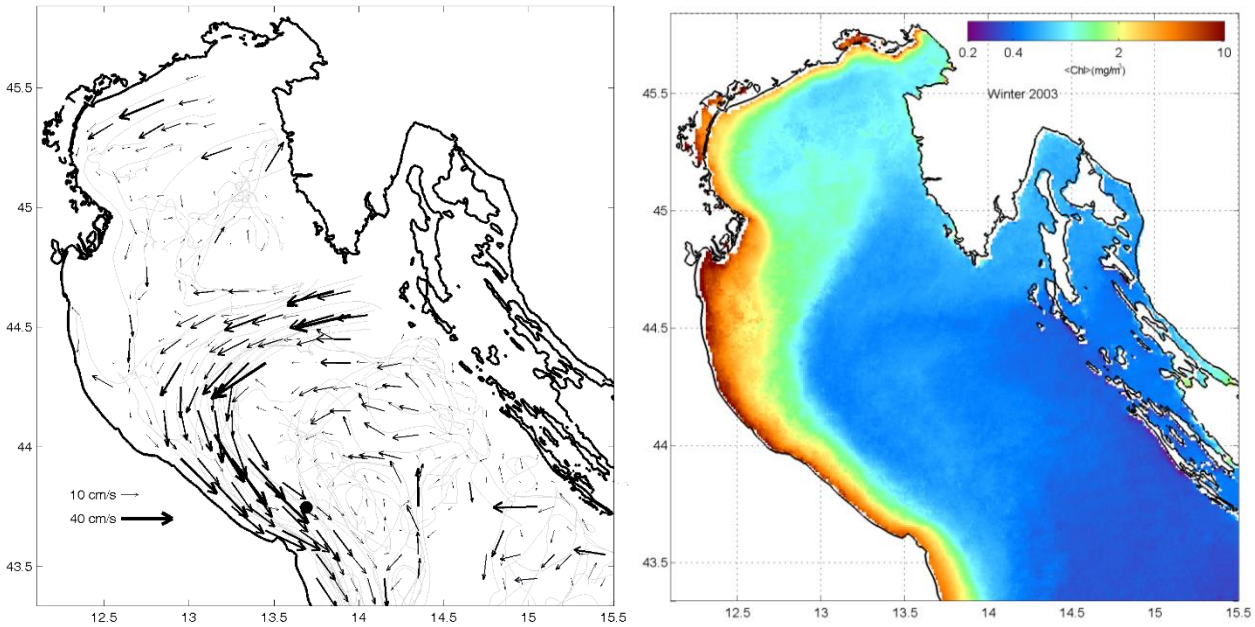


Figure 2-4 Left: Example of circulation from Bora event: near-surface circulation map in winter 2003 derived from the drifter low-pass filtered velocities averaged in bins of 0.1º x 0.1 º bins. The arrows are depicted only for bins with more than three 6-hourly velocity observations. Right:Color-coded map of winter averaged near-surface MODIS chlorophyll concentration (January, February and March 2003).

Mean temperatures in the region are comprised between 14-23 °C (mean value 17.3 °C, median 17.07 °C), with maxima found in the western region and minima in the Dalmatian islands area. In the summer time the thermal variability is much lower, with mean values bracketed between 21 and 27 °C (mean 24.47 °C, median 24.44 °C), and maxima in the south-west region, minima in the eastern one (also because of upwelling phenomena). During the fall season the surface waters get cooled down, and this happens faster in the north-east and south-west part of the basin, with values between 13 and 22 °C (averaged values in the area being 18.14 °C, median 18.37 °C (Figure 2-5)

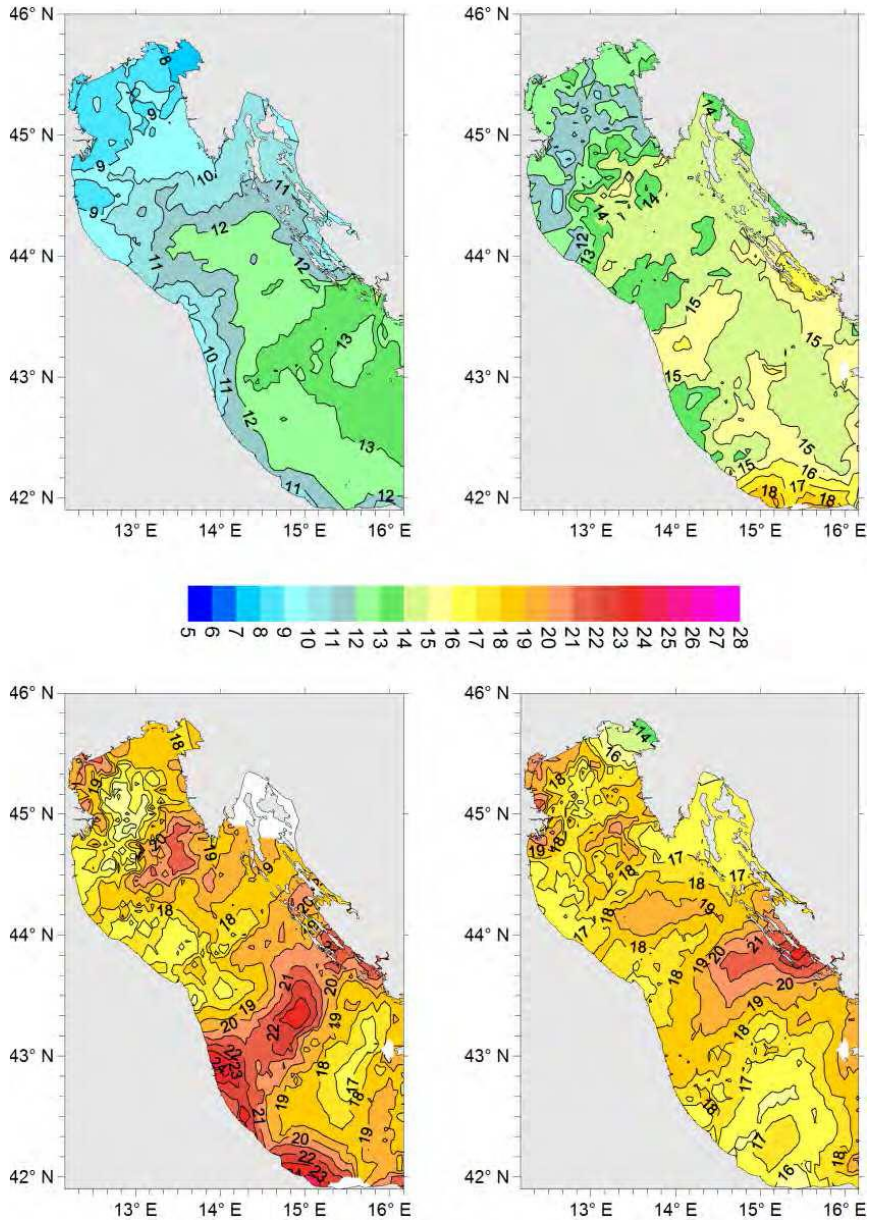


Figure 2-5 Seasonal climatological maps (winter top left, spring top right, summer bottom left, autumn bottom right) of 20 m depth temperature (°C) in the northern-central Adriatic Sea (note that a small area close to the Italian coasts is actually shallower than 20 m). (FROM:; Russo, Aniello; Carniel, Sandro; Sclavo, Mauro; and Krzelj, Maja, "07 Climatology of the Northern-Central Adriatic Sea" (2012).*Modern Climatology.* Book 8. http://digitalcommons.usu.edu/modern_climatology/8)

Maxima salinities are reachedduring winter and minima ones in summer, that is not perfectly matching Po river discharge, whose maxima are reached in spring-autumn and minima in summer. During winter, the mean salinity is 37.40 (median 38.18); along the coastal region there exists a band of low salinity waters, which largest extension is found in front of the Po delta area The whole northern area between the Po river delta and Istria peninsula has salinity values lower than 38.00, while higher values (up to 38.40) are observed in the central-eastern region of the basin (Figure 2-6).

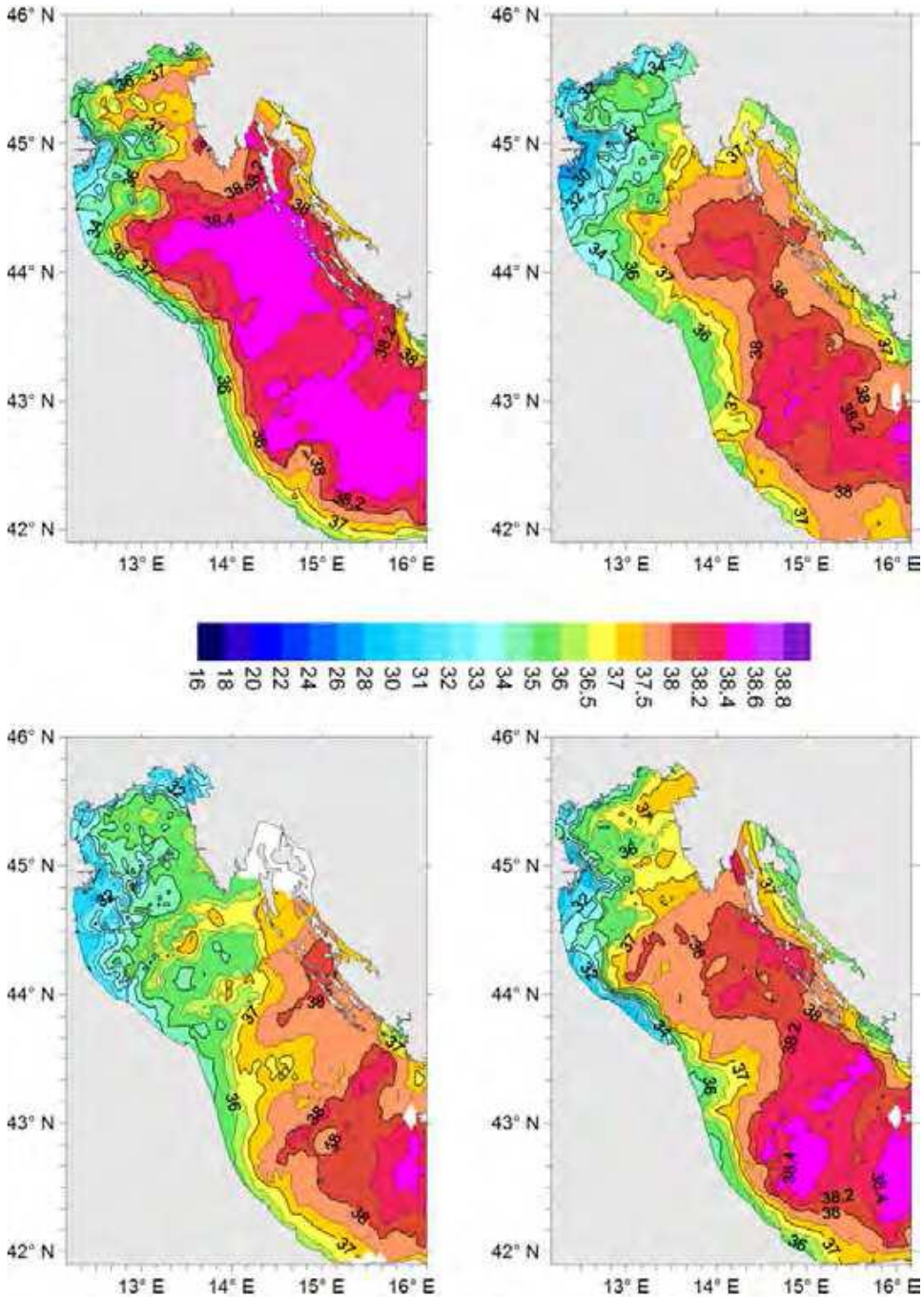


Figure 2-6 Seasonal climatological maps (winter top left, spring top right, summer bottom left, autumn bottom right) of surface salinity in the northern-central Adriatic Sea.

2.1.2 Focus Area 2

In the Ionian Sea during the warm period the surface temperature reaches 24° C, while in the deeper layers the temperature falls at 16° C. There is strong thermocline formation at about 50 m depth (Figure 2-7a). During the cold period of the year there is mixture of the water masses and the surface temperature is about 16° C while the in the deeper layers is about 15° C.

Salinity presents a surface minimum (at about 34.5) psu during the cold period, mainly near Kalamas River mouth (Figure 2-7b). But this signal is very superficial and local. The summer salinity profile is typically stable at 38° C.

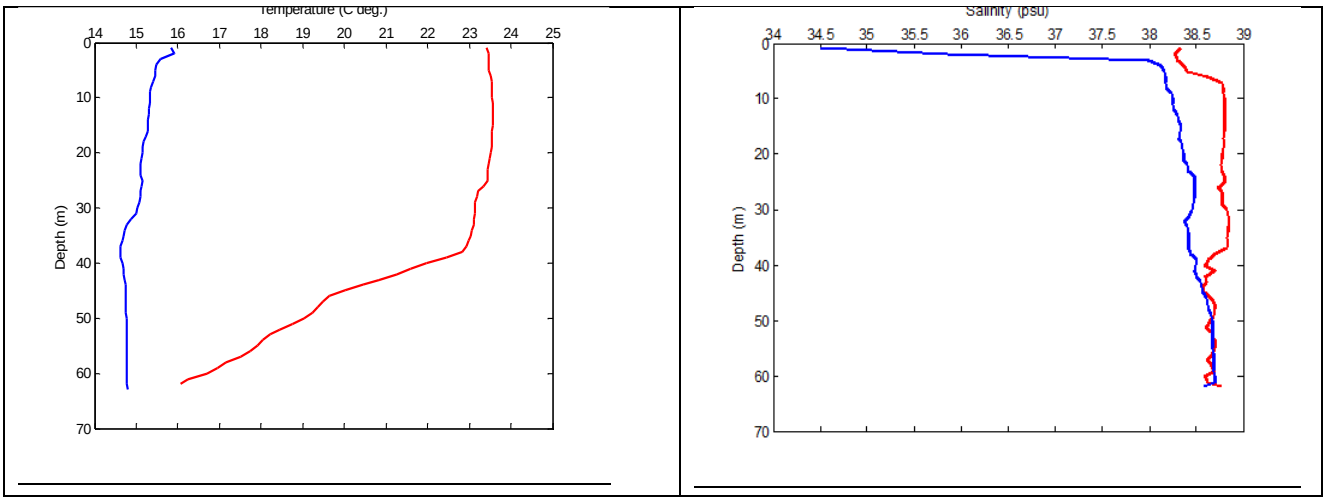


Figure 2-7a Sea temperature profile during winter (blue line) and during summer (red line); figure 2-7b: Salinity profile, during winter (blue line) and during summer (red line)

In the coastal region between the Island Kerkyra and the Hellenic mainland, the local fresh-water input is very low through the whole year.

The temperature of the surface waters of the coastal areas has a strong annual cycle reaching 26.0° C or even 28.0-30.0° C in more enclosed areas such as the Amvrakikos gulf. In contrast, the temperatures in the winter can reach the 11.0-12.0° C. This leads to strong seasonal thermoclines during the summer in depths between 30 and 60m (SoHelME 2005). Table 2-1 summarises the ranges in temperature and salinity values of some coastal regions during summer and winter (SoHelME 2005).

Table 2-1 Typical surface-to-bottom ranges of temperature and salinity in several coastal areas of the Ionian Sea during winter (February, March) and summer (August, September), and representative surface/bottom standard deviation values of them (based on CTD data from the Medar Group 2002).

	WINTER		SUMMER	
	Temperature ° C (Surface-Bottom)	Salinity (Surface-Bottom)	Temperature ° C (Surface-Bottom)	Salinity (Surface-Bottom)
Corfu	11-15	37-38	25-14	38-39
Epirus coasts	12-15 (at 50m)	37-38 (at 50m)	23-16 (at 50m)	37.5-38.8 (at 50m)
Amvrakikos Gulf	10-15	26-38	30-14	26-38
Patraikos Gulf	12.5-12.5 (at 50m)	38.5-38.5 (at 50m)	25.5-15.2 (at 50m)	38.4-38.5 (at 50m)
W. Peloponnisos	15-15 (at 30m)	38.5-38.5 (at 30m)	25-20 (at 30m)	38.7-38.8 (at 30m)

The knowledge of the circulation of Hellenic Ionian coastal areas is rather limited (Figure 2-8). The circulation in the open sea of Ionian is determined by the general circulation of the central Mediterranean Sea as well as the bottom topography and the local interaction with the atmosphere.

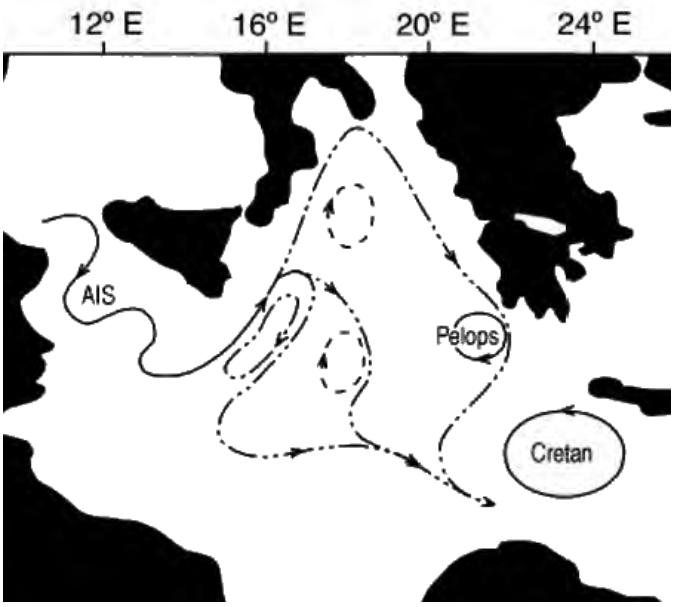


Figure 2-8 Surface circulation of the Ionian Sea and the Central Mediterranean (Source: Malanotte-Rizzoli et al., 1997. Modified)

Water masses are well oxygenized (about 5-6 ml/l) with the exception of some very coastal areas near river mouths or human activities (e.g. aquaculture), where some low oxygen values (about 3ml/l) are measured during the worm period of the year.

The inflowing Atlantic Water (AW) mass, which is characterised by low salinities and is being modified by mixing and air-sea interaction along the African coast, occupies a 150-200 m thick layer in the Ionian Sea. The thickness of this surface layer decreases as it flows eastwards. The Eastern Mediterranean Deep Water (EMDW) mass is formed in the Ionian Sea, where the intermediate waters are being mixed with the deep cold and dense winter Adriatic waters that are outflowing through the Otranto Strait.

Until 1987 the Ionian sub-basin scale circulation consisted of a number of cyclonic and anticyclonic gyres and a meandering jet (Figure 2-8) (POEM group 1992, Malanotte-Rizzoli et al. 1997). According to this dynamic structure, the Atlantic Ionian Stream jet is formed by the North African Current which enters the Sicily Strait. It consists of two main branches: the Ionian Anticyclones (IA) in the central of Ionian Sea with multiple centers and a second branch which crosses the entire Ionian from north to south, advecting AW on its left side and Ionian Sea surface Water (ISW) on its right. Then, this jet meanders further eastward and forms the Mid-Mediterranean Jet (MMJ) while crossing the Cretan Passage carrying AW to the east. Between the late 1980s and the late 1990s the circulations changed due to the decrease of AW into the Aegean and Levantine basins and the rising salinities in these areas (Malanotte-Rizzoli et al., 1997).

The upper-layer cyclonic/anticyclonic circulation in the Ionian Sea is determined by the mechanism of the Adriatic-Ionian Bimodal Oscillating System (BiOS) (Figure 2-9). This changes the circulation of the North Ionian Gyre (NIG) from cyclonic to anticyclonic and vice versa, on decadal time scale. The variability in the upper-layer Ionian circulation of the last 20 years has been primarily driven by changes in the thermohaline processes associated with modifications in the properties of Adriatic Dense Water (AdDW) (Gacic et al., 2010). It has been shown, that this internal mechanism can also shape the biogeochemical conditions in the Southern Adriatic. Depending on the circulation regime in the Ionian Sea the nutricline and the

oxygen minimum/nutrient maximum layer are either upwelled or downwelled. This determines significant variations in the biogeochemical concentration of the water column moving towards the Adriatic through the Strait of Otranto (Civitarese et al., 2010).

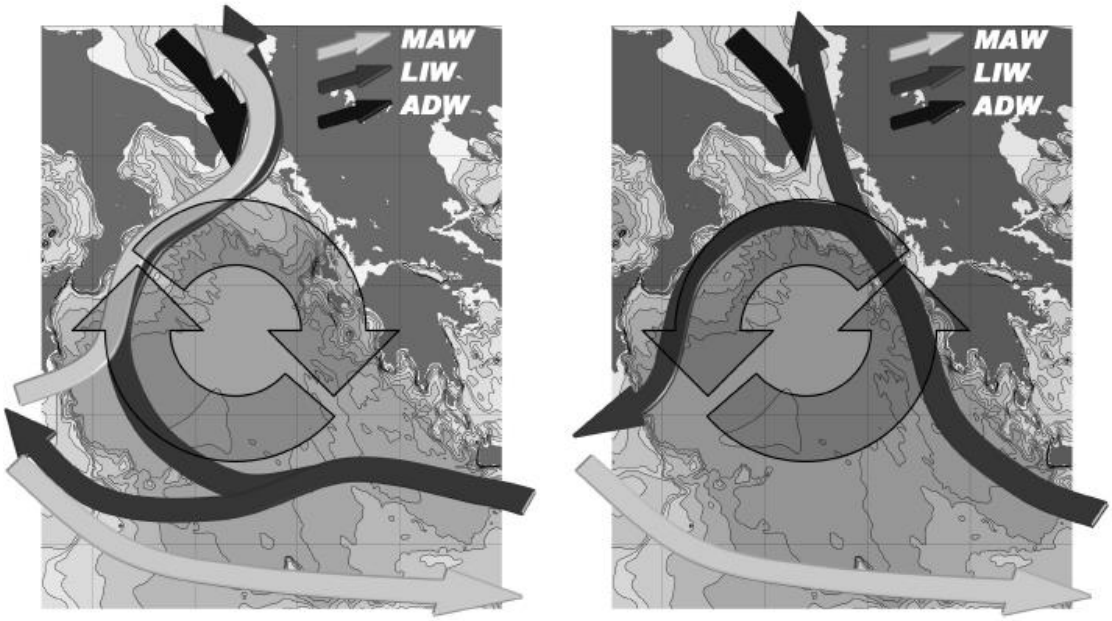


Figure 2-9 Anticyclonic (left) and cyclonic (right) circulation modes and the consequent pathways of the major water masses according to the BiOS mechanism (Civitarese et al. 2010).

According to General Fisheries Commission for the Mediterranean (GFCM), the Ionian Sea (Division 37.2.2) is geographical defined in three sub-areas: the Western Ionian Sea (sub-area 19), Eastern Ionian Sea (sub-area 20) and Southern Ionian Sea (sub-area 21) (FAO 2011). The Ionian Sea is located at the Eastern part of the Mediterranean and bounded at west by the Italian coast and from east by the Greek coast (D' Onghia et al. 2003).

The Western Ionian Sea geomorpologicy is characterized by the Taranto Valley (2200 m in depth) and the Apennine thrust sheets (Cataudella & Spagnolo 2011). Many submarine canyons are located along the Western Ionian coasts.They are important for the biodiversity in the Mediterranean Sea because they can be a refuge for many bathyal and endemic species (Gili et al.1998). The deepest point (Vavilov Deep 5121 m) is located at the Eastern Ionian Sea, which is the maximum depth in the Mediterranean (FAO 2006). The Greek part of the Ionian Sea is composed by narrow continental shelf and the deep Hellenic Trench.

The coastlines consist mainly of alluvial or deltaic sediments, sandstones, mudrocks and marls as well as calcareous rocks. The Ionian Sea recieves freshwater and suspended sediment supply from the rivers Kalamas, Acherontas and Acheloos. These rivers discharge affects the total mass flux of the Ionian Sea especially during the winter (high mass flux). The total mass flux is furthermore influenced by eolian inputs and biological production. Most of the gulfs of Ionian Sea have a tectonic origin. The sedimentation is being controlled by the fault and tectonic movements (SoHelME 2005).

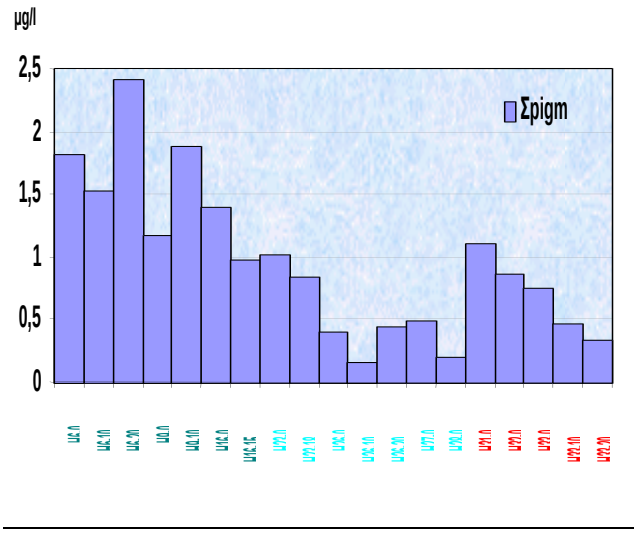
The Amvrakikos Gulf is mainly affected by agricultural activities. The Patraikos Gulf is affected by the industrial and agricultural activities as well as the port of Patras. The rivers Glafkos and Acheloos also transfer polluted waters. The marine environment of Astakos Gulf is affected mainly by the existing fish farms in the vicinity with dissolved and particulate form of metals (SoHelME 2005).

The Greek part of the Adriatic-Ionian region is in general oligoptophic. At the surface layers the nitrate concentration is about 0.10 μg-at/L, but near river mouths or areas of human activities (e.g. acusculture) is about 10 times higher. Phosphates follow a similar pattern, varying from 0,1 to 0,3 μg-at/L. Both Italian and Greek waters are oligotrophic except some coastal areas

that are mesotrophic (Katsavenakis et al. 2010) and some gulfs that are eutrophic (Amvrakikos Gulf, chl a >1.0 mg.m-3) (SoHelFI 2007).

From a hydrographic point of view there are three main water masses: the Modified North Atlantic Water (AW), the Levantine Intermediate Water (LIW) and the Eastern Mediterranean Deep Water (EMDW) (Theocharis et al. 1993). The surface AW enters in the Ionian Sea from Western Mediterranean through the Sicilian Channel and extend down to 60 - 150 m. The salinity increases from 37.5 psu in Sicilian Channel to 38.6 psu near the Cretan Passage (Theocharis et al. 1993) and the temperature ranges from 13ºC to 28ºC. The LIW expands under the surface level and extends down to 800-900 m. The temperature and the salinity varies between the Southern and Northern Ionian. The EMDW is characterized by cold and low salinity water that enters mostly from Adriatic Sea and extends under the LIW to the bottom (Cataudella & Spagnolo 2011).

Moreover, the Greek study area, generally presents very low concentration values of photosynthetic pigments (Σpig). In the open Ionian Sea the surface Σpig values rarelly exeed 1μg/l. In the semi-enclosed areas, as in the Corfu Sea, these values can be 2-3 times higher during the spring bloom (Figure 2-10), mainly near Kalamas river mouth.



St	long	Lat
H6	39° 30' 23''	20° 15' 19''
H9	39° 30' 44''	20° 14' 42''
H16	39° 30' 00''	20° 13 41
H23	39° 31' 36''	20° 09' 45''
H26	39° 31' 23''	20° 08' 19''
H27	39° 32' 02''	20° 08' 00''
H28	39° 32' 21''	20° 07' 51''
H31	39° 34' 39''	20° 08' 38''
H32	39° 35' 49''	20° 07' 54''
H33	39° 35' 30''	20° 06' 48''

Figure 2-10 Values of Σpig concentrations during the spring bloom in Corfu Sea (left) in representative sampling stations (right)

Two different aspects of vegetation and animal life are described. The first one is characteristic of the pristine areas and the second one in the areas where human activity (e.g. aquaculture) occur.

In the pristine areas the characteristic vegetation on hard substrata is dominated by the brown algae (Cystoseira spp.) forests. The typical photophilic aspect of the vegetation is composed by the red alga Laurencia sp., and the brown algae Padina pavonica, Stypocaulon scoparia and Sphacelariales. More than 100 species of small red algae (mainly Ceramiales) are present. The animal life is characterized by the presence of sponges (Chondrilla nucula, Aplysina aerophoba and Chondrosia reniformis) and sea urchins (Paracentrotus lividus, Arbacia lixula, Sphaerechinus granularis). The typical sciaphilic aspect of the vegetation is composed by the calcareous red algae (Corallinales). Soft substrata are dominated by seagrass meadows

(mainly Posidonia oceanica). Under low hydrodynamic conditions the meadows cover the entire infralittoral zone, from the surface down to 45 m depth. Under high hydrodynamic conditions the shallow meadows of Posidonia oceanica are replaced by meadows of Cymodocea nodosa. Near the deeper limit of the seagrass meadows the green algae Caulerpa prolifera and Caulerpa racemosa are forming prairies. The later is an alien species, presenting invasive behavior since the late 90's.

In the areas impacted by organic pollution local eutropication phenomena occur. The big brown algae are absent and the seagrass meadows (if present) are covered by epiphytes (small filamentous brown and green algae and gelatinous cyanobacteria and diatoms). The presence of the bryozoan Zoobothryon verticillatum is also characteristic. The photophilic aspect is dominated by calcareous red algae Jania sp. and Amphiroa rigida, small brown algae (mainly Sphacelaria cirrosa), and the green alga Codium bursa.The sponges Aplysina aerophoba, Chondrilla nucula, Chondrosia reniformis, Crambe crambe, Petrosia ficiformis and the sea anemone Actinia equina together with many ascidians and mussels are also present. Sciaphilic aspects with calcareous red algae are present Corallina sp. and Peyssonnelia sp., Lithothamnion spp., and the green alga Udotea petiolata together with sponges (Phorbas tenacior, Cliona rhodensis, C. celata, Chondrilla nucula, Phorbas tenacior, Ircinia sp. and Tethya cf. aurantium), as well as the sea anemone Aiptasia mutabilis, the moluscs Hexaplex trunculus and and Arca noae are present.

Regarding fisheries resources, the main demercal target species is Merluccius merluccius with important nursery grounds in the Ionian Sea. Other important commercial species in the area are the Loligo vulgaris, Mullus barbatus, Spicara smaris, Parapanaeus longirostris, Sardina pilchardus and the deep water shrimps Aristaeomorpha foliacea and Aristeus antnnatus (EU Med fisheries and exploited resources 2004-06). In the area of Ionian Sea seventeen exotic species have been recorded, eight of which are definitely Lessepsian migrants. Some of them are Parexocoetus mento, Saurida undosquamis, Siganus luridus, Siganus rivulatus, Stephanolepis diaspros and Upeneus moluccensis (SoHelME 2005, SoHelFI 2007).

The spatio-temporal patterns of a series of population and community metrics in the E. Ionian Sea throughout a 10 year period and their relationship with environmental and fishing factors was studied, with an emphasis on deep sea species, which are sensitive to fishing impact and revealed strong spatial patterns in fish, crustacean and cephalopod distributions (Tsagarakis et al., 2013).

2.2 Existing knowledge about the study area in terms of significant EU projects, monitoring and specific study and reports

R. Mosetti, M. Maniopoulou, P. Panayiotidis, V. Vassilopoulou, T. Primožič

A brief overview of most important basin-scale monitoring programs and studies on the Adriatic basin is given to outline the framework of knowledge available. The objective of this review is to show at what extent environmental data are available in the macro-region and in the focus areas and to give a reference for the data collection phase (WP2).

2.2.1 INTERREG PROGRAMS (1999-2006)

Two oceanographic programs of the northern Adriatic have been financed by the UE. The Venice section of CNR ISMAR participated to these programs in the last years:

- the INTERREG II Italian-Slovenian "Interventions for the water protection" started in February 1999 and lasted in December 2001;

- the second program represents the line B of the INTERREG III Italian-Slovenian program, called "Biological Oceanography of the Northern Adriatic (Acronym OBAS)". It was carried out in the years 2002-2006. Both the project were performed in the Northern Adriatic area between 44° 45' and 45°15' N, on a station grid with 6 west - east transects The map of the stations is presented in Figure 2-11.

The main goals of INTERREG II programs were:

- Evaluation of the trophic state of the Northern Adriatic basin using some water quality descriptors as nutrients and biological tracers;

- Description of Ipo-anoxic crises;

- Analysis of the mucilage aggregate production events;

- Phytoplankton bloom and potentially toxic species control;

- Phytoplankton primary production and export of Organic Carbon from the water column.

During INTERREG III the same topics were studied with the following implementations:

- Installation of a oceanographic meda 20 miles far from the Italian coast;

- Microbial ecology studies with emphasis of the bacteria influence on the Carbon cycle;

- Late phytoplankton bloom studies and haldeyde production effects over the fertility rates of the zooplankton;

- Evaluation of the gelatinous zooplankton;

- Cetacean population census.

In the framework of INTERREG II program, 31 oceanographic surveys have been carried out onboard of the ships D'Ancona, Urania and of the motorboat Misys.

During the cruises, meteorological parameters have been collected on 47 stations (global solar radiation, temperature, relative humidity, wind speed and direction) together with vertical profiles of temperature, salinity, dissolved oxygen, flourescence, transmittance and PAR irradiance. On 11 selected stations, samples were collected for hydrochemical parameters (pH, dissolved oxygen, dissolved nutrients), dissolved organic carbon (DOC), particulate matter (as total and organic fraction dry weight), particulate organic carbon (POC), particulate nitrogen (PN), chlorophyll and other photosynthetic pigments, phytoplankton and zooplankton countings. In 2 selected stations phytoplankton primary productivity has been measured by in-situ incubations with the 14C method.

For a visual assessment on the state of aggregation of suspended organic matter, observations with a scuba camera were performed along the water column.

Furthermore the arrangement of a monitoring station located 20 nm from the coast (Station C10, Figure 2-11) was started. In this station automatic instrumentation consisting of sediment traps measuring downward particle fluxes, current meters and self-recording CTD probes, will be deployed.

In June and July 2000, during the development of massive gelatinous aggregates occurred in the northern Adriatic, helicopter surveys have been carried out to detect the extension of the phenomenon. In October 2000, after a Po River flood event, an oceanographic survey was carried out in the basin to verify the impact of the flood on the prodelta area ecosystem.

During INTERREG III, in the 2002, 8 monthly cruises have been carried out onboard of the ship U. D'Ancona on a transect from the Po river delta towards the East in order to start a research on the winter bloom effects over the copepod recruitment. From May 2003 to July 2006, 14 seasonal cruises have been carried out in the same station grid (Figure 2-11), on board of the ships Urania and Dallaporta, with the same sampling protocol respect to INTERREG II, with the following new activities on:

- heterotrophic bacteria, and on their dynamics and activity within the microbial food web,

- flux citofluorimetry measurements for the evaluation of picoplankton,

- microzooplankton samplings,

- pigment analysys (HPLC),

- dolphins observations.

In the other months surveys over a reduced station grid (Figure 2-12) have been performed onboard of Misys and Boreana motorships with instrumental measurements (CTD and submarine videocamera) and samplings in two selected stations (C10, E06, see Figure 2-11).

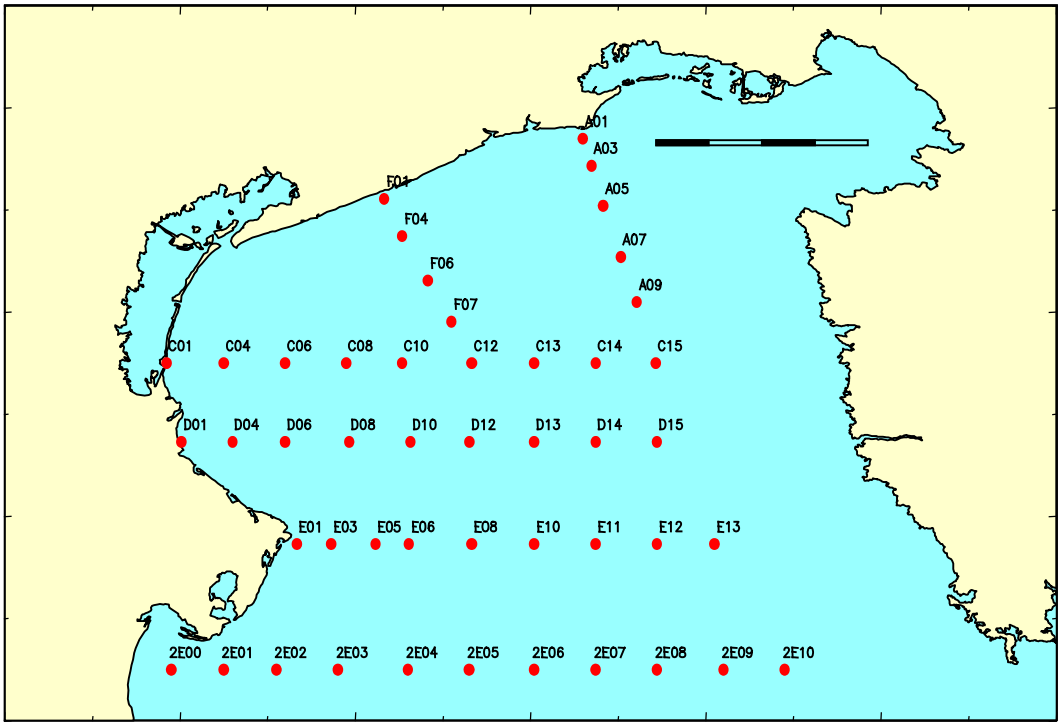


Figure 2-11 Station grid during INTERREG II and during the seasonal cruises of INTERREG III.

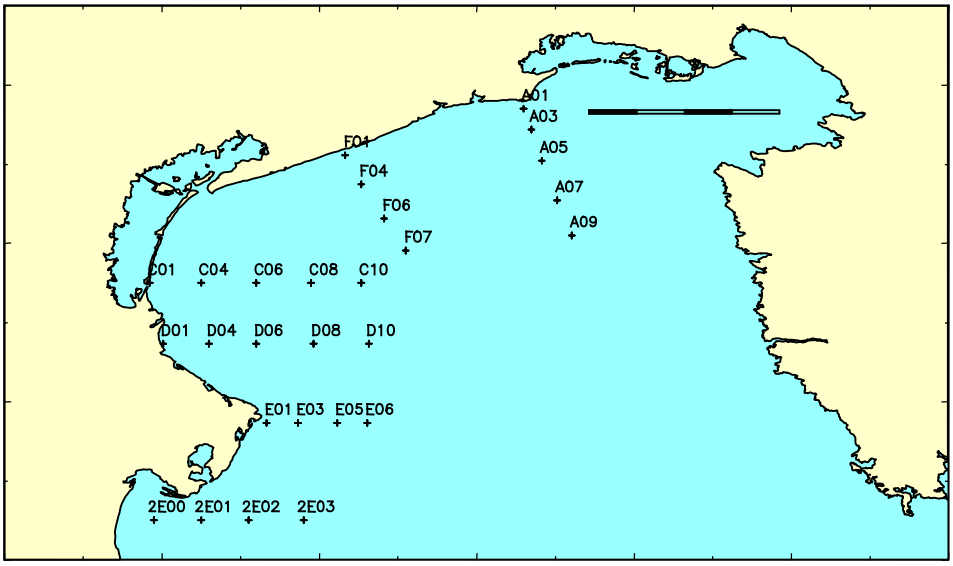


Figure 2-12 Station grid during the instrumental cruises of INTERREG III.

MAT PROJECT (1999-2003).

The MAT project was focused on the processes leading to mucilage formation in the Adriatic and Thyrrenian Sea (Figure 2-13)

The monitoring programme was carried out from 1999 to 2003. Three transects were sampled monthly and sea water samples were collected to for chemical and biological analyses along the water column.

The most important results were collected in the special issue of the journal Science of total environment 353 (2005).

Research project regarding the mucilage phenomenon in the Adriatic and the Tyrrhenian Seas. The main objectives are: The identification of the meteorological and hydrodynamic conditions which promote mucilaginous aggregate formation; the identification of the most important biological, chemical and hydrological factors controlling the production and formation of mucilaginous aggregates; to furnish the Italian Environment Ministry tools for a correct interpretation of the phenomenon. This program was carried out by Marine Biology Laboratory of University of Trieste, CNR-ISMAR of Venice, the Center for Marine Research Rovinj "Rudjer Boskovic Institut", Rovinj, Croatia and the Italian Central Institute for Marine Research (ICRAM).

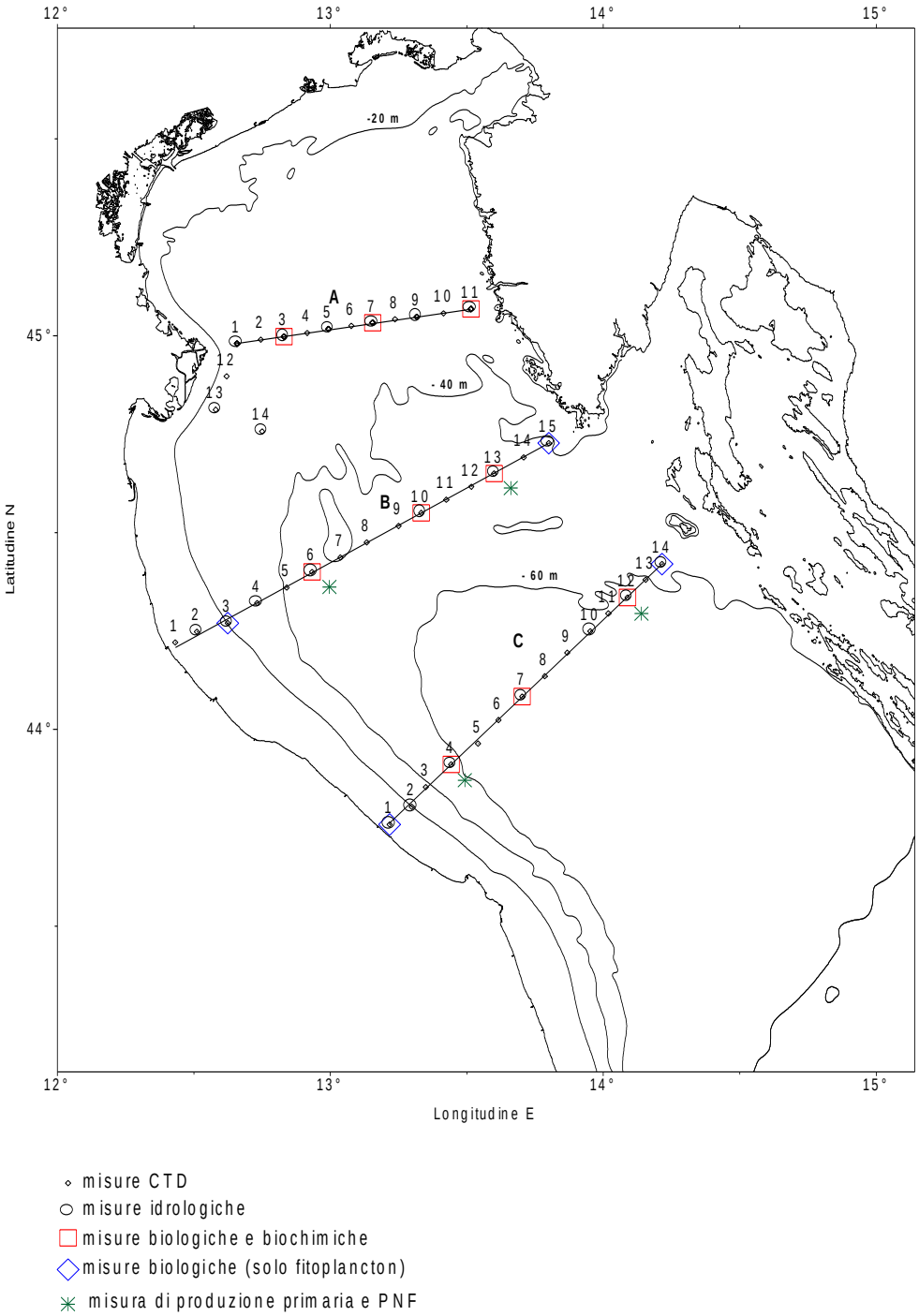


Figure 2-13 Station grid of MAT project.

<u>The ADRICOSM Pilot Project (2001-2005)</u>

ADRICOSM is a Pilot Project developed to implement an integrated coastal zone management system in the Adriatic Sea, consisting of a predictive circulation module and a river basin and wastewater management module. The aim was the prediction of coastal current variability in Near Real Time (NRT), and the monitoring and modeling of a river basin and wastewater system in a test site.

The ADRICOSM Pilot Project was launched in October 2001, within the Adriatic Ionian Initiative. In fact ADRICOSM has been designed to follow the recommendations of the Preparatory High Level Expert Meeting "Comprehensive Joint Water Environment Protection Program for the Adriatic-Ionian Region" (Split, Croatia) on 8-10 may 2000. Moreover, it builds upon the Italian-Slovenian and Croatian agreement for scientific and technological collaboration in the Adriatic Sea.

ADRICOSM has been also designed to be consistent with the international directives defined in the UNESCO-IOC Coastal Global Ocean Observing System (C-GOOS) and the UNEP-Mediterranean Action Plan Integrated Coastal Areas and River Management Program.

ADRICOSM involves sixteen scientific institutions from three Adriatic riparian Countries (Italy, Slovenia and Croatia) and from France. It is financed by the Italian Ministry for the Environment and Territory (Department for Environmental research and Development) and is scientific-technically coordinated by the National Institute of Geophysics and Volcanology (INGV) in Italy.

Within ADRICOSM a near real time (NRT) monitoring and numerical modelling system was set up in order to make an accurate forecast of short-term variability in the dynamics-circulation of the sea in coastal areas. The images give an overview of the entire spatial domain of the numerical model encompassing the entire Adriatic Sea, as well as of spatial subdomains in which a nesting method and the selection of accompanying spatial increments in the applied numerical models are used. The locations of CTD-probes, on which some monitoring within this project was performed are marked in Figure 2-14.

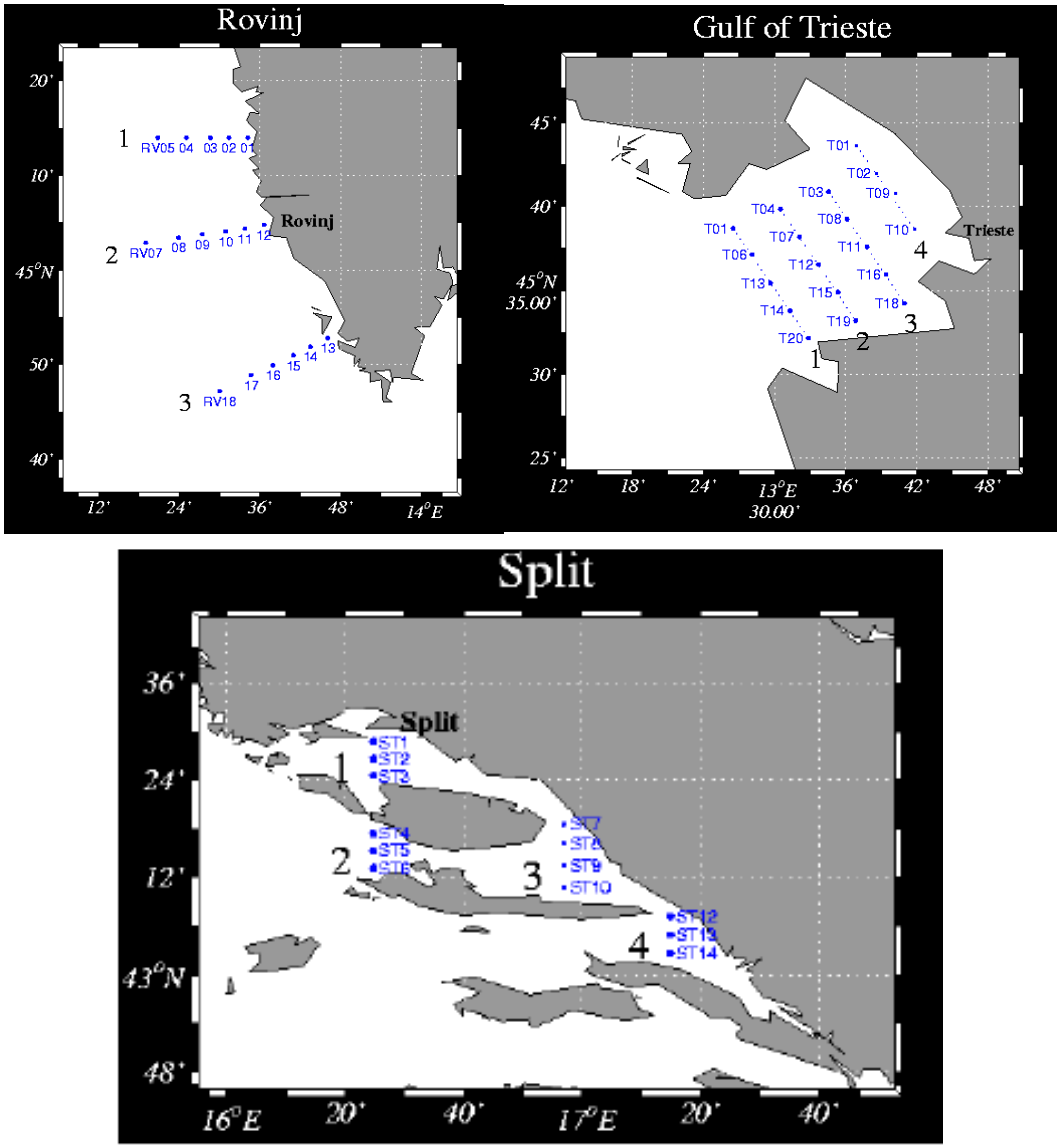


Figure 2-14 Station grid of ADRICOSM project.

2.2.2 Monitoring programs of Croatian coastal waters

The most relevant program on marine environmental research and monitoring is the **"Croatian national monitoring Program"**, the so-called **Jadran Project**. It is executed by Ruder Bošković Institute (The Center for Marine Research, Rovinj and the Division for Marine and Environmental Research, Zagreb); the Institute of Oceanography and Fisheries of Split, including its laboratories in Dubrovnik; the laboratories of the Faculty of Science in Zagreb and the Hydrographic Institute of the Republic of Croatia in Split.

The monitoring program, active from 1998, considers both coastal areas and transects off-shore, in the northern and southeastern Adriatic (see map in Figure 2-15). Monitoring is carried out 7 times per year on at least 5 depths; 11 times per year on the Rovinj – Po river mouth section.

The following parameters are measured:

- basic meteorological parameters and state of the sea;
- PAR, fluorescence, transmission of light;
- salinity, temperature, density anomaly, dissolved oxygen, sea transparency;
- nutrients;

- total chlorophyll a and pheopigments;
- potential photosynthetic activities (in northern Adriatic)
- sea currents, direction and speed.

Additionally, on a certain number of stations during the monitoring of unusual phenomena the following parameters are measured:

- survey of the water column and the bottom of the sea;
- biomarker photosynthetic pigments;
- transparent exopolymer particles (TEP);
- organic microaggregates and adhesion coefficient;
- total hydrocarbons;
- lipid biomarkers in suspended substances;
- dissolved organic carbon and phosphorus;
- qualitative and quantitative determination of microphytoplankton; autotrophic and heterotrophic pico- and nanoplankton; microzooplankton; mesozooplankton (200 µm); macrozooplankton;
- bacterial production
- qualitative and quantitative composition of ichtyoplankton and meiofauna.

The oceanographic monitoring described above is part of a much more comprehensive framework of analysis, foreseen within Jadran project. The project consists of several sub-activities with specific objectives:

- evaluation of impact of economic activities on the coastal sea in Croatia
- management of biological resources and protection of biodiversity
- unusual phenomena endangering human health, tourism and fisheries development of technologies and instruments indispensable for the monitoring, exploitation and protection of the Adriatic Sea.

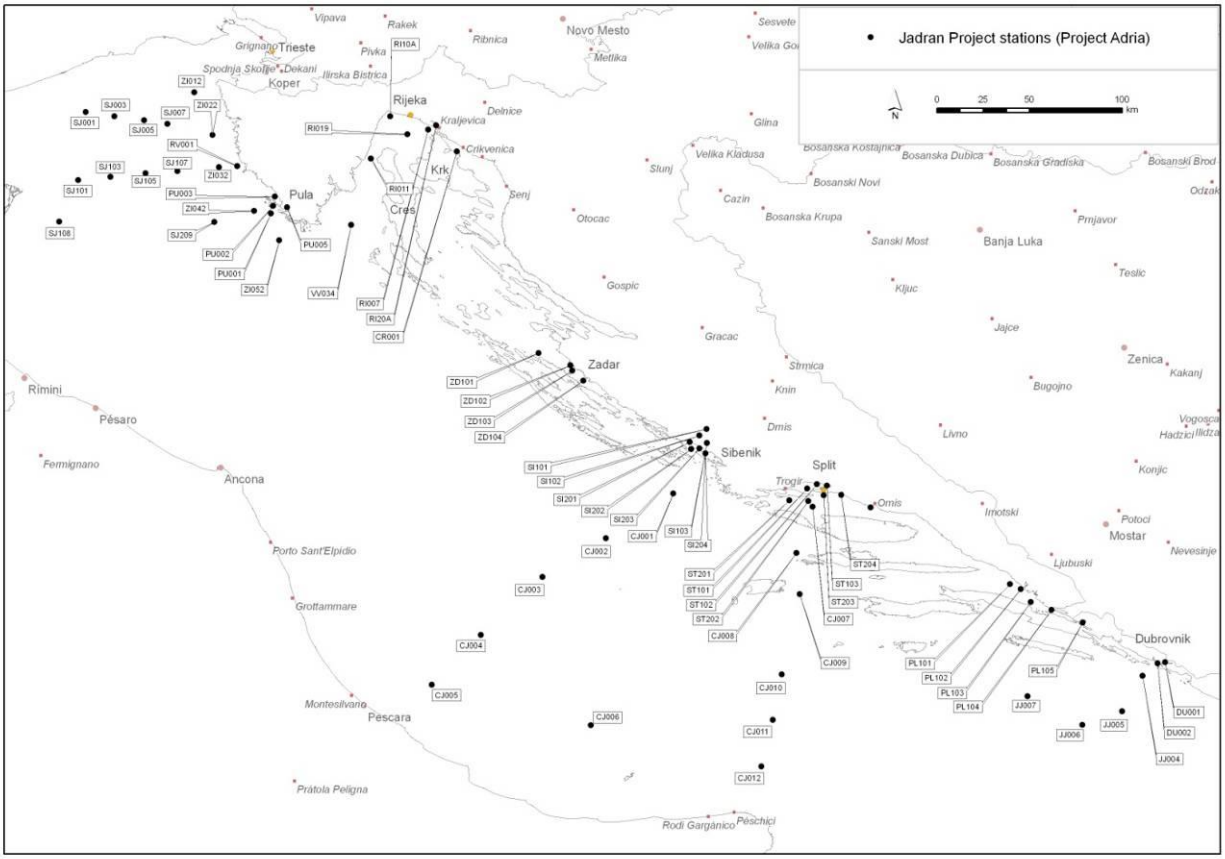


Figure 2-15 Stations of "Croatian national monitoring Program" - Jadran Project.

The **VIR-KONAVLE monitoring Program** has been conducted from 1976 to 2006 by the Institute of Oceanography and Fisheries in Spit. 15 monitoring stations (1978-1998) and 16 monitoring stations (1998-2006) have been monitored three times per year. The monitoring program focuses on the coastal area from Zarad do Dubrovnik.

The following parameters have been measured:

- physical and chemical characteristics of sea water (temperature, salinity, density, transparency, suspended matter, oxygen, pH, nutrients);
- biological characteristics (phytoplankton, zooplankton, bacterioplankton, benthos communities, coastal habitats of fish, cephalopoda and crabs, bacteria);
- characteristic pollutants (heavy metals in surface sediments – Pb, Zn, Cd, chlorinated hydrocarbons in surface sediments and shellfish)
- pH, dissolved oxygen;
- nutrients;
- biomass and composition of phytoplankton;
- microzooplankton and net zooplankton;
- heterotrophic bacteria;
- total coliform, faecal coliform, faecal streptococci;
- dynamics of waster masses (also by numerical models).

The **Wastewater effluents monitoring Program** (1996-2006) is executed by the Hydrographic Institute of the Republic of Croatia in Split includes monitoring of sea temperature, salinity and density; transparency, color of the sea; dissolved oxygen, ph; nutrient; sea currents at several sea-side locations in front of the following towns: Omiš, Ploče, Vela Luka, Zadar, Hvar, Povlja, Šibenik, Korčula, Split – Stobreč, Rogoznica, Brna, Trpanj, Crkvice, Cavtat, Slano, Stomorska, Orebić, Kupari, Kukljica, Sućuraj, Jelsa-Vrboska-Starigrad, Srima – Tribunj – Vodice, Pašman, Pag, Kali, Biograd, Kaštela – Trogir, Mljet (Pomena), Povljana, Preko, Komiža, Vir, Splitska, Vinišće, Medulin, Maslinica, and Blato.

The **Watercourse-borne pollution of the Adriatic** is a project assessing the general ecological stratus of internal wasters, with reference to the use for specific purposes. Quality assessment is based on the Regulation on Water Classification (five categories). The monitoring program considered between 2000 and 2002, 277 measuring stations among rivers, springs, wells, canals, natural and artificial lakes.

Along with mandatary indicators (oxygen regime, nutrients, microbiological and biological indicators) there are also special program of research of additional indicators (metals, organic compounds, radioactivity).

The **EKO-Kăstela Bay Project** considers the effluent dispersion from submarine outfalls of the town of Split. This area (see Figure 2-16) is known as one of the most polluted areas of the eastern coast of the Adriatic. The environmental pollution is a consequence of fast industrialization and urbanization without development of appropriate urban infrastructure (particularly waste water collection and disposal systems).

To face such problems an extended monitoring and modeling program has been set up, by application of physical models, *in situ* measurements and numerical models.

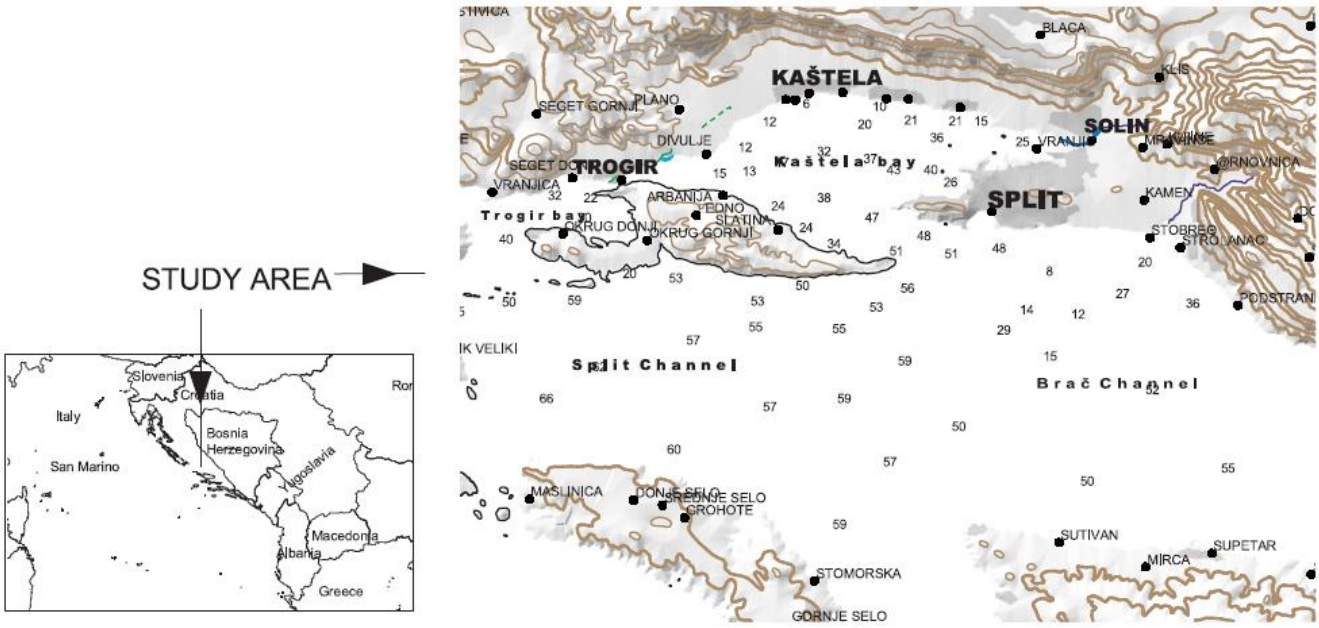


Figure 2-16 EKO- Kăstela Bay Project – Study area (from Margeta and Baric, 2001).

The **Beach Water quality Monitoring Program** is coordinate, integrated and analysed by the Ministry of Environmental Protection, Physical Planning and Construction. During the sampling weather conditions are observed and a visual inspection of the sea is made (color, transparency, visible floating waste matter, visible suspended waste matter). The temperature of the sea and pH value are defined at a sampling point, and microbiological indicators and determined (total coliform, faecal coliform, faecal streptococci).

The monitoring program is conducted at the following locations:

- Rijeka:

Grčevo, Ružićevo, Glavanovo, Hotel Park bathing area, Sablićevo, bathing area of the Jadran Hotel, "3. Maj" recreation centre, bathing area - west, bathing area - east, the football field, Kantrida-Vila Nora, a beach below the swimming pool, a beach belonging to the Children's Hospital, a beach belonging to the Pensioners' Home, Bivio bathing area, Skalete, Recreation Centre, a beach for the disabled, Preluk-east, Preluk-centre, Preluk-west.

- Opatija:

Volosko-below the bunker, Volosko bathing area, Veli mul, Puntica bathing area, below the Municipality, Lipovica, a beach of the "Triglav" Hotel, Tomasevac bathing area, the "Royal" Hotel, "Lido" bathing area, a bathing area of the "Kvarner" Hotel, the "Millenium" Hotel, bathing area "Slatina"-centre, a bathing area of the "Kristal" Hotel, a bathing area of the "Adriatic" Hotel, Zonovo, Villa "Ariston", Punta Kolova, bathing area - motel, "Ičići", the starting point of the Ičići bathing area, the end of the Ičići bathing area, Ika beach, a beach below the Faculty of Tourism and Hospitality Management, bathing area Slatina kraj.

- Novigrad:

AC"Mareda"I-beach north, AC"Mareda"II- a beach below the restaurant, Novigrad I, Karpinjan beach, Novigrad II, Trst beach, Novigrad III, Rivarella beach, TN"Tare"I-a beach of the "Maestral" Hotel, TN"Tare"II-a beach of the "Laguna" Hotel, TN"Tare"III-a campsite beach.

- Biograd na Moru: Primorje, Ilirija "Soline", Ilirija soline, Kumenat.
- Zadar:

Punta Bajlo, Zd-1, Kolovare, Arbanasi - school, Zd-2, Kolovare, the Kolovare Hotel, Zd-4, Kolovare, Mulić, Zd-5, Kolovare, beach Kolovare-swimming pool, Kolovare, Puntamika-west,

Zd-8, Borik, Zd-9, the Donat Hotel, Zd-10, Zgon, Zd-11, Diklovac, Diklovac, Zd-13, Diklovac, Diklo, Zd-15, Peruštine, Kožino, Primorje, Kožino, the Pinija Hotel, Petrčane, condominium complex, Zd-21 , Punta Skala, Rt. Korinjak, Veli Iž, Knež cove, Iž Mali, Lokvina cove, Rava, Lučina cove, Molat, Široka cove, Ist, Žalić cove, Silba, Suturišće cove, Zd-35, Silba

Harbour local bathing area, Zd-36, Olib, beach Vitrenjak, "Jadran" beach, Brgulje, bay, Podšibinski cove, Zapuntel, Luka cove.

- Rogoznica: Gornji Muli, Račice, Kopača.
- Makarska: Kamena, Tučepi, Slatina, Tučepi, Sv. Petar, Plaže-centre, Dalmacija Hotel, Cvitača.
- Omiš / Dugi Rat:

Pisak, Ruskamen, Stanići-Velika Luka, Nemira, Brzet, Omiš beach centre, Omiš beach, starting point, AK Zapad, Duće-west, Duće-harbour, Dugi Rat-Glavica, Dugi Rat-beach, Sumpetar, Krilo, Bajnice

- Orebić: Polače, Trstenik, Trstenica, Orebić, Bellevue Hotel, Orebić, Orebić, Orebić, Kućište, Viganj, Lovište.
- Opuzen: the rivermouth, Opuzen.

2.2.3 Monitoring programs of Greek waters

The present description of the environmental features (abiotic and biotic) in the Greek part of the Adriatic-Ionian Sea is based on a collection of publications (papers and Technical Reports), reflecting the oceanographic research activity in the area during the last 20 years. Below a selection of some key oceanographic projects conducted in the region are presented.

The OTRANTO project

It is the base line oceanographic project, focusing on the water mass exchanges between the south Adriatic and the north Ionian. It was carried out during 1995-95, on 44 sampling positions (132 samplings) (Figure 2-17, left). Temperature and salinity were the main parameters measured.

The Corfu Sea project It is the base line oceanographic project for Corfu Sea, focusing on natural environmental drivers and the anthropogenic pressures. It was carried out during 1991-92 on 109 sampling positions (478 samplings) (Figure 2-17, right). The main parameters measured were temperature salinity, trophic status and biodiversity (benthos and plankton). Emphasis was given on the role of the Kalamas river fresh water input (at the eastern part of Corfu Sea), as well as on the impact of urban pollution deriving from the city of Kerkyra and the nearby touristic activity.

Figure 2-17 Sampling stations from OTRANDO project (left). Sampling stations from Corfu Sea project (right).

<u>The Corfu-Diapontian (Ionian Island Region) project</u>

This project was carried out on the coasts of Corfu Prefecture, which is part of the Ionian Island Region (Figure 2-18, left). Three areas where studied for the evaluation of the carrying capacity of the aquaculture development: 1) The Diapontian plateau, 2) The Lefkimi Bay (south-eastern Corfu) and Paxi Islands, 3) The Lefkimi lagoon. Two seasonal samplings were carried out during the period 2004-05, in a network of sampling stations.

Emphasis was given to the temperature and salinity patterns, the trophic status of the water column and the biodiversity (pelages and benthos).

<u>The Thesprotia coasts (Epirus Region) project</u>

This project was carried out on the coasts of Thesprotia Prefecture, which is part of the Epirus Region (Figure 2-18, right). Two areas were studied for the evaluation of the carrying capacity of the aquaculture development. The first one was focusing in the coastline from Igoumenitsa Bay to the Kalamas River mouth and the second one was focusing at the Sagiada coastline, which is a narrow strip of Greek land in the border line with Albania. Two seasonal samplings were carried out during the period 2004-05, in a network of sampling stations.

Emphasis was given to the temperature and salinity patterns, the trophic status of the water column and the biodiversity (pelages and benthos).

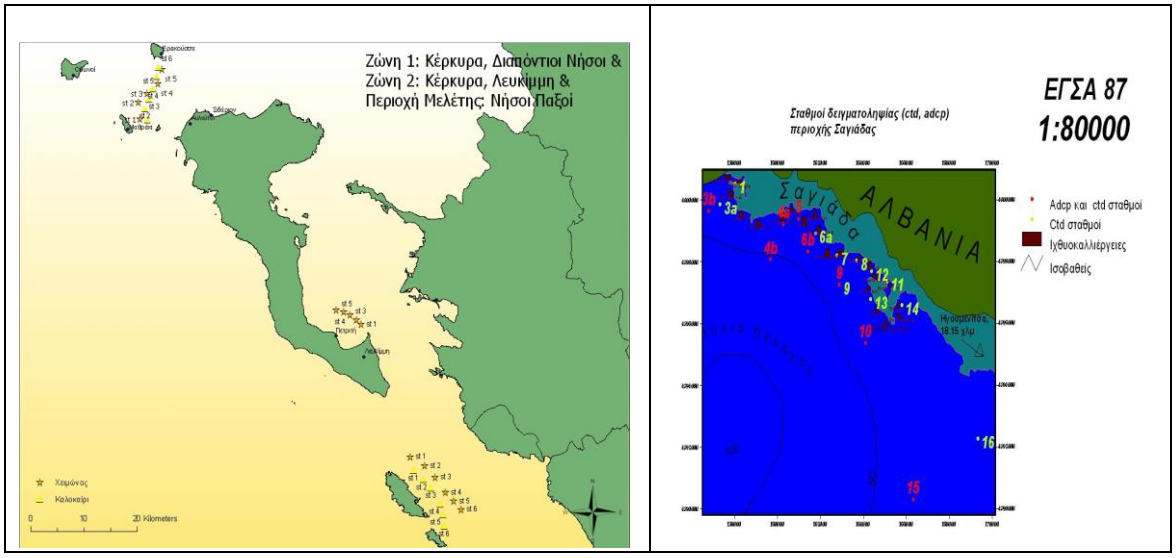


Figure 2-18 Sampling stations of the Corfu-Diapontian Islands project (left). Sampling stations of the Thesprotia coasts project (right).

Below a list of the relevant projects for the AIM of interest for ADRIPLAN:

- BEACHMED-E project (France, Greece, Italy, Morocco, Spain and Tunisia);
- COASTANCE project (Croatia, Cyprus, France, Italy, Greece and Spain);
- ECASA project (Croatia, France, Germany, Greece, Italy, Norway, Portugal, Slovenia, Spain, Sweden and the United Kingdom);
- ENCORA project (Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Monaco, the Netherlands, Poland, Portugal, Russia, Spain, Sweden, the United Kingdom and Ukraine);

- HERMES project (Belgium, France, Germany, Greece, Ireland, Italy, Kenya, Monaco, the Netherlands, Norway, Portugal, Romania, Russia, Spain, Sweden, Turkey, the United Kingdom and Ukraine);
- PEGASO project (Algeria, Belgium, Egypt, France, Greece, Croatia, Italy, Lebanon, Morocco, Romania, Spain, Switzerland, Tunisia, Turkey, the United Kingdom and Ukraine);
- OURCOAST project (all coastal EU countries);
- EUROISLANDS project (Greece, Malta, Sweden, Spain, Cyprus, Denmark, Italy, Estonia, Finland)
- MARLISCO project (Italy, The Netherlands, UK, Belgium, France, Slovenia, Ireland, Romania, Germany, Cyprus, Bulgaria, Portugal, Greece, Denmark)
- MESMA project (The Netherlands, UK, Germany, Belgium, Greece, Ireland, Spain, Italy, Malta, Bulgaria, Norway, Denmark, Poland)
- APICE project (Italy, France, Greece, Spain)
- SPICOSA project (France, Spain, Italy, Belgium, Norway, Turkey, Portugal, Ireland, UK, Sweden, Greece, Poland, Germany, the Netherlands, Denmark, Estonia, Bulgaria, Latvia, Romania, Israel, Sweden)
- PERSEUS project (Greece, France, Spain, Italy, Romania, Malta, Turkey, UK, The Netherlands, Cyprus, Slovenia, Croatia, Israel, Bulgaria, Romania, Ukraine, Russia, Georgia, Malta, Germany, Tunisia)
- ESaTDOR project (UK, Norway, Spain, Germany, The Netherlands, Romania, Greece)
- MIUR-IT RITMARE Ecosystem-based approach; sustainable fishery; ICZM/MSP in the AI Sea
- Erasmus Mundus EM Master Course on MSP Networking and stakeholder involvement
- IPA ADRIGOV Maritime governance in the Adriatic
- MED MAREMED ICZM in the Adriatic
- Interreg PlanCoast ICZM/MSP in the Adriatic
- IPA SHAPE ICZM/MSP in the Adriatic
- IPA COASTANCE ICZM in the Adriatic
- FP7 MICORE Coastal Defence/CCA in the northern Adriatic
- FP7 THESEUS Coastal Defence/CCA in the northern Adriatic
- IPA HAZADR Risk prevention & management in the Adriatic
- MED BEACHMED Best practices for coastal management – defence
- FP7 MARLISCO Marine Litter
- DG MARE EMODNET-Chemistry PP
- 2009-2012
- Environmental data collection in the North Adriatic
- DG MARE EMODNET-Chemistry 2 Products for MSFD needs in the Mediterranean Sea
- DG MARE EMODNET-Biology 2 Products for MSFD needs in the Mediterranean Sea
- MED APICE Maritime activities in the Adriatic
- FP6 SPICOSA Ecosystem, anthropogenic pressures
- FP7 Pegaso Stakeholder involvement; ecosystem-based approach; ICZM

- DG MOVE ADRIAMOS Sea-based transport service integrated in the logistic chain along the
- Adriatic-Ionian transport corridor
- IPA ECOSEA Sustainable fishery in the Adriatic
- Interreg ADRIFISH Sustainable fishery in northern Adriatic Sea
- Interreg ADRI.BLU Stakeholder involvement for sustainable fishery in northern Adriatic Sea
- MiPAAF - FAO. ADRIAMED Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea
- DG MARE - MiPAAF
- HMRDF – FAO
- EASTMED Scientific and Institutional Cooperation to Support Responsible Fisheries in
- the Eastern Mediterranean
- SEE NATREG Management of MPA
- FP7 COCONET Investigation of synergy between MPAs and OWFs
- MESEA project: Mediterranean Sea acidification in a changing climate (FP7 Project)

For Focus Area 1 relevant projects also for MSP are:

- SHAPE project: focused on sustainable development in the Adriatic Sea, specifically in strengthening institutional support for the protection and management of resources (natural and cultural) and risk prevention. Main results of the SHAPE project were: Overview of the ICZM Protocol in the Adriatic region, Thematic maps, Maritime spatial planning methodology, Reports: Analysis of the legal framework, policies and planning tools on the Adriatic, GIS atlas of the Adriatic area, Scientific reports, Workshops, Transnational Conferences, Synergies and sharing of results between related projects, within the Adriatic Forum and cooperation with organizations such as the Adriatic Euro region and other European regions and European and international institutions.
- TOSCA framework of the Med Programme: aims to improve the quality, speed and effectiveness of decision-making process in case of marine accidents in the Mediterranean concerning oil spill pollution and search and rescue (SAR) operations. (Italy, France, Greece and Spain)
- HAZADR (Italy, Slovenia, Croatia): running from October 2012 to March 2015, is the establishment of a cross-border network for the prevention of risks and for the early management of emergencies, in order to reduce the risk of pollution and contamination of the Adriatic Sea and its coasts. Therefore, HAZADR aims at strengthening a common reaction capacity of the communities belonging to the Adriatic Region against environmental and technological hazards due to collisions, shipwrecking and spillage of oil and toxic material into the sea that could seriously pollute the marine environment and damage the socio-economic activities of the Adriatic coastal communities. In synthesis, HAZADR helps the Adriatic regions: to upgrade the knowledge framework over the estimated environmental and socio-economic risks in the most vulnerable Adriatic areas due both to natural and human-induced factors, as well as the harmonization of the laws governing the protection of the sea from pollution.
- TREZZE Interreg project (Italy, Slovenia) on sustainable management, protection and enhancement of the natural heritage by strengthening the attractiveness and competitiveness of the area and contributing to the protection of biodiversity.
- NETCET - Network for the Conservation of Cetaceans and Sea Turtles in the Adriatic (WEB: http://www.netcet.eu/). The main objective of the NETCET project is to develop common strategies for the conservation of cetaceans and sea turtles in the Adriatic

through pan-Adriatic cooperation. Cetaceans and sea turtles are a shared endangered natural heritage which cannot be managed by a single state in isolation. Due to the migratory nature of these species and the joint responsibility of Adriatic states, collaboration is essential to planning effective long-term conservation strategies. Marine biodiversity conservation problems and more specifically cetaceans and sea turtles conservation are common to all countries across the Adriatic but experience across regions in this field varies and there is thus much to be gained by bringing together best practice and experience with the aim of defining a common conservation framework and tools/measures for the conservation of endangered marine species, making these tools readily available to other regions towards the end of the project. For these reasons the NETCET project, coordinated by the City of Venice, is managed by 13 partners situated in several Countries of the Adriatic Basin: Italy, Croatia, Albania, Montenegro and Slovenia.

- IONAS - Ionian and Adriatic cities and ports joint cooperation, programme Interact. Cooperation between the Ionian and Adriatic cities and ports - since 2004. In the project were 24 partners, mainly municipalities and port authorities in the Adriatic and Ionian area, from 6 countries. The project is designed to transfer the experience gained through different projects in the Interreg initiative. These projects were focused in three problems, which are the starting point of the Project Ionas:

  • Lack of communication on issues of transport and logistics between the Adriatic and Ionian ports

  • Lack of effective procedures to manage the impact of port activities on the environment,

  • lack of communication between ports and port cities.

  The project focuses on improving cooperation between ports, but also cities and their ports. The project objectives are to improve the efficiency of the Interreg initiative, to promote the integration of a program to create results that will be useful for future Interreg programs.

- CAMP Slovenia project - The program of coastal zone management. CAMP was conducted jointly MAP - Mediterranean Action Plan, the Republic of Slovenia and the Municipality of South Primorska. CAMP Slovenia was based on the priorities of the MAP (including the Mediterranean Strategy for Sustainable Development, which was adopted at the 14th Meeting of the Parties to the Barcelona Convention in November 2005 in Portorož), the principles and provisions of the new MAP ICAM Protocol 6 environmental program of the EU and its thematic strategies, as well as adopted CSPs (in particular, the Spatial Development Strategy of Slovenia and the National Environmental Action Plan 2005-2012). Within the framework of CAMP Slovenia was carried out a total of 9 projects. The main project was the preparation of the Conception of Spatial Development of South Primorska. This was the basic spatial strategy document areas that will affect the character of the future (spatial) development in the region, and thus the sustainable development of the area. Final phase of the project was based on the results of the individual projects CAMP Slovenia and System Analysis and Prospective Sustainability Analysis. The result the Coastal zone management programme, with four priority areas:

  ◦ strengthening the sustainability of key activities - tourism, transport (programs for sustainable tourism development, sustainable mobility in the region, environmental protection and maritime activities)

  ◦ Reducing pressures on the environment (programs : Protection of water resources and reduce the burden on water system of integrated waste management in the region , protection against natural and other disasters , including climate change)

  ◦ Effective protection of cultural heritage and natural values and biodiversity conservation (program management of cultural heritage, natural values and biodiversity, and their integration into development processes)

◦ Ensure sustainable spatial development for greater competitiveness and higher quality of life in the region (with the programs: spatial development to support increased competitiveness of the region, improving the quality of life in the region, Spatial planning for the sustainable development of the coastal zone).

For Focus Area 2 relevant projects also for MSP are:

- CADSEALAND project (Greece, Italy);
- ADRIAMOS project (Greece, Italy)
- EASTMED project (Greece, Italy)
- COCONET project (Belgium, Italy, France, Spain, Denmark, Romania, Greece, Bulgaria, Montenegro, Ukraine, Tunisia, Israel, Morocco, Turkey, UK, Georgia, Norway, Russia, Malta, Croatia, Albania)

2.3 Information gathering and data sources

M. Lipizer

The ADRIPLAN partnership consortium, involving both technical and institutional partners, has contributed to the inventory of available data and data sources on the relevant topics required for marine spatial planning in the Adriatic – Ionian Macroregion. The inventory of existing data, databases, maps and documents on maritime activities and on the status of the marine environment as defined according to the descriptors of the Marine Strategy Framework Directive has been compiled at macroregional scale, as well as for the two focus areas. ADRIPLAN is capitalizing on the relevant information collected within the several projects and monitoring programs (Section 2.2) addressing issues related to MSP, in particular on all already mapped information available through JRC- European Atlas of the Sea, SHAPE-Adriatic Atlas, ARPA FVG adri.blu GIS of the Northern Adriatic, Atlas of the Venice Lagoon, DB Coconet, Mediseh and the Slovenian GIS. All data sources used in ADRIPLAN Initial Assessment are cited in the following chapters and are listed at the end of the document. Relevant maps are gathered in ADRIPLAN data portal, which will thus combine spatial information on uses of the sea, environmental status and policy and legal aspects.

3 Policy and socio-economic framework

3.1 Review of relevant policies

A. Barbanti, P. Campostrini, M. Morelli, D. Scarcella, T. Papatheochari, S.Niavis, H. Coccossis

3.1.1 The strategic EU blue frame

Europe 2020 is the European Union's ten-year growth and jobs strategy that was launched in 2010 for smart, sustainable and inclusive growth includes five headline targets that set out where the EU should be in 2020[1].

These cover employment; research and development; climate/energy; education; social inclusion and poverty reduction. The objectives of the strategy are also supported by seven 'flagship initiatives' providing a framework through which the EU and national authorities mutually reinforce their efforts in areas supporting the Europe 2020 priorities such as innovation, the digital economy, employment, youth, industrial policy, poverty, and resource efficiency.

The Commission published a Communication taking stock of the Europe 2020 strategy in March 2014, four years after its launch[2]. This in turn paves the way for a thorough review of the Europe 2020 strategy.

The Blue Growth Strategy, in line with the objectives of the Europe 2020 strategy, aims to support the sustainable growth in the marine and maritime sectors as a whole and recognizes that seas and oceans are drivers for the European economy, with great potential for innovation and growth. As reported in the Communication COM(2012) 494 final, "*The EU's blue economy represents 5.4 million jobs and a gross added value of just under €500 billion per year. In all, 75% of Europe's external trade and 37% of trade within the EU4 is seaborne. The individual sectors of the blue economy are interdependent. They rely on common skills and shared infrastructure such as ports and electricity distribution networks. They depend on others using the sea sustainably*."

This strategy identifies five specific sectors as potential drivers of blue growth: aquaculture, marine and coastal tourism, marine renewable energy, marine mineral mining and marine biotechnology "*where additional effort at EU level could stimulate long-term growth and jobs in the blue economy, in line with the objectives of the Europe 2020 strategy"*. All five sectors are to be the subject of further initiatives under the auspice that " *With increasing awareness of the blue economy, and further analysis, other promising areas for EU policymaking may emerge"*.

The EU Integrated Maritime Policy (IMP)[3]**,** is a common and comprehensive framework for EU policies relating to maritime issues: it promotes an inter-sectoral approach, without replacing sectoral policies but ensuring coherence among each other, at the different decision making levels.

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1 Communication from the Commission, "EUROPE 2020- A strategy for smart, sustainable and inclusive growth", COM(2010) 2020 final, Brussels, 3.3.2010.

2 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "Taking stock of the Europe 2020 strategy for smart, sustainable and inclusive growth", COM(2014) 130 final/2, Brussels, 19.3.2014.

3 Communication from the Commission to the European Parliament, the Council, the European economic and Social Committee and the Committee of the Regions, "An Integrated Maritime Policy for the European Union", COM(2007) 575 final, Brussels, 10.10.2007.

The IMP focus its action primarily in the following 5 areas:

- maximizing the Sustainable Use of the Oceans and Seas
- building a knowledge and innovation base for the maritime policy
- delivering the highest quality of life in the coastal regions
- promoting Europe's Leadership in International Maritime Affairs
- raising the visibility of Maritime Europe.

In October 2012, the Declaration of the European Ministers responsible for the Integrated Maritime Policy and the European Commission, on a Marine and Maritime Agenda for growth and jobs ("Limassol Declaration") stressed that *"the Europe 2020 strategy should be backed by a dynamic agenda for seas and oceans that supports the growth, competitiveness and job-creating potential towards a sustainable blue economy" .*

The introduction of "Blue Growth" concept into IMP makes it fully consistent with the Europe 2020 targets: the sector of **blue economy is crucial** to achieve the challenge of a smart, sustainable and inclusive growth. In fact, the EU regional policies in Mediterranean Marine region[4] and in the Adriatic Ionian Region[5] are both referred to these two main EU strategies, Europe 2020 and IMP, as unified by the "Blue Growth" paradigm, which is to be taken into due consideration in any planning exercise in the area.

At international level, it is worth to mention the **Convention on Biological diversity** that was opened for signature on 5 June 1992 at the United Nations Conference on Environment and Development (the Rio "Earth Summit") and entered into force on 29 December 1993. The European Union is a Party of the Convention.

The Convention on Biological Diversity was inspired by the world community's growing commitment to sustainable development. It represents a dramatic step forward in the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources. The 5th Convention of Parties, held in Nairobi in year 2000, defined and endorsed **the ecosystem approach** as the primary framework for action under the Convention and recommended the application of the principles and other guidance6. The Ecosystem Approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It is based on the application of appropriate scientific methodologies focused on levels of biological organization which encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that **humans, with their cultural diversity, are an integral component of ecosystems**.

The Ecosystem Approach, which has been fully adopted by EU, requires environmental protection requirements to be integrated into the definition and implementation of the Union maritime policies and activities, with a view to promote sustainable development. In this sense, any MSP activity should adopt an ecosystem-based approach

The Marine Strategy Framework Directive[7] **– MSFD** is the environmental pillar of the IMP and refers also to other directives such as the Water Framework Directive, the Habitat and

4 Communication from the Commission to the Council and the European Parliament, "Towards an Integrated Maritime Policy for better governance in the Mediterranean", COM(2009) 466 final, Brussels, 11.9.2009.

5 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "A Maritime Strategy for the Adriatic and Ionian Seas", COM(2012) 713 final, Brussels, 30.11.2012.

6 Decision v/6 of the 5th COP, see http://www.cbd.int/decision/cop/default.shtml?id=7148

7 Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy, OJ L 164/19 of 25.6.2008.

Birds Directives that establish the Natura 2000 network (these directives are well explained in other sections of this document - see also next section 3.2). The overall target of MSFD is the achievement of Good Environmental Status of all European Seas by 2020, measured by 11 descriptors. Recently, the implementation of the MSFD went through to its first milestones: the initial assessments have been delivered (Art. 8), as well as the determination of Good Environmental Status (Art. 9) and the establishment of environmental targets (Art. 10) has been finished by most of the Member States. MS have to establish by 15 July 2014 a monitoring programme for ongoing assessment and by 15 October 2014 they have to notify the Commission of their monitoring programs[8]. The IMP recognizes that the benefits of reaching Good Environmental Status in Europe's marine waters extend beyond the potential economic gains to be made from exploiting the various components of European marine resources. Therefore, the protection and restoration of the EU's marine environment and wildlife must is a priority.

The MSFD was the key component of EU activity towards the marine environment under the 6th Environmental Action Programme, adopted in 2002 and ended in 2012.

The 7th Environment Action Programme[9] (EAP), adopted on November 2013, is the new Environmental programme guiding European environment policy until 2020.

The programme lists nine priority objectives the EU needs to do by 2020:

1. to protect, conserve and enhance the Union's natural capital;

   The EAP expresses the commitment of the EU, national authorities and stakeholders to speed up the delivery of the objectives of the 2020 Biodiversity Strategy[10] and the Blueprint to Safeguard Europe's Water Resources[11]. The **EU Biodiversity Strategy to 2020** sets six main targets and 20 actions needed to halt the loss of biodiversity and the degradation of ecosystem services and restore them as far as feasible. The 7th EAP outlines that it is necessary to step up the implementation of that Strategy, and meet the targets contained therein in order to enable the Union to meet its biodiversity headline target for 2020. Whereas the Strategy includes built-in measures to improve the implementation of the Birds and Habitats Directives, including the Natura 2000 network, reaching the headline target will require the full implementation of all existing legislation aimed at protecting natural capital. The six targets of the Biodiversity Strategy cover: (1) the full implementation of EU nature legislation to protect biodiversity, (2) Better protection for ecosystems, and more use of green infrastructure, (3) More sustainable agriculture and forestry (4) Better management of fish stock, (5) Tighter control on invasive alien species, (6) A bigger EU contribution to averting global biodiversity loss.

   The **Blueprint to Safeguard Europe's Water Resources** outlines actions that concentrate on better implementation of current water legislation, integration of water policy objectives into other policies, and filling the gaps. Therefore the Blueprint will contribute to reaching Good Environmental Status under the Marine Strategy Framework Directive, provided that there is adequate coordination with programmes of measures under the Marine Strategies due by 2015.

2. to turn the Union into a resource-efficient, green and competitive low-carbon economy;

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8 DIKE_9-2014-3, Reporting Package for MSFD Article11 on monitoring programme, 26 February 2014

9 Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet', OJ L 354/171 of 28.12.2013.

10 Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions, "Our life insurance, our natural capital: an EU biodiversity strategy to 2020", COM(2011) 244 final, Brussels, 3.5.2011.

11 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "A Blueprint to Safeguard Europe's Water Resources", COM(2012) 673 final, Brussels, 14.11.2012.

The Europe 2020 Strategy seeks to promote sustainable growth by developing a more competitive low-carbon economy that makes efficient, sustainable use of resources. Therefore this priority objective requires the full implementation of the Union Climate and Energy Package to reach the milestones identified for 2020 and for building a competitive, safe and sustainable low-carbon economy by 2050. Whereas the Union is currently on track to reduce domestic GHG emissions 20% below 1990 levels by 2020, meeting the 20% energy efficiency target will require far more rapid efficiency improvements and behavioral change. All sectors of the economy will need to contribute to reducing GHG emissions.

3. to safeguard the Union's citizens from environment-related pressures and risks to health and well-being;

The World Health Organization (WHO) estimates that environmental stressors are responsible for between 15% and 20% of all deaths in 53 European countries. According to the OECD, urban air pollution is set to become the primary environmental cause of mortality worldwide by 2050[12]. Europe already has high standards for air quality, but in many cities, pollution remains above acceptable levels. Ensuring the good quality of Europe's bathing waters benefits both human health and the Union's tourism industry. The adverse consequences of floods and drought for human health and economic activity are being experienced more frequently, partly due to changes to the hydrological cycle and land use. Further work in this direction will be informed by a comprehensive review of Union air quality legislation and by the implementation of the Blueprint to Safeguard Europe's Water Resources.

Concerning the risk prevention from floods, part of the purpose of the WFD, as set out in Article 1(e), is to "contribute to mitigate the effects of floods". However risk prevention is not one of the principal objectives of the WFD. Following the adoption of the WFD, the need for a European legislation on the management of flood risks was expressed in the 2004 EC Communication on flood risk management[13], on the basis of the likelihood of an increasing of floods frequency and severity due to climate change. The 23rd of October 2007 the European Parliament and the Council adopted the Directive 2007/60 on the assessment and management of flood risks[14]. According to the Directive, by 22 December 2015, Member States must prepare and implement flood risk management plans for each river basin district, based on flood hazard maps and flood risk maps. Flood risk management plans shall include: the objectives, focusing on the reduction of potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity, and, if appropriate, on non-structural initiatives and/or on the reduction of the likelihood of flooding, and the measures for achieving the objectives.

4. to maximize the benefits of Union environment legislation by improving implementation;

The improvement of the implementation of the Union environment *acquis* at Member State level will be one of the top priorities in the coming years. There are significant differences in implementation between and within Member States. There is a need to equip those involved in implementing environment legislation at Union, national, regional and local levels with the knowledge, tools and capacity to improve the delivery of benefits from that legislation, and to improve the governance of the process. The EAP recognizes the importance of much greater public access to information (according to the Aarhus Convention) in improving public understanding of environmental issues.

5. to improve the knowledge and evidence base for Union environment policy;

Union environment policy is based on environmental monitoring, data, indicators and assessments linked to the implementation of Union legislation, as well as formal scientific

12 DECISION No 1386/2013/EU

13 Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions "Flood risk management Flood prevention, protection and mitigation", COM(2004)472 final, Brussels, 12.07.2004.

14 See paragraph 3.2.3

research and 'citizen science' initiatives. Further implementation of the Shared Environmental Information System[15] and the common approaches and standards on acquisition and collation of consistent spatial information under the INSPIRE[16] and Copernicus[17] systems, as well as other environmental information systems for Europe (such as the Biodiversity Information System for Europe (BISE) and the Water Information System for Europe (WISE), will help will efforts to streamline reporting obligations under different relevant legislation.

6. to secure investment for environment and climate policy and address environmental externalities;

   This can only happen if impacts on the environment are properly accounted. The EAP sets out some actions in order to secure investment for environment and climate policy.

7. to improve environmental integration and policy coherence;

   The 7th priority objective is the better integration of environmental concerns into other policy areas, such as regional policy, agriculture, fisheries, energy and transport. The assessment of the environmental, social and economic impacts of policy initiatives and full implementation of Environmental Impact Assessment legislation will ensure better decision-making and coherent policy approaches that deliver multiple benefits.

   Local and regional authorities, responsible for decisions on the use of land and marine areas, have an important role in assessing environmental impacts and protecting, conserving and enhancing natural capital, thus also achieving greater resilience to the impact of climate change and to natural disasters. The envisaged expansion of energy and transport networks, including offshore infrastructure, will need to be compatible with protection of nature and climate adaptation needs and obligations.

   This requires, in particular a full integration of environmental and climate-related requirements and incentives in policy initiatives, including reviews and reforms of existing policy and a fully implementation of the Strategic Environmental Assessment Directive[18] and the Environmental Impact Assessment Directive[19];

8. to enhance the sustainability of the Union's cities;

   The EAP aims to promote the initiatives that support innovation and best practices in cities. The aim is to ensure that by 2020, most cities in the EU are implementing policies for sustainable urban planning and design, and are using the EU funding available for this purpose. This requires in particular the agreement on a set of criteria to assess the environmental performance of cities and the development of a common understanding on how to contribute to improved urban environments by focusing on the integration of urban planning with objectives related to resource efficiency, an innovative safe and sustainable low-carbon economy, sustainable urban land-use, sustainable urban mobility, urban biodiversity management and conservation, ecosystem resilience, water management, human health, public participation in decision-making and environmental education and awareness.

9. To increase the Union's effectiveness in addressing international environmental and climate-related challenges.

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15 Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, "Towards a Shared Environmental Information System (SEIS)", COM(2008) 046, Brussels, 1.2.2008

16 Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007, establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), OJ L 108/1, 25.4.2007.

17 http://www.copernicus.eu/

18 See paragraph 3.2.3

19 See paragraph 3.2.3

The EU and its Member States are committed to engage more effectively in working with international partners towards the adoption of Sustainable Development Goals as a follow-up to the Rio+20 conference.

In many EC documents MSP is explicitly considered an essential cross-cutting tool for the implementation of the EU Integrated Maritime Policy and an instrument to strengthen the EU maritime economy. In fact, the main objective of MSP is to facilitate the coherent and sustainable implementation of the different policy initiatives relevant for seas and coasts. The full respect of the sea's natural capital and the coherence with global fight against climate change are the main pillars of any environmental-based consideration in MSP.

The following figure presents an overall sketch to have in mind when conducting the marine planning exercise, which results aims to allow the coexistence of many activities (transport, fisheries, aquaculture, energy, tourism), minimizing spatial competition, reaching and maintaining the Good Environmental Status and guaranteeing a sustainable management of the marine resources.

The Blue Growth appears to be a paradigm inspired by main EU strategies and encompassing environment-inspired regulation and action frameworks and EU sectoral policies

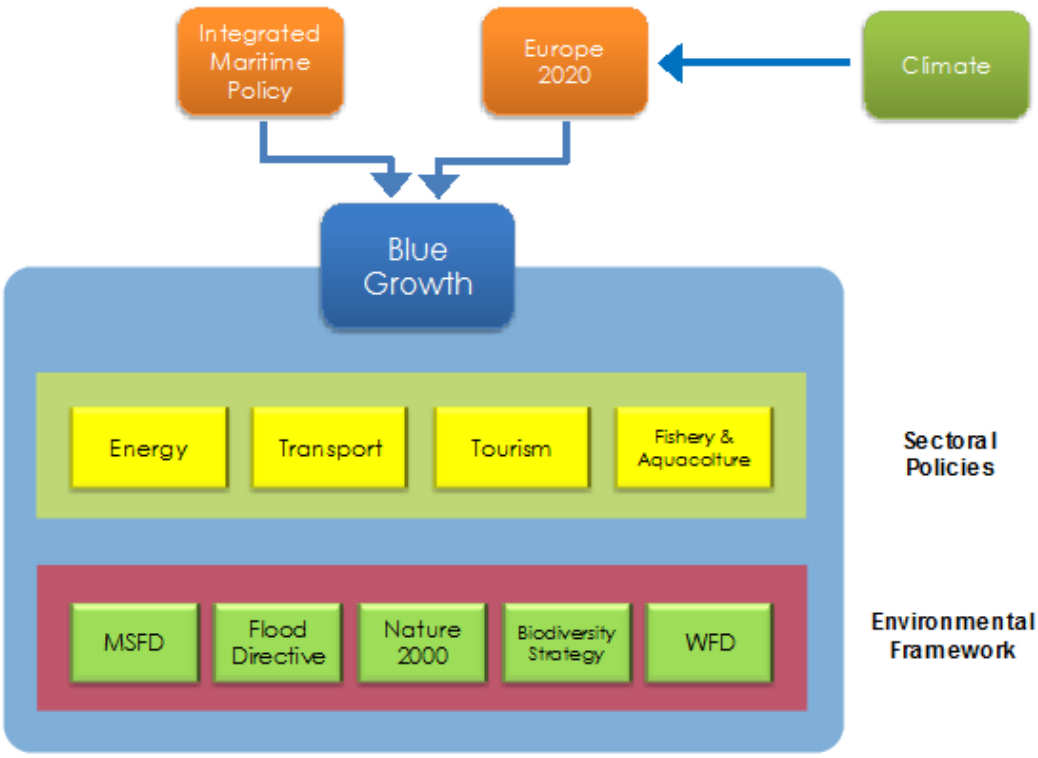

Figure 3-1 The Blue Growth strategy as a paradigm inspired by main EU strategies and encompassing sectoral policies and environment- inspired frameworks

Towards Integrated Coastal Zone Management (ICZM) and Marine Spatial Planning (MSP)

It is worth to briefly consider here the efforts made in the last two decades by the European Union to promote measures to remedy deterioration and to improve the situation in the European coastal zones, as they are in many sense a precursor of MSP. From 1996 to 1999,

the EC operated a Demonstration Programme on ICZM, designed around 35 demonstration projects and 6 thematic studies. Based on the experiences and outputs of the Demonstration Programme, the Commission adopted the Recommendation concerning the implementation of ICZM, adopted by Council and Parliament in 2002[20]. The Recommendation outlines the steps that Member States should take to develop national strategies for ICZM, and identifies a strategic approach based on:

a) protection of the coastal environment, based on an ecosystem approach preserving its integrity and functioning, and sustainable management of the natural resources of both the marine and terrestrial components of the coastal zone;

b) recognition of the threat to coastal zones posed by climate change and of the dangers entailed by the rise in sea level and the increasing frequency and violence of storms;

c) appropriate and ecologically responsible coastal protection measures, including protection of coastal settlements and their cultural heritage;

d) sustainable economic opportunities and employment options;

e) a functioning social and cultural system in local communities;

f) adequate accessible land for the public, both for recreational purposes and aesthetic reasons;

g) in the case of remote coastal communities, maintenance or promotion of their cohesion;

h) improved coordination of the actions taken by all the authorities concerned both at sea and on land, in an aging the sea-land interaction.

In 2010 the EU coastal Member States were invited to provide an update of the progress in implementing ICZM from 2006 up to 2010. In addition to the national reports the Commission, DG Environment, provided a series of studies for the follow up of the ICZM Recommendation and a project, OURCOAST, aiming to support and ensure the exchange of experiences and best practices in coastal planning and management, where some Adriatic-Ionian experiences are reported, too[21].

On 13 September 2010, the Council adopted the decision to ratify the **Protocol on Integrated Coastal Zone Management to the Barcelona Convention**[22]. This decision represents a strong signal of commitment from the EU to the protection and sustainable management of the Mediterranean coast.

The **Maritime Spatial Planning** has been officially launched for the first time by the Blue Book on Maritime Policy in 2007. The "Roadmap for MSP" was adopted on 25 November 2008[23]. In 2010 the European Commission adopted a communication on the achievements and future development of MSP in the EU (COM(2010) 771final). In this Communication, the Commission "sees a clear need for, and an added value in, continued work towards a common approach to MSP", based on the significant experienced gathered in the Member States and in third countries. Furthermore, the Commission underlines the importance of fully integrate in the MSP the implementation of the Marine Strategy Framework Directive and ICZM. The need for coastal and marine policies integration and the coordination of their respective planning and regulatory tools is also one of the major outcomes of the consultation launched by the Commission in 2011. Based on the results of the consultation, in 2013 the EC launched a

20 Recommendation of the European Parliament and of the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management in Europe (2002/413/EC), OJ L 148/24, 6.6.2002.

21 See http://ec.europa.eu/ourcoast/

22 Council Decision of 13 September 2010 concerning the conclusion, on behalf of the European Union, of the Protocol on Integrated Coastal Zone Management in the Mediterranean to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (2010/631/EU), OJ L 279/1, 23.10.2010.

23 Communication from the Commission, "Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU", COM (2008) 791, Brussels, 25.11.2008.

proposal for a Directive establishing a framework for Maritime Spatial Planning and Integrated Coastal Zone Management[24], which is presently under discussion in the trialogue between the EC, the Council and the EP[25].

In addition, for the Mediterranean Sea, the Commission committed a study on "Exploring the potential of Maritime Spatial Planning in the Mediterranean Sea"[26] (Final Report 2011). The study identified the Adriatic Basin as one of the four areas having more potential for the application of cross border/international MSP. In this report the potential of MSP is analyzed on the basis of three aspects: the purpose of MSP in the area (type and intensity of uses as well as the ecological value of the marine area), the feasibility of MSP in the area (scientific data / knowledge base, institutional capacity, legal and administrative supportive framework and stakeholders involvement;) the conditions for cross-border/international cooperation (in case the marine area falls beyond national jurisdiction).

3.1.2 The specific sectoral policies

Common Fisheries Policy (CFP)

The EU has a policy for fisheries (Common Fisheries Policy) which has been amended and updated several times since its establishment in 1971. The CFP does not represent a fixed body of rules, it is a work in progress that has to adapt to changing biological and political circumstances.

A first major reform occurred in 2002[27]. In 2009, the Commission launched a wide public debate on the way EU fisheries are managed. Its Green paper on reform of the common fisheries policy [28] outlined the challenges facing Europe's fisheries.

The CFP reform was approved in December 2013[29]. The present regulation represents the culmination of an extended process which begun with the consultation process of 2009 and continued with the 2011 package of reform proposals of the European Commission (COM(2011)417 – COM(2011) 425 – COM(2011) 416 – COM(2011) 424 – COM(2011) 418).

The reformed CFP aims to bring fish stocks back to sustainable levels, to promote sustainable aquaculture, to provide EU citizens with a stable and healthy food supply for the long term and to promote healthy marine ecosystems. It seeks to bring new prosperity to the fishing sector, end dependence on subsidies and create new opportunities for jobs and growth in coastal areas.

The CFP has the objective to provide coherent measures concerning a broad range of matters, such as conservation, management and exploitation of living aquatic resources, limitation of the environmental impact of fisheries, conditions of access to waters and resources, structural policy and the management of the fleet capacity, control and enforcement, aquaculture, common organisation of the markets and international relations[30].

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24 Proposal for a Directive of the European Parliament and of the Council establishing a framework for maritime spatial planning and integrated coastal Management, COM(2013)133, Brussels, 12.3.2013.

25 Adopted by the European Parliament, April 2014, http://europa.eu/rapid/press-release_IP-14-459_en.htm

26 http://ec.europa.eu/maritimeaffairs/documentation/studies/study_msp_med_en.htm

27 Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy, OJ L 358/59, 31.12.2002.

28 Green Paper Reform of the Common Fisheries Policy, COM(2009)163 final, Brussels, 22.4.2009.

29 Regulation (EU) No 1380/2013 of 11 December 2013 amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC.

30 See paragraph 3.2.3

Specific provisions for fishing in the Mediterranean Sea are found in Council Regulation (EC) No. 1967/2006 of 21 December 2006 concerning management measures for sustainable exploitation of fishery resources in the Mediterranean Sea.

On 2 December 2011 the European Commission proposed a new fund for the EU's maritime and fisheries policies for the period 2014-2020: the European Maritime and Fisheries Fund (EMFF)[31].The EMFF focuses on the long term strategic objectives of the two policies: the new CFP and the IMP. In line with the objectives of Europe 2020 strategy, the EMFF is structured around 4 pillars:

- Smart, Green Fisheries to foster the transition to sustainable fishing which is more selective, produces no discards, does less damage to marine ecosystems and thus contributes to the sustainable management of marine ecosystems; and to provide support focused on innovation and value added, making the fisheries sector economically viable and resilient to external shocks and to competition from third countries.
- Smart, Green Aquaculture: to achieve economically viable, competitive and green aquaculture, capable of facing global competition and providing EU consumers with healthy and high nutrition value products.
- Sustainable and Inclusive Territorial Development: to reverse the decline of many coastal and inland communities dependent on fishing, through adding more value to fishing and fishing related activities and through diversification to other sectors of the maritime economy.
- Integrated Maritime Policy to support those cross cutting priorities which generate savings and growth but which the Member States will not take forward on their own – such as marine knowledge, maritime spatial planning, integrated coastal zone management and integrated maritime surveillance, the protection of the marine environment, in particular its biodiversity, and adaptation to the adverse effects of climate change on coastal areas.

Aquaculture

Aquaculture is one of the pillars of the EU's Blue Growth Strategy and its development can contribute to the Europe 2020 Strategy. The EU seafood market is currently supplied for 25% from EU fisheries, 65% from imports and 10% from EU aquaculture. EU total apparent consumption of fishery and aquaculture products reached some 13.2 million tonnes. Available data show a growing gap – estimated at 8 million tonnes – between the level of consumption of seafood in the EU and the volume of captures from fisheries. The Commission and Member States can help ensuring that this gap is partly filled by environmentally, socially and economically sustainable EU aquaculture. Aquaculture has been growing at 6.9% p.a. globally, but in the EU this level of growth has not been achieved, with production remaining at the same level since at least 2000.

Based on current labour productivity, each percentage point of current EU consumption produced internally through aquaculture would help create between 3,000 and 4,000 full-time jobs. This figure confirms that, although aquaculture represents a relatively small part of the EU economy[32], it has the potential to boost growth and jobs in EU coastal and inland areas. A close cooperation with the processing industry can further improve job creation and competitiveness in both sectors.

31 COM(2011) 804 final - European Maritime and Fisheries Fund (EMFF)

32 In 2010, the value of EU aquaculture production was € 3.1 billion for 1.26 million tones of production

The Commission intends to boost aquaculture through the Common Fisheries Policy reform, and has recently published Strategic Guidelines[33] presenting common priorities and general objectives at EU level. Aquaculture is dependent on clean and healthy marine and fresh waters. The Commission intends to help national and regional administrations to implement EU environmental legislation without imposing unnecessary burdens on producers.

Guidelines on the integration of aquaculture in Natura2000 sites have been published in 2012[34], and similar guidelines on aquaculture and the WFD and the MSFD are expected soon.

Four priority areas are addressed in the EC Strategic Guidelines in order to unlock the potential of EU aquaculture:

1. Reduce administrative burdens
2. Facilitate access to water and space
3. Improve competitiveness

Exploit competitive advantages – "level playing field

On the basis of these guidelines, Member States are now elaborating multiannual national plans for the development of sustainable aquaculture. It is a matter of fact that these plans should consider other possible uses of the same marine space, so an appropriate MSP procedure is a clear necessity for the design and the actual implementation of aquaculture plans.

Tourism

The Blue Growth Communication of 2012 listed coastal and maritime tourism as one of five focus areas for delivering sustainable growth and jobs in the blue economy, with special potential to foster a smart, sustainable and inclusive Europe. Half of European coastal tourism's jobs and related value added activities are located in the Mediterranean[35].

On 20 February 2014, the European Commission adopted a Communication on ”A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism”[36]. This strategy sets out 14 targeted actions involving national, regional and industry level partners:

1. Strive to close gaps in tourism data availability, in particular coastal and maritime.
2. Develop a coastal and maritime focus, where appropriate, in EU tourism initiatives, including promotional and communication campaigns.
3. Promote a pan-European dialogue between cruise operators, ports and coastal tourism stakeholders.
4. Support the development of transnational and interregional partnerships, networks, clusters and smart specialization strategies.
5. Assess the need for EU action on qualification requirements for professional yacht skippers and recreational boating.

33 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, “Strategic Guidelines for the sustainable development of EU aquaculture”, COM(2013) 229 final, Brussels, 29.4.2013.

34 http://ec.europa.eu/environment/nature/natura2000/management/docs/Aqua-N2000%20guide.pdf

35 Final Report “Study in support of policy measures for maritime and coastal tourism at EU level”, Specific contract under FWC MARE/2012/06 - SC D1/2013/01-SI2.648530, Rotterdam/Brussels, 15 September 2013.

36 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, “A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism”, COM(2014) 86 final, Brussels, 20.2.2014.

6. Assess the need for EU action on provisions for nautical tourism safety equipment.
7. Stimulate innovative management schemes through the ICT and the Tourism business portal.
8. Promote ecotourism, using the European Eco-Management and Audit Scheme (EMAS) and EU Ecolabel indicators and encourage linking to other sustainability actions
9. Promote implementation of the Protocol to the Barcelona Convention on Integrated Coastal Management and the relevant Council Recommendation, and promote Maritime Spatial Planning and Green Infrastructure, to ensure the sustainable development of EU coastal areas.
10. Promote strategies on waste prevention, management and marine litter to support sustainable coastal and maritime tourism.
11. Encourage the diversification and integration of coastal and inland attractors, including through transnational thematic itineraries like cultural, religious or ancient trade routes.
12 Contract a study on how to improve island connectivity and design innovative tourism strategies for (remote) islands.
13. Contract a study to identify innovative practices for marina development.
14. Develop an online guide with an overview of the main funding opportunities available for the sector (particularly SMEs).

Climate and Energy

Climate&Energy policies and strategies are relevant to MSP for many reason, as the sea is a place where energy is:

- Produced (both from renewable and fossil sources)
- Transported (both by ship and bottom-located infrastructures like cables and pipelines)
- Consumed (by ships and boats, for transport of passengers and goods, for fishery, for leisure)

After a brief introduction, only the maritime/marine-related issues are considered here below.

The climate and energy package is a set of binding legislation which aims to ensure the European Union meets its ambitious climate and energy targets for 2020.

These targets, known as the "20-20-20" targets, set three key objectives for 2020:

- A 20% reduction in EU greenhouse gas emissions from 1990 levels;
- Raising the share of EU energy consumption produced from renewable resources to 20%;
- A 20% improvement in the EU's energy efficiency

The climate and energy package comprises four pieces of complementary legislation which are intended to deliver on the 20-20-20 targets:

- Reform of the EU Emissions Trading System (EU ETS)
- National targets for non-EU ETS emissions
- National renewable energy targets
- Carbon capture and storage

The climate and energy package does not address the energy efficiency target directly. This is being done through the 2011 Energy Efficiency Plan and the Energy Efficiency Directive. While the EU is making good progress towards meeting its climate and energy targets for 2020, an integrated policy framework for the period up to 2030 is needed to ensure regulatory certainty for investors and a coordinated approach among Member States.

It is worth to consider here the development occurred in the last months and in some sense are still occurring during the period of the ADRIPLAN project.

The framework 2020-2030 presented by the European Commission in January 2014 seeks to drive continued progress towards a low-carbon economy[37]. It aims to build a competitive and secure energy system that ensures affordable energy for all consumers, increases the security of the EU's energy supplies, reduces our dependence on energy imports and creates new opportunities for growth and jobs.

EU leaders agreed in March 2014 to decide on the framework in October 2014 at the latest. In the conclusions of the European Council of 20/21 March 2014, between the other decisions, is reported the following:

"Efforts to reduce Europe's high gas energy dependency rates should be intensified, especially for the most dependent Member States. Moderating energy demand through enhanced energy efficiency should be the first step which will also contribute to other energy and climate objectives. The European Council calls on the Commission to conduct an in-depth study of EU energy security and to present by June 2014 a comprehensive plan for the reduction of EU energy dependence. The plan should reflect the fact that the EU needs to accelerate further diversification of its energy supply, increase its bargaining power and energy efficiency, continue to develop renewable and other indigenous energy sources and coordinate the development of the infrastructure to support this diversification in a sustainable manner, including through the development of interconnections. Such interconnections should also include the Iberian Peninsula and the Mediterranean area. Where relevant, interconnections should also be developed with third countries."

Europe's energy networks

Significant investments are urgently needed to modernize and expand Europe's energy networks to achieve the Union's energy and climate policy objectives in terms of competitiveness, sustainability and security of supply. In particular:

- Interconnected smart electricity grids are necessary to foster market integration, to integrate the increasing amounts of electricity generated from renewable sources, and to maintain the system's security at the same time.
- A secure gas supply calls for an interconnected, diversified and more flexible pipeline system, and land-locked countries in Central-Eastern Europe are in need of diversified oil supplies.

To this aim, Regulation (EU) No 347/2013 is intended to facilitate the timely development and interoperability of trans-European energy networks (TEN-E) and sets out a new framework under which energy infrastructure is planned and implemented, for the period up to 2020 and beyond[38]

37 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "A policy framework for climate and energy in the period from 2020 to 2030", COM(2014) 15 final, Brussels, 22.1.2014.

38 Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009, OJ L 115/39, 25.4.2013.

This Regulation establishes nine strategic geographic infrastructure priority corridors in the domains of electricity, gas and oil, and three Union-wide infrastructure priority areas for electricity highways, smart grids and carbon dioxide transportation networks, and introduces a transparent and inclusive process to identify concrete projects of common interest (PCIs), which are needed to implement the priority corridors.

This process is based on regional cooperation, involving all relevant parties in the field of energy, who deliver their knowledge and expertise with regard to the technical feasibility and market conditions, both from a national and a European perspective. Stakeholders include transmission system operators (TSOs) and other project promoters, ministries, national regulatory authorities (NRAs), the European Network of Transmission System Operators in gas and electricity (ENTSO-E and ENTSOG), the Agency for the Cooperation of Energy Regulators (ACER), the Commission, and observers such as the Energy Community

The regulation provides criteria to identify projects of common interest (i.e. cross-border projects or projects which benefit two or more Member States) necessary to implement them, which may be eligible for EU funding under the "Connecting Europe Facility" financing instrument. The regulation also provides for new, more transparent and accelerated procedures to grant permits for such projects, which should generally not exceed 3.5 years. In addition, it lays down rules on the possible cross-border allocation of construction costs for infrastructure projects of common interest.

The Commission adopted a first EU-wide list of projects of common interest on the basis of regional lists on 14 October 2013[39]. Subsequent lists will be drawn up every two years. No later than 2017, the Commission will publish a report on the implementation of these projects.

Financial assistance is provided by the Regulation establishing the Connecting Europe Facility with a budget of EUR 5.1 bn for energy in the period 2014-2020.

The process to establish the first Union list of PCIs started in March 2012. About 430 projects have been submitted and firstly were assessed by the Regional Groups established under the Regulation and composed of representatives of the Member States, national regulatory authorities, transmission system operators (TSOs), as well as the Commission, the Agency for the Cooperation of Energy Regulators (the Agency) and the European Network of Transmission System Operators for Electricity and Gas (ENTSO-E and ENTSOG). By discarding those projects that did not meet the general criteria, the regional groups reduced the number of projects to about 250 and finally, the final regional lists agreed by the decision-making bodies on 24 July 2013 contained 69 clusters of 136 PCIs in electricity, 55 clusters of 104 PCIs in gas, 6 oil and 2 smart grid PCIs.

All of the proposed projects obtained the approval of the Member States to which territory they relate.

In the following tables are reported the projects of interest for the area of ADRIPLAN project.

3. Priority corridor North-South electricity interconnections in Central Eastern and South

Eastern Europe ('NSI East Electricity')

3.19 Cluster Italy - Montenegro between Villanova and Lastva including the following PCIs:

3.19.1 Interconnection between Villanova (IT) and Lastva (ME)

6. Priority corridor North-South gas interconnections in Central Eastern and South Eastern

Europe ('NSI East Gas')

Projects allowing gas to flow from Croatian LNG terminal to neighboring countries

6.5 Cluster Krk LNG Regasification Vessel and evacuation pipelines towards Hungary,

39 Commission delegated regulation C(2013) 6766 final

Slovenia and Italy, including the following PCIs:

6.5.1 LNG Regasification vessel in Krk (HR)

6.5.2 Gas pipeline Zlobin – Bosiljevo – Sisak – Kozarac – Slobodnica (HR)

6.5.3 LNG evacuation pipeline Omišalj – Zlobin (HR) – Rupa (HR) / Jelšane (SI) – Kalce (SI) or

6.5.4 Gas pipeline Omišalj (HR) – Casal Borsetti (IT)

Projects allowing gas from the Southern gas corridor and/or LNG terminals reaching Italy to flow towards the north to Austria, Germany and Czech Republic (as well as towards the NSI West corridor)

6.18 PCI Adriatica pipeline (IT)

6.19 PCI Onshore LNG terminal in the Northern Adriatic (IT) (The precise location of the LNG terminal in the Northern Adriatic will be decided by Italy in agreement with Slovenia)

Other projects

6.21 PCI Ionian Adriatic Pipeline (Fieri (AB) – Split (HR))

7. Priority corridor Southern Gas Corridor ('SGC')

7.1 Cluster of integrated, dedicated and scalable transport infrastructure and associated equipment for the transportation of a minimum of 10 bcm/a of new sources of gas from the Caspian Region, crossing Georgia and Turkey and ultimately reaching final EU markets through two possible routes: one crossing South-East Europe and reaching Austria, the other one reaching Italy through the Adriatic Sea, and including one or more of the following PCIs:

7.1.3 Gas pipeline from Greece to Italy via Albania and the Adriatic Sea [currently known as the "Trans-Adriatic Pipeline" (TAP)]

7.1.4 Gas pipeline from Greece to Italy via the Adriatic Sea [currently known as the "Interconnector Turkey-Greece-Italy" (ITGI)]

Renewable Energy

The Renewable Energy Roadmap[40] sets out the Commission's long-term strategy for renewable energy in the European Union (EU). It demonstrated that 20% target for the overall share of energy from renewable sources and a 10% target for energy from renewable sources in transport would be appropriate and achievable objectives.

These goals are headline targets of the Renewable Energy Directive 2009/28/EC which establishes a European framework for the promotion of renewable energy, setting mandatory national renewable energy targets for achieving a 20% share of renewable energy in the final energy consumption and a 10% share of energy from renewable sources in transport by 2020.

Maritime wind energy represents a relevant source of clean, indigenous and renewable energy. The EC Communication on "Offshore Wind Energy: Action needed to deliver on the Energy Policy Objectives for 2020 and beyond"[41] outlines that one of the obstacles to the development of maritime wind energy is the lack of an integrated strategic planning in the marine environment.

The Renewable Energy directive is relevant to MSP for the production of energy (especially

40 Communication from the Commission to the Council and the European Parliament, "Renewable Energy Road Map Renewable energies in the 21st century: building a more sustainable future", COM(2006) 848 final, Brussels, 10.1.2007.

41 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, " Offshore Wind Energy: Action needed to deliver on the Energy Policy Objectives for 2020 and beyond", COM(2008) 768 final.

offshore wind farm) and for the use of alternative fuel in transport (better considered in the Transport sectoral policy paragraph). In the Italian case, the authorisation to offshore wind farms is subjected to national (not regional) rule.

At this moment, no large offshore wind farms are located along the Adriatic coast.

Transport

Maritime transport (Short-sea shipping, deep-sea shipping, and passenger ferry services) is by far the largest maritime economic activity in the Adriatic and Ionian in terms of GVA and employment[42].

In line with the flagship initiative "Resource efficient Europe" set up in the Europe 2020 Strategy and the new Energy Efficiency Plan 2011, in March 2011 the European Commission presented the White Paper "Roadmap to a Single European Transport Area"[43], a series of 40 concrete initiatives for the next decade to establish a system that enhance European economic progress, competitiveness and offers high quality mobility services while using resources more efficiently. Transport systems should use less and cleaner energy, better exploit a modern infrastructure and reduce its negative impact on the environment and key natural assets like water, land and ecosystems.

The White Paper identify ten goals around three priorities for reaching a competitive and resource efficient transport, which corresponds also to the benchmarks for achieving the 60% GHG emission reduction target:

a) Developing and deploying new and sustainable fuels and propulsion systems

1. Halve the use of 'conventionally-fuelled' cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO2-free city logistics by 2030
2. 40% of low-carbon sustainable fuels in aviation and **40% (if feasible 50%) less emissions in maritime transport by 2050**

b) Optimizing the performance of multimodal logistic chains, including by making greater use of more energy-efficient modes

3. 30% of road freight over 300 km should shift to other modes such as rail **or waterborne transport** by 2030, and more than 50% by 2050
4. Triple the length of the existing high-speed rail network. By 2050 the majority of medium-distance passenger transport should go by rail.
5. A fully functional and EU-wide multimodal TEN-T 'core network' by 2030
6. By 2050, connect all core network airports to the rail network, **ensure that all core seaports are connected to the rail freight and, where possible, inland waterway system**.

c) Increasing the efficiency of transport and infrastructure use with information systems and market-based incentives

7. Deployment of SESAR by 2020 and completion of the European Common Aviation Area. Deployment of ERTMS, ITS, SafeSeaNet, River Information Services and Galileo
8. By 2020, establish the framework for a European multimodal transport information, management and payment system

42 EUNETMAR, "Study to support the development of sea-basin cooperation in the Mediterranean, Adriatic and Ionian, and Black sea - Analysis to support the elaboration of the Adriatic and Ionian maritime Action Plan", MARE/2012/07 - REF. NO 2, March 2014.

43 White Paper, Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 final, Brussels, 28.3.2011.

9. Move close to zero fatalities in road transport by 2050
10. Move towards full application of "user pays" and "polluter pays" principles

Therefore, the White paper identifies 4 main issues for implementing the above goals:

1. A genuine Single European Transport Area without residual barriers between modes and national systems
2. Innovation to address the full cycle of research, innovation and deployment in an integrated way through focusing on the most promising technologies and bringing together all actors involved
3. An EU transport infrastructure policy with a common vision and sufficient resources.

Concerning the Single European Transport Area in maritime transport, emphasized also by the Blue Book on IMP, European Commission adopted in 2009 the Communication on a European maritime transport space without barriers[44]. With its European maritime transport space without barriers, the Commission is seeking to boost the overall effectiveness of intra-EU maritime transport by removing major administrative obstacles. This has an important role in helping the EU to respect its environmental commitments and address its energy challenge. This is also part of a broad strategy which encompasses the Motorways of the Sea project, the Marco Polo programme and the TEN-T projects.

The "Motorways of the Sea" have been proposed by the Transport White Paper of September 2001 as a "real competitive alternative to land transport". These "motorways of the sea" should be part of the Trans-European network (TEN-T). According to Art.12 of TEN-T[45] "The trans-European network of motorways of the sea is intended to concentrate flows of freight on sea-based logistical routes in such a way as to improve existing maritime links or to establish new viable, regular and frequent maritime links for the transport of goods between Member States so as to reduce road congestion and/or improve access to peripheral and island regions and States. Motorways of the sea should not exclude the combined transport of persons and goods, provided that freight is predominant." Besides classical financial instruments (such as the Cohesion Fund, ERDEF, …), the setting-up of Europe's Motorways of the Sea rests on two instruments: the TEN-T projects, and the Marco-Polo programme.

One of the routes selected to be a Motorway of the Sea is the south-east Europe, which connects the Adriatic Sea to the Ionian Sea and the Eastern Mediterranean, including Cyprus.

The Union guidelines for the development of the trans-European transport network[46] identify the following priorities for maritime infrastructure development (Art. 23):

a) promoting motorways of the sea including short-sea shipping, facilitating the development of hinterland connections and developing measures to improve the environmental performance of maritime transport;
b) interconnection of maritime ports with inland waterways;
c) implementation of VTMIS and e -Maritime services;
d) introduction of new technologies for the promotion of alternative fuels and energy-efficient maritime transport, including LNG;

44 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "Communication and action plan with a view to establishing a European maritime transport space without barriers, COM (2009) 10 final, Brussels, 21.1.2009.

45 Decision No 884/2004/EC of the European Parliament and of the Council of 29 April 2004 amending Decision No 1692/96/EC on Community guidelines for the development of the trans-European transport network, OJ L 201/1, 7.6.2004.

46 Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU

e) modernization and expansion of the capacity of the infrastructure necessary for transport operations within the port area.

As regards ports, the White Paper underlined the huge potential that EU ports have for sustaining the economic recovery and contributing to the long term competitiveness of European industries. The sector is continually evolving has the potential to make existing port infrastructure obsolete.

Among the main challenges that the sector are facing:

- Increased size and complexity of the fleet, in particular ultra-large container ships, new types of Ro-Ro ferries and gas-carriers.
- Stricter requirements on environmental performance and alternative fuels (e.g. cold ironing and LNG). The Commission's Clean Power for Transport initiative and the proposal for a Directive on the deployment of alternative fuels infrastructure requires that all maritime ports of the TEN-T Core network are equipped with LNG refueling points according to common technical standards by 2020.
- Trends in the fast growing cruise industry and in logistics and distribution systems have led to an increased need for value added services within the area of the port;
- Significant developments in the energy trades, with a shift from oil and refined products towards gas; a need for significant gasification facilities in ports; potential volumes of dry biomass and CO2 transport and storage.

On 23 May 2013, the Commission adopted the Communication "Ports: an engine for growth"[47] that reviews the European Port Policy. The Communication outlines a strategy based on a set of actions to address the following issues:

1. Connect ports to the trans-European network
2. Modernize port services
3. Attract investment to ports
4. Promote the Social Dialogue
5. Raise the environmental profile of ports
6. Encourage innovation

Enhancing the competiveness and attractiveness of Adriatic Ionian regional ports was the main goal of the North Adriatic Port Association (NAPA), when it was first established in 2010. Especially, in the context of the EU enlargement process, NAPA had the objective to develop the North Adriatic Ports as the South-gate to Europe, thus, strengthening the role of the Adriatic Sea in the international maritime transport routes.

3.1.3 The Mediterranean regional cooperation

Mediterranean Action Plan (MAP) and the Mediterranean Commission for Sustainable Development (MCSD) have been designated at the Johannesburg summit as the most relevant programme and institutional framework for the implementation of sustainable development in the Mediterranean region.

The Convention on the protection of the sea and coastal zone of the Mediterranean (Barcelona Convention), adopted in 1976 and revised in 1995, and the six supporting protocols represent the legal framework for the activities of MAP and MCSD[48].

The **Mediterranean Action Plan**, adopted in 1975, is a regional cooperative effort involving 21 neighboring states bordering the Mediterranean Sea, as well as the European Union.

47 Communication from the Commission, "Ports: an engine for growth", COM(2013) 295 final, Brussels, 23.5.2013.

48 See Paragraph 3.2.2

The Action Plan for the Protection of the Marine Environment and the Sustainable Development of the Coastal Areas of the Mediterranean (MAP Phase II) has the following main objectives:

- to ensure sustainable management of natural marine and land resources and to integrate the environment in social and economic development, and land use policies
- to protect the marine environment and coastal zones through prevention of the pollution
- to protect nature and protect and enhance sites and landscapes of ecological and cultural value
- to strengthen solidarity among Mediterranean coastal States in managing their common heritage and resources for the benefit of present and future generations
- to improve the quality of life

To intensify integrated planning of coastal areas is a priority of the next ten years MAP strategy. The introduction of the MAP affirms that "major shortcomings in the protection of the Mediterranean marine environment and its coastal regions are the inappropriate management of coastal zone due to the lack of adequate coastal zone planning and management; inadequate national legislation and its effective enforcement; weak institutional structures and inadequate human resources allocated for these types of activities; and lack of mobilization of adequate financial resources and clear political commitment to solve existing problems"(1995).

Concerning the implementation of sustainability principles in the Mediterranean region, the MCSD has provided major inputs to the formulation of **the Mediterranean Strategy of Sustainable Development** (MSSD), adopted in 2005.

MSSD has four main objectives:

1. Contribute to economic development by enhancing Mediterranean assets;
2. Reduce social disparities by implementing Millennium Development Goals and strengthen cultural identities;
3. Change unsustainable production and consumption patterns and ensure sustainable management of natural resources;
4. Improve governance at the local, national and regional level.

To help meet these four major objectives, the Strategy aims to achieve real progress on seven issues:

1. promote sustainable management of the sea and the littoral and urgently stopping the degradation of coastal zones;
2. control urbanization and promote sustainable urban development;
3. promote 'quality' agriculture and sustainable rural development;
4. promote better management of water resources and demands;
5. manage energy demand and reduce the long-term effects of climate change;
6. ensure sustainable mobility through appropriate transport management;
7. make tourism a leading vector for sustainable Mediterranean development.

The initiative, **Union for the Mediterranean**, launched in 2008, is seen to complement the Barcelona process and the European Neighborhood Policy (ENP). The UfM includes all EU member states and 16 coastal states of the Mediterranean. It builds on the Barcelona Process and the Mediterranean Action Plan, but within a new political and institutional framework and with broader political and diplomatic objectives. It has a joint secretariat and is chaired by two co-presidents, from the EU side and from non-EU countries. It has six priorities (de-pollution, maritime and land highways, civil protection, alternative energies, higher education and research, and business initiatives). According to the declaration of 2008, the challenge is "to enhance multilateral relations, increase coownership of the process, set governance on the basis of equal footing and translate it into concrete projects, more visible to citizens". The

"project guidelines" issued in 2011, also include environmental impacts, pollution prevention and mitigation of threats to biodiversity (ESPON-ESaTDOR, 2011).

3.1.4 The Adriatic/Ionian cooperation

EU Strategy for the Adriatic and Ionian Region

The geographic area of the Adriatic-Ionian Macro-Region includes four EU Member States (Italy, Croatia, Slovenia and Greece) as well as Bosnia and Herzegovina, Serbia, Montenegro and Albania, which are all at the pre-accession stage for entry into the EU.

In 2012, the European Council gave mandate to the Commission for the presentation of a new EU Strategy for the Adriatic and Ionian region (EUSAIR) before the end of 2014[49]. The EC Communication "A Maritime Strategy for the Adriatic and Ionian Seas" [50] is one of the main components of the Strategy, and is based on 4 pillars:

1) Maximizing the potential of the blue economy,
2) Maximizing the potential of the blue economy, healthier marine environment,
3) A safer and more secure maritime space,
4) Sustainable and responsible fishing activities.

The new EUSAIR focuses on regional issues of common interest and high relevance for the Adriatic and Ionian countries, and is structured around the following four pillars, that absorb also the 4 pillars of the Maritime Strategy (Discussion-paper on an EU Strategy for the Adriatic and Ionian Region (EUSAIR), August 2013):

a) Driving innovative maritime and marine growth: The main specific challenges and objective identified by the Discussion paper, are:

   • Developing market intelligence and services to ensure that marketing of fisheries and aquaculture products in the region is clear, efficient and fully compliant with applicable rules.

   • Promoting common marketing and consumer awareness on Adriatic-Ionian seafood products, including seafood traceability and quality certification systems.

   • Improving good management for sustainable fisheries, including through the development of multiannual plans and other measures such as, inter alia, Marine Protected Areas

   • Increasing the profitability and sustainability of fisheries and aquaculture activities.

   • Improving the culture of compliance, saving resources, facilitating the collection, and transfer of data and information and enhancing cooperation for the monitoring and control of fishing activities.

   • Developing tools to properly site aquaculture, including tools to identify activities for potential co-location with other economic activities.

b) Connecting the region: The main specific challenges and objectives identified by the Discussion paper are:

   • Optimizing interfaces, procedures and infrastructure to facilitate trade with southern, central and eastern Europe, also by ensuring the rapid implementation of a maritime transport space without barriers.

   • Improving hinterland connections of seaports to TEN-T and enforcing the development of intermodality in the Adriatic-Ionian region through the establishment of freight villages and land corridors.

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49 European Council 13/14 December 2012, Conclusions, EUCO 205/12, Brussels, 14 December 2012.

50 COM(2012) 713 final, 30 November.2012.

• Enhancing cooperation between national or regional maritime authorities with the EU, establishing mechanisms to enable maritime traffic information exchange between national VTMIS systems through SafeSeaNet, notably for candidate and potential candidate countries.

• Improving the culture of compliance in flag and port state control, liability and insurance of shipping, accident investigation and port security.

• Developing modern security technologies in the ports of the region.

• Reducing isolation of islands and remote areas by improving their access to transport and energy services.

• Increasing efficiency and reducing the environmental impact of transport systems, notably by providing alternative, sustainable and environmentally friendly, combined transport solutions.

• Minimization of pollution from ship traffic, in particular oil, emissions to air and litter.

• Continuing improving sub-regional cooperation and monitoring the existing mechanisms, as regards prevention, preparedness and coordinated response to major oil spills.

• Increasing the resilience of infrastructure to natural and man-made disasters

• Addressing energy dimension, as far as a macro-regional approach may facilitate a positive impact on accessibility, energy efficiency and environment.

• Preserving security of environment during transport of dangerous goods and activities related to the energy sector.

• Developing environment-friendly fuels in marine transport as well as implementation of renewable energy sources.

• Creating energy seasonal balancing opportunities.

• Regulatory reform and rationalization at each energy interconnection point in the regional system.

c) <u>Preserving, protecting and improving the quality of the environment</u>

• Addressing eutrophication (mainly in the Adriatic Sea) by transnational coordinated actions on both point sources (e.g. nutrients and nitrogen discharges from municipal waste and wastewater treatment facilities or industries) and diffuse sources (e.g. nitrates from agriculture) and by enhancing the recycling of nutrients.

• Preserving biodiversity, habitats and ecosystems and their services by implementing the European ecological network Natura 2000 and managing it, considering also related work within the Barcelona Convention.

• Dealing with Invasive Alien Species. Ensuring good environmental and ecological status of the marine and coastal environment by 2020 in line with the relevant EU acquis and the Ecosystem Approach of the Barcelona Convention.

• Reducing marine litter, including through cleaning programmes and better waste management in coastal areas.

• Improving harmonization and coordination in MSP and ICZM, also by facilitating related conflict resolution between local and national or supranational approaches. Supporting waste and waste water management, in particular in urban areas along the coast and rivers.

• Preserving and improving coastal environmental quality by protecting cultural and natural heritage such as coastal and maritime cultural landscapes, including from the impact of climate change.

d) <u>Increasing regional attractiveness</u>

• Capitalizing on existing tools and initiatives in the framework of EU tourism policy.

- Supporting the sustainable development of coastal, maritime and hinterland tourism while reducing seasonality of demand, limiting its environmental footprint and taking into consideration the impacts of a changing climate.
- Promoting the sustainable development of cruise and nautical tourism. Establishing links of those forms of tourism with other forms of regional economic development.
- Enhancing the value and appreciation of culture and natural heritage, also including links with the development of creative enterprise and services.
- Encouraging innovation, clustering and developing of new common marketing strategies and products, including tourist promotion through common branding.
- Improving coordinated governance in the tourism sector among private and public entities.
- Enhancing and improving safety and security of all tourism products, especially diving, sailing and adventure tourism type of products.
- Improving quality management and sustainability, e.g. through the European Tourism Quality label (ETQ) or other joint labels, as well as the promotion of service innovation (e.g. through the use of ICT).
- Developing the links between health tourism and active ageing (Life-science industry).
- Promoting tourism activities and services based on local products (agro and sea foods), cultures and values, to support active social inclusion and opportunities for youth in remote areas and areas exposed to demographic changes.

MSP is fully transversal to the four pillars.

Moreover, "Research, innovation and SMEs development", as well as "Capacity Building" are two cross-cutting aspects which will come across each and every pillar.

In order to develop the EUSAIR Action Plan, 4 Working Groups (one per pillar) will be set up, each of them coordinated by an EU Member State in association with a non-EU country.

The Trilateral Commission for the protection of the Adriatic

The Trilateral Commission for the protection of the Adriatic originates from the bilateral commission between Italy and Yugoslavia (1974), which was re-launched in 1992, including Italy, Croatia and Slovenia. Montenegro has recently become a member of the initiative. Even though the other Adriatic countries – Albania and Bosnia and Herzegovina – do not form part of the Trilateral Commission, their interest in activities conducted by the Trilateral Commission was expressed. They were invited for – and attended – the last meetings of the Trilateral Commission. The main goal of the Trilateral Commission is the protection of the Adriatic Sea and coastal areas against pollution. Therefore, the Commission: (i) studies all problems related to the pollution of the Adriatic Sea waters and coastal areas; (ii) does propositions and recommendations to the government related to the research needed; (iii) is engaged in introducing measures required to eliminate the current pollution and prevent new causes of pollution.

The Trilateral Commission presents the adequate institutional framework for the cooperation of the Adriatic states in the field of marine environmental protection. Moreover, the work of the Trilateral Commission has proved to be an efficient model, housing different aspects of marine environmental issues and providing for appropriate response to new challenges. Consequently, the Trilateral Commission is believed to be the instrument to come to a common vision – a long-term Maritime Spatial Planning strategy – with regard to cross-border/international Maritime Spatial Planning in the (Northern) Adriatic.

Main topics approached by the Commission are:

- Ballast water management in the Adriatic Sea;

• Implementation of the Sub-Regional Intervention Plan for Cases of Sudden Adriatic Sea Pollution;

• EU Marine Strategy Directive;

• The integrated management of coastal areas and safe harbours;

• The members emphasized the importance of coordination and synergy of all activities in the Adriatic for the purpose of its efficient protection and sustainable development

The Adriatic-Ionian Euroregion (AIE)

The Euroregion addresses interregional cooperation between regions of the Adriatic and Ionian coastline. The AIE was founded on June 30, 2006 as a non-profit association, aimed to promote the coordinated and integrated development between regions of the area. It represents a model for cross-border and interregional co-operation.

Today the association counts 26 members (Regional and Local governments from Italy, Greece, Croatia, Bosnia and Herzegovina, Montenegro and Albania). All members are units of territorial self-governments and most of them are NUTS2 (the first level below State, in conformity with the European Community nomenclature NUTS, and with the administrative organization of each country).

The AIE goals can be synthesized into the protection of the cultural heritage, protection of the environment, sustainable economic development in the field of SMEs, tourism, fishery, transport and infrastructure. Furthermore the association supports the members, especially those in the European accession process, to create joint initiatives and to prepare the regional stakeholders to be qualified in the implementation of the cohesion policy and to deal with the European financial instruments.

Another important aim is to support the European citizenship through actions that promotes the involvement of citizens by developing their sense of European identity and appreciating multilingualism and multiculturalism as common European heritage.

In particular the AIE members achieve their activities pursuing the following objectives:

- to establish and to develop mutual relations between inhabitants and institutions of this territory as precondition for the improvement of knowledge, understanding and collaboration;
- to create the conditions for the economic development respecting the environment;
- to determine common interests of development, preparation, definition and harmonization of a common development strategy;
- to achieve the cultural exchange programmes;
- to ensure the conditions for an effective exchange of experiences and implementation of EU programmes.

The association has 6 committees, working on respective thematic with a yearly programme:

1. Commission for tourism and culture
2. Commission for fisheries
3. Commission for transport and infrastructure
4. Commission for environment
5. Commission for economic affairs
6. Commission for Welfare and Youth.

The Adriatic Ionian Initiative (AII)

The initiative links the coastal countries of the Adriatic and Ionian seas. The AII was established at the Summit on Development and Security on the Adriatic and Ionian Seas, held in Ancona (Italy) on 19th/20th May 2000 and attended by the Heads of States and Governments of Italy, Albania, Bosnia and Herzegovina, Croatia, Greece and Slovenia. The Initiative was later extended to Serbia and Montenegro. The overall objective of the initiative was the "determination to improve cooperation among the local and regional level of authorities within the AII". Its fields of action are:

1. Small and medium sized enterprises.
2. Transport and maritime cooperation.
3. Tourism, culture and inter-university cooperation.
4. Environment and protection against fire.

In the context of AII, the participating countries have signed in 2010 a protocol on tourism development involving marine planning issues. Moreover, the signatories have agreed to encourage the widespread development of competitive and sustainable tourism including maritime activities in order to contribute to social and economic growth in an environment-friendly manner. The members of the initiative have also underscored their commitment to foster the maritime and environmental security of the Adriatic Sea with special reference to maritime shipment and fighting marine pollution and to promote economic cooperation maritime transport.

Through the priority field of Tourism, culture and inter-university cooperation, the necessity for all AII countries to proceed to more concrete steps concerning maritime tourism has been emphasized. In this context, two ideas have been proposed that Member states can implement in order to promote marine and yacht tourism. The first proposal concerns the creation of «A Network of Ancient Ports» between all AII Member States which will strengthen the cultural identity in the Adriatic and Ionian Seas. The second one concerns the creation of a common database concerning the marinas. The aim was to create a common benchmark of the marine infrastructure in the Adriatic and Ionian Seas. Under the field priority of Transport and maritime cooperation, it was concluded that it is necessary to work on strengthening communication between Member States, to strengthen cooperation and concretizing specific proposals regarding motorways of the sea and short sea shipping. Regarding the protection of the sea from pollution from vessels, the common position of the initiative is that it is very important to work on the prevention of marine pollution, both individually and in the global regional level. In order to implement full efficiency in all countries bordering the sea, it is necessary to harmonize legislation of all member countries with International Maritime Organization Conventions and European Union directives related to the Adriatic Sea.

One of the six round tables that are active in the framework of AII is the Round Table on Environmental Protection and Sustainable Development. In this framework a document called the Adriatic Action Plan (AAP) was adopted at the environmental ministers' meeting in June 2003 in Zadar, Croatia. The Adriatic Action Plan aims to link together the AII Countries in efforts to reduce the negative impacts of human activities in the Adriatic-Ionian basin. Due to the closed nature of the two seas and increasing pressures on the environment from economic activities, negative pressures are increasing and becoming an ever more serious threat to the sustainable development of the region.

As mentioned above, three projects are in the heart of the environmental aspect of both the Adriatic Sea case studies, the Contingency Plan for the Adriatic aiming at improving sub-regional cooperation in the prevention of, and response to, maritime pollution from shipping, the Ballast Waters Management Plan, foreseeing the implementation of preventive activities related to the introduction of ballast water into the Adriatic ecosystem and the Integrated Coastal Zone Management in order to implement sustainable development.

Slovenia, Italy and Croatia have agreed to commence activities for developing a Sub-regional Contingency Plan for the Northern Adriatic, to be coordinated by the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC/IMO/UNEP). Countries involved expect that results will significantly improve sub-regional cooperation in the

prevention of, and response to, maritime pollution from shipping, which will be a big step forward towards sustainable development.

In the context of the Ballast Water Management Plan for the Adriatic, cooperation was agreed through several strategic projects in data collection, early warning systems, risk assessment, decision support systems, control and monitoring.

The main result of the constant work of the 8 States at different levels within the framework of the AII has been to keep open dialogue between Countries that until few years before had fought each other. Multi-lateral cooperation has been positive both for cooperation at the technical and at the political levels.

Maritime affairs are a priority of the Adriatic Ionian Initiative. Cooperation activities are decided within the Round Table on Maritime Cooperation. The activities of the Round Table involve the representatives of the 8 Countries dealing with sea affairs at their competent Ministries. During the last few months the focus has been on cooperation at the level of coastguards and the other entities that have similar functions in countries not having such institutions (e.g. Slovenia). These activities have prepared the ground for fruitful multilateral and bilateral cooperation (ESPON-ESaTDOR, 2013).

Three fora linked to the AII:

1. The Forum of the Adriatic and Ionian Chambers of Commerce: a transnational, non-profit association linking the chambers of commerce of countries along the Adriatic and Ionian coasts: Italy, Croatia, Bosnia and Herzegovina, Montenegro, Slovenia, Greece and Albania. The aim of the association, established in 2001, is to strengthen the synergies and opportunities for socio-economic development of the Adriatic and Ionian area. The Forum establishes six working groups: Agriculture, Environment, Women's Entrepreneurship, Transports, Tourism and Fisheries/Aquaculture.

2. The Network of the Universities - UniAdrion: a "Network of Universities" established with the purpose to create a permanent connection among universities and research centres of the Adriatic and Ionian Region. The main objective of the network is the realization of didactic initiatives, such as training courses, masters, research projects. The network is organized in 5 working groups:

1. Protection, Cataloguing and Promotion of Cultural Heritage
2. Environment and Sustainable Development
3. Cultural Tourism and Development
4. Economy, Communication, Ports and Economic Relations
5. Technical Aspects and Standards of the UniAdrion Network

3. The Forum of Adriatic and Ionian Cities: the Forum aims to build and develop the economic, social, environmental and cultural heritage of the Adriatic and Ionian coastal cities and to collaborate on European integration and enlargement. It pursues this goal by promoting innovative forms of decentralized cooperation and partnerships between local authorities of the member countries. The association, formed in 1999 (Ancona) was an initiative of the Municipality of Ancona and ANCI (Italian National Association of the Municipalities) with the approval of the "Charter of Ancona" and brings together the coastal cities of the 7 countries of the Adriatic-Ionian Basin: Italy, Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Albania and Greece. Greece is participating in the association with five cities: Kerkyra, Igoumenitsa, Parga, Patra and Preveza. Recently, the Forum of the Adriatic and Ionian Chambers of Commerce, the Forum of the Adriatic and Ionian Cities, UniAdrion (Virtual University of the Adriatic-Ionian basin) and the permanent secretariat of the Adriatic-Ionian Initiative have joined forces in order to strengthen the cooperation activities among the participating countries of the Adriatic-Ionian area (Forum of Adriatic and Ionian Cities).

3.1.5 Cooperation in Adriatic Area supported by European Funds

International cooperation in the Adriatic Sea began in the middle 1990s, firstly in the form of international aid to provide rescue and relief to populations affected by war and then to improve the development of areas. During the last 20 years, this cooperation has come into the framework of European territorial cooperation and has been supported by Pre-Accession and Structural Funds[51].

According to the database of projects elaborated by Svim[52] (Marche Region) and Territorial cooperation Department. of Marche Region there are four main sources of funding; the IPA Programme, Interreg IVC Programme, South East Europe Programme, MED Programme and Italy - Slovenia Cross-border Cooperation Operational Programme[53].

The main instrument for the area has been the IPA (Instrument for Pre-Accession Assistance) Adriatic Crossborder Cooperation Programme (2007-2013), established by the European Union (EC Regulation n. 1085/2006) to assist Candidate Countries and Potential Candidate Countries in their progressive alignment with the standards and policies of the European Union. The IPA Programme is the result of joint programming work carried out by the relevant participating countries and is part of the cooperation process in the Adriatic area. The Programme's objective is to strengthen sustainable development capabilities of the Adriatic region through a concerted strategy of action between the partners of the eligible territories.

The strategic choices, on which the Programme is based, are detailed in the definition of priorities below:

1. Strengthening research and innovation to facilitate development of the Adriatic area through economic, social and institutional cooperation.

2. Promoting, improving and protecting natural and cultural resources through joint management of technological and natural risks.

3. Strengthening and integrating existing infrastructure networks, promoting and developing transport, information and communication services.

The new programming period for exploiting the EU resources 2014-2020 is opening new opportunities. The Strategy for Adriatic and Ionian Sea should also address a better and more effective spending under the new financial framework 2014-2020.

3.2 Legal framework

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3.2.1 Overview

Maritime Spatial Planning (MSP) is a new concept in national, EU and international law. It derives from the multiplication of sea uses with the consequent interference of different activities (e.g. shipping and extraction of oil, fishing and conservation of deep seabed ecosystems) and the need to accommodate these activities while promoting a rational use of the seas.

At present, there is no general legal obligation pending on States to engage with MSP. However, with the adoption of the MSP Directive in July 2014,[54] EU States are now requested

51 http://ec.europa.eu/enlargement/instruments/overview/index_en.htm; http://ec.europa.eu/regional_policy/what/index_en.cfm

52 SVIM is the Development Agency of Marche Region.

53 http://www.ai-macroregion.eu/projects-clusters-2007-2013

[54] Directive 2014/89/EU of the European parliament and of the Council of 23 July 2014 establishing a fram,ework for maritime spatial planning (OJ L257/135 of 28 August 2014).

to adopt legislation concerning maritime spatial planning, on the basis of which plans will have to be adopted.

The absence of a general duty to undertake MSP outside the EU and the voluntary nature of this activity, however, do not mean that there are no legal rules that may condition MSP. Rather, there are many legal rules that need to be taken into account when undertaking MSP, at the international and national level. International law of the sea, in fact, regulates the uses of the seas and oceans and provides basic principles concerning, among others, navigation, exploitation of living and non-living resources, protection of the marine environment, the conduct of marine scientific research and the construction and operation of artificial islands and other man-made structures. Environmental duties are further refined and detailed in a growing number of treaties. All these rules are then incorporated into national domestic legal systems and the EU legal system.

The normative framework relevant for MSP is to be found at three levels:

a) the international level, which includes
    i. customary international law, which is binding for all States
    ii. treaties, which create legal obligations for States that have ratified them or that have acceded to them
    iii. decisions adopted by international organizations, which create legal obligations for member States
b) the European level (EU legislation, including regulations, directives and decisions)
c) the domestic level (national legislation and regulations, as well as regulation adopted at the regional and local level)

From the point of view of their content, relevant legal acts may determine which State or other actor can/must exercise jurisdiction with respect to certain matters or they may indicate what conduct needs to be put in place and what standards apply. In the case of MSP, both types of acts are relevant, as it is important to know **who** can adopt regulatory or enforcement measures and **what** should be the content of these measures.

Identification of the State or other entity that can or must adopt certain measures reposes on two criteria:

a. the **area** in which the activity takes place
b. the **type** of activity that is considered

A first set of criteria divides the sea in different maritime zones, within which the coastal State and other States enjoy a varying array of rights and duties. Transversal special areas may also be proclaimed by international organizations and sometimes by single States for the protection of the marine environments, the prevention of pollution, the conservation of living resources or for security purposes.

A second set of criteria look at the type of activity – navigation, exploitation of mineral resources, mariculture, tourism, scientific research etc. – and may attribute jurisdiction over it to one or more States. Furthermore, rules relating to the type of activity may provide conditions or may impose limitations to the coastal State or to other entities.

From a legal point of view, a clear distinction needs to be drawn between acts that produce normative effects (i.e. create legal obligations) from those that do not (i.e. contain only recommendations, suggestions or best practices). This part will deal mainly with the former.

This section will first relate the obligations arising out of the MSP Directive and will then present international, EU and national legislation that may affect the procedure and content of plans. It will then describe the legal status of the Adriatic Sea and the Ionian Sea and will conclude summing up the main legal issues and challenges for maritime spatial planning in the Adriatic-Ionian region.

3.2.2 The MSP Directive

The MSP Directive is the first legal instrument to provide for mandatory maritime spatial planning. It contains two main obligations for EU Member States:

- to adopt **legislation** to establish and implement maritime spatial planning by **18 September 2016** (Art. 4 and Art. 15)
- on the basis of this legislation, to establish **plans** as soon as possible and at the latest by **31 March 2021** (Art. 15)

The MSP Directive applies to all waters under the jurisdiction of EU States, unless States have included portions of marine waters (e.g. ports or coastal waters) within town and country planning (Art. 2).

The MSP directive sets the objectives, minimum requirements, basic principles and procedural requirements for maritime spatial planning (see boxes).

States have furthermore to identify **competent national authorities** and communicate the list of authorties to the Commission (Article 13).

Objectives of maritime spatial planning

(Article 1 and Article 5)

Maritime spatial planning should promote, through the application of an **ecosystem based approach**:

- the sustainable growth of maritime economies
- sustainable development of marine areas
- sustainable use of marine resources
- the coexistence of relevant activities and uses

In particular, States should pursue the following objectives:

- development of energy sectors at sea, of maritime transport, and of the fisheries and aquaculture sectors
- preservation, protection and improvement of the environment, including resilience to climate change impacts
- other objectives such as the promotion of sustainable tourism and the sustainable extraction of raw materials

States may determine how the different objectives are reflected and weighted in their maritime spatial plan. In particular, States in different regions may attribute different weight to the objectives, taking into account the peculiarities of the region.

The MSP Directive indicates a number of activities and uses that may to be taken into consideration in the drafting of legislation and the establishment of plans. These include (Article 8):

- aquaculture areas,
- fishing areas,
- installations and infrastructures for the exploration, exploitation and extraction of oil, of gas and other energy resources, of minerals and aggregates, and for the production of energy from renewable sources,
- maritime transport routes and traffic flows,
- military training areas,

- nature and species conservation sites and protected areas,
- raw material extraction areas,
- scientific research,
- submarine cable and pipeline routes,
- tourism,
- underwater cultural heritage.

States may consider other activities, if relevant for the setting up of plans. However, the MSP Directive does **not** apply to activities the sole purpose of which is **defence or national security** (Art. 2).

Minimum requirements for maritime spatial planning

(Article 6)

In preparing maritime spatial plans, States shall:

- take into account land-sea interactions (Article 7);
- take into account environmental, economic and social aspects, as well as safety aspects;
- aim to promote coherence between maritime spatial planning and the resulting plan or plans and other processes, such as integrated coastal management or equivalent formal or informal practices;
- ensure the involvement of stakeholders (Article 9);
- organise the use of the best available data (Article 10);
- ensure trans-boundary cooperation between Member States (Article 11);
- promote cooperation with third countries (Article 12).

3.2.3 International legal instruments

At the international level, a number of treaties are relevant for MSP in the Adriatic Sea, since they provide guidance as to the division of jurisdiction between States and the principles that should underlie planning activities. In many cases, treaties are adopted within a relevant international organization, such as the United Nations, the IMO or the FAO.

Global treaties and institutions

UNCLOS. The most important treaty is undoubtedly the **United Nations Convention on the Law of the Sea** (UNCLOS), 1982.[55]

The UNCLOS regulates the existence and content of maritime zones (internal waters, territorial sea, contiguous zone, exclusive economic zone, continental shelf, high seas, International Seabed Area) and establishes which State or States can exercise jurisdiction within each zone and what the limits of this jurisdiction are.

55 Montego Bay, 10 December 1982. Entry into force: 16 November 1994. Text in 1833 UNTS 3. The UNCLOS has been modified by the 1994 Agreement relating to the implementation of Part XI. The 1994 modifications relate to the legal regime for the exploration and exploitation of mineral resources of the International Seabed Area, which comprises all seabed and subsoil beyond national jurisdiction. The 1994 Agreement is not relevant for the Adriatic and Ionian regions, since the Adriatic and Ionian seabed and subsoil are entirely subject to national jurisdiction, and will not be considered further in this report.

The UNCLOS also provides substantial regulation for the conduct of maritime activities that include navigation, exploitation of marine living resources, exploitation of mineral resources, the laying of submarine cables and pipelines, some security issues (piracy, unauthorized broadcasting), protection of the marine environment, marine scientific research, and protection of underwater cultural heritage. Finally, the UNCLOS creates a number of institutions that may play a role in the conduct of maritime activities.

All Adriatic-Ionian States are parties to the UNCLOS.

IMO treaties. The International Maritime Organization (IMO) has adopted numerous treaties concerning the safety and security of navigation and the protection of the marine environment.

- **International Convention for the Safety of Life at Sea** (SOLAS)[56] contains detailed technical regulations concerning the safety of navigation. In 2002, the SOLAS was significantly amended and it now addresses also the security of ships and ports (SOLAS Chapter XI-2 which incorporates the **International Ship and Port Facility Security (ISPS) Code**).[57]
- **International Convention for the Prevention of Pollution from Ships** 1973, as amended by the 1978 Protocol (MARPOL). MARPOL includes six annexes, which provide detailed technical regulation concerning pollution from
    - **oil** (Annex I)
    - **noxious liquid substances carried in bulk** (Annex II)
    - harmful substances carried by sea in **packaged form** (Annex III)
    - **sewage** (Annex IV)
    - **garbage** (Annex V)
    - **air pollution** (Annex VI)
- **International Convention on Standards of Training, Certification and Watchkeeping for Seafarers** (STCW)
- **International Convention on Maritime Search and Rescue** (SAR),
- Convention for the **Suppression of Unlawful Acts Against the Safety of Maritime Navigation** (SUA) and the Protocol for the **Suppression of Unlawful Acts Against the Safety of Fixed Platforms Located on the Continental Shelf**[58]
- Convention on the **International Regulations for Preventing Collisions at Sea** (COLREG)
- **Maritime Labour Convention** (MLC)

Most IMO treaties share some common characteristics:

- the tacit amendment procedure, according to which technical regulations are discussed by appropriate technical bodies and changes enter into force automatically, unless a specified number of States objects;

- the requirement that conformity with the prescribed standards be certified by certificates issued by national authorities;

- the primary responsibility for enforcing the regulations rests with the flag state; however, the port state also plays a relevant role in ensuring compliance.

Fish Stocks Agreement. The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982

56 London, 1 November 1974. Entry into force: 25 May 1980. The SOLAS is regularly amended and updated.

57 The ISPS Code is further complemented by the non-binding ILO/IMO Code of practice on security in ports.

58 The SUA Convention and Protocol were originally adopted in 1988 and were modified in 2005.

relating to the Conservation and Management of **Straddling Fish Stocks and Highly Migratory Fish Stocks** (FSA), modifies the UNCLOS provisions relating to fishing in the high seas.

While the FSA deals mainly with the high seas, two important provisions (Art. 6 on the application of the precautionary approach and Art. 7 on the compatibility of conservation and management measures) apply also to areas subject to national jurisdiction.

CBD. The **Convention on Biological Diversity** (CBD), 1992, is the main global treaty devoted to the conservation of biological diversity and the sustainable use of its components. It also addresses the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

Art. 4 of the CBD describe the scope (ambit of application) of the Convention:

> Subject to the rights of other States, and except as otherwise expressly provided in this Convention, the provisions of this Convention apply, in relation to each Contracting Party:
>
> (a) In the case of components of biological diversity, in areas within the limits of its national jurisdiction; and
>
> (b) In the case of processes and activities, regardless of where their effects occur, carried out under its jurisdiction or control, within the area of its national jurisdiction or beyond the limits of national jurisdiction.

The CBD is completed by two protocols:

a. **Cartagena Protocol on Biosafety**, 2000, which has the aim to ensure the safe handling, transport and use of living modified organisms that may have adverse effects on biological diversity, taking also into account risks to human health
b. **Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing** of Benefits Arising from their Utilization, 2010.

CPUCH. The UNESCO **Convention on the Protection of Underwater Cultural Heritage** (CPUCH), 2001, has been adopted to strengthen protection of underwater cultural heritage. It complements the UNCLOS by adding detailed provisions on the duties of States to protect underwater cultural heritage within their territorial sea, contiguous zone, continental shelf and in the International Seabed Area.

All Adriatic States are parties to the CPUCH with the exception of Greece.

Regional treaties

The Barcelona Convention and Protocols. Mediterranean States have concluded one of the first regional treaties for the protection of the marine environment, the **Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean** (Barcelona Convention).[59] This treaty, which extends to all Mediterranean waters irrespective of their legal condition, provides the general principles and the institutional framework for the protection of the marine environment.

The Barcelona Convention is further implemented by protocols dealing with specific types of pollution, and other tools to protect and preserve the marine environment. Seven protocols have been so far adopted, dealing with:

59 The Barcelona Convention was originally adopted in 1976 and was modified (and renamed) in 1995, to take into account the developments of environmental law following the 1992 Rio Conference. The adoption of the Barcelona Convention followed closely the creation of the regional seas programme by UNEP and the adoption of the Mediterranean Action Plan (MAP). While the MAP contains primarily political commitments, as such not directly binding for States, the Barcelona Convention and Protocols establish legal obligations that are directly binding on all States parties to these treaties.

- dumping (1976, amended 1995);
- prevention of marine pollution from ships and management of emergencies (1976, replaced by a new version 2002) which has created REMPEC;
- land-based pollution (1980, amended 1996);
- specially protected areas and biodiversity (1982, replaced by a new version in 1995;);
- offshore activities (1994, in force since 2011);
- hazardous wastes (1996)
- integrated coastal zone management - ICZM (2008, in force since 2011).

The **ICZM Protocol** of Barcelona Convention is a very special legally binding instrument about coastal management (the first significant step in the development of international legislative instruments for ICZM) that aims at leading Mediterranean States and the EU to better managing their coastal zones, as well as dealing with the emerging coastal environmental challenges, such as climate change.[60] Through the ICZM Protocol, Contracting Parties have undertaken the legal obligation to "establish a common framework for the integrated management of the Mediterranean coastal zone and take the necessary measures to strengthen regional cooperation for this purpose" (Art.1). Parties are committed to cooperate in order to promote sustainable development and ICZM taking into account as a basis the MSDS document.

The objectives of integrated coastal zone management are to:

(a) facilitate, through the rational planning of activities, the sustainable development of coastal zones by ensuring that the environment and landscapes are taken into account in harmony with economic, social and cultural development;

(b) preserve coastal zones for the benefit of current and future generations;

(c) ensure the sustainable use of natural resources, particularly with regard to water use;

(d) ensure preservation of the integrity of coastal ecosystems, landscapes and geomorphology;

(e) prevent and/or reduce the effects of natural hazards and in particular of climate change, which can be induced by natural or human activities;

(f) achieve coherence between public and private initiatives and between all decisions by the public authorities, at the national, regional and local levels, which affect the use of the coastal zone.

In implementing the Protocol, the Parties shall be guided by general principles of integrated coastal zone management, which lay on the application of an ecosystem approach, of a broad overall perspective (thematic and geographic) which takes into account local specificity, on the enhancement of vertical and horizontal coordination among institutions, on the promotion of public participation in a transparent decision making process.

In its territorial scope, the ICZM Protocol uses the concept of the 'coastal zone', defined as 'the geomorphologic area either side of the seashore in which the interaction between the marine and land parts occurs in the form of complex ecological and resource systems made up of biotic and abiotic components coexisting and interacting with human communities and relevant socio-economic activities'. The coastal zone is delimited by the seawards and the landwards limits (Art. 3):

(a) the seaward limit of the coastal zone, is the external limit of the territorial sea of Parties; and

60 The ICZM Protocol is of particular relevance for MSP. The ICZM Protocol was adopted in furthering Article 4.3(e) of the Barcelona Convention, which requests the Contracting Parties to promote the integrated management of the coastal zones, taking into account the protection of areas of ecological and landscape interest and the rational use of natural resources.

(b) the landward limit of the coastal zone, is the limit of the competent coastal units as defined by the Parties.

The **Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic area** ('ACCOBAMS') aims at the protection of cetaceans.

The **General Fisheries Commission for the Mediterranean** ('GFCM') was created in 1949 and was revised in 1997 by the Amendment to the Agreement for the Establishment of a General Fisheries Council for the Mediterranean. Its aim is to promote the development, conservation, rational management, and best utilization of marine living resources, as well as the sustainable development of aquaculture in the Mediterranean, Black Sea, and connecting waters. Subject to an opt-out clause, the GFCM can adopt binding measures concerning fishing methods and fishing gear, minimum size for individuals of specified species, open and closed fishing seasons and areas, and the regulation of the amount of total catch and fishing effort, and their allocation among members. Recent action includes steps to combat IUU fishing, mainly conducted by coastal States, with the adoption in 2008 of a binding recommendation on a regional scheme on port State measures to combat illegal, unreported, and unregulated fishing.[61] The measure applies, for the time being, only to Mediterranean waters and only to vessels flying the flag of non-Members. The GFCM now constitutes the central forum for the discussion and adoption of binding measures for the protection of fish stocks in the Mediterranean. Its action is, however, hampered by the incomplete data provided by subjects involved in fisheries activities and by the fact that in some cases binding measures cannot be adopted due to the lack of political will, as well as to the lack of economic means.

The **International Commission for the Conservation of Atlantic Tunas** ('ICCAT'), created in 1966 by the International Convention for the Conservation of Atlantic Tunas for the conservation and management of tuna and tuna-like species, has also competence in the Mediterranean Sea. The ICCAT determines catch quotas and other conservation and management measures for bluefin tuna stocks and other species, including swordfish, and has adopted measures to specifically combat IUU fishing including trade sanctions.

The **Convention on Environmental Impact Assessment in a Transboundary Context** (Espoo Convention)[62] requires States parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries.

The **Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters** (Aarhus Convention) establishes a number of rights of the public (individuals and their associations) with regard to the environment. Parties to the Convention are required to make the necessary provisions so that public authorities (at national, regional or local level) will contribute to these rights to become effective.

	Albania	Bosnia-Herzegovina	Croatia	Greece	Italy	Montenegro	Slovenia	European Union
UNCLOS	√	√	√	√	√	√	√	√

61 GFCM 'Recommendation GFCM/2008/1 on a Regional Scheme on Port State Measures to Combat Illegal, Unreported and Unregulated Fishing in the GFCM Area'

62 Espoo, 25 February 1991. Entry into force: 10 September 1997. Text in 1989 UNTS 309. The Espoo Convention has been amended twice; amendments have not yet entered into force.

SOLAS	√		√	√	√	√	√	
MARPOL[63]	I-V		I-VI	I-VI	I-VI	I-V	I-VI	
STCW	√		√	√	√	√	√	
SAR	√		√	√	√	√	√	
SUA	√	√	√	√	√	√	√	
COLREG	√		√	√	√	√	√	
MLC		√	√	√	√			
FSA			√	√	√		√	√
CBD	√	√	√	√	√	√	√	
CPUCH	√	√	√		√	√	√	
Barcelona Convention	√	√[64]	√	√	√	√	√	√
Dumping protocol	√	√	√	√	√		√	√
Emergency protocol	√	√	√	√	√		√	√
SPA protocol	√	√	√	√	√	√	√	√
Land-based pollution protocol	√	√	√	√	√	√	√	√
Offshore protocol	√							√
Hazardous wastes protocol	√					√		
ICZM protocol	√	√				√	√	√
ACCOBAMS	√		√	√	√	√	√	
GFCM	√		√	√	√	√	√	√
ICCAT	√		√	√	√		√	√
Espoo Convention	√	√	√	√	√	√	√	√
Aarhus Convention	√	√	√	√	√	√	√	√

Table 3-1 Ratification of international Treaties by Adriatic-Ionian States and EU

3.2.4 EU legal framework

Legal acts adopted by the EU (regulations, directives, decisions) are legally binding for EU Member States. While regulations and decisions are directly applicable within member States,

[63] Numbers indicate annexes that bind the State.
[64] Bosnia-Herzegovina is not a party to the 1995 Amendments.

directives typically require the adoption of implementing legislation by the State. Implementing legislation can be adopted at the national, regional or local level.

The EU competence to regulate specific areas can be exclusive or shared:

- Exclusive EU competence: only the EU may legislate and adopt legally binding acts, the Member States being able to do so themselves only if so empowered by the Union or for the implementation of Union acts.[65]
- Shared competence between the EU and Member States: the EU and the Member States may legislate and adopt legally binding acts in that area. The Member States shall exercise their competence to the extent that the EU has not exercised its competence. The Member States shall again exercise their competence to the extent that the Union has decided to cease exercising its competence.[66]

In addition to the MSP Directive, there are numerous legal acts that are relevant for the MSP, in particular concerning fishing and protection of the environment.

Fishing

EU member States have transferred to the EU exclusive competence on fisheries.[67] As a consequence, they have very limited powers to adopt regulatory measures. The following EU legislative acts are relevant for MSP:

Regulation no 1380/2013 on the Common Fisheries Policy.[68] The Regulation provides an updated framework for the Common Fisheries policy.

Its scope is quite wide and includes both **fishing and aquaculture**, within and beyond areas subject to national jurisdiction.

> "1. The Common Fisheries Policy (CFP) shall cover:
>
> (a) the conservation of marine biological resources and the management of fisheries and fleets exploiting such resources;
>
> (b) in relation to measures on markets and financial measures in support of the implementation of the CFP: fresh water biological resources, aquaculture, and the processing and marketing of fisheries and aquaculture products.
>
> 2. The CFP shall cover the activities referred to in paragraph 1 where they are carried out:
>
> (a) on the territory of Member States to which the Treaty applies;
>
> (b) in Union waters, including by fishing vessels flying the flag of, and registered in, third countries;
>
> (c) by Union fishing vessels outside Union waters; or
>
> (d) by nationals of Member States, without prejudice to the primary responsibility of the flag State."[69]

While the general principle endorsed in Regulation 1380/2013 is that EU fishing vessels shall have **equal access to waters** subject to the jurisdiction of member States,[70] the following exception is allowed:

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65 Art. 2(1) Treaty on the Functioning of the European Union.

66 Art. 2(2) Treaty on the Functioning of the European Union.

67 Art. 3(1)(d) Treaty on the Functioning of the European Union.

68 Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013, OJ L 354/22 of 28 December 2013.

69 Art. 1(1) REGULATION (EU) No 1380/2013

In the waters up to 12 nautical miles from baselines under their sovereignty or jurisdiction, Member States shall be authorized, until 31 December 2022, to restrict fishing to fishing vessels that traditionally fish in those waters from ports on the adjacent coast, without prejudice to the arrangements for Union fishing vessels flying the flag of other Member States under existing neighborhood relations between Member States and the arrangements contained in Annex I, fixing for each Member State the geographical zones within the coastal bands of other Member States where fishing activities are pursued and the species concerned. Member States shall inform the Commission of the restrictions put in place under this paragraph.[71]

Regulation 1380/2013 indicates principles of good governance to be followed by the EU and member States[72] and regulates in detail measures for the conservation and sustainable exploitation of marine biological resources, including conservation measures,[73] emergency measures, unwanted catches, landing obligations, allocation of fishing opportunities, fleet registers. The Regulation also provides for the possibility to establish **fish stock recovery areas**, on the recommendation of member States.[74]

The Union shall, while taking due account of existing conservation areas, endeavour to establish protected areas due to their biological sensitivity, including areas where there is clear evidence of heavy concentrations of fish below minimum conservation reference size and of spawning grounds. In such areas fishing activities may be restricted or prohibited in order to contribute to the conservation of living aquatic resources and marine ecosystems. The Union shall continue to give additional protection to existing biologically sensitive areas.

Environmental protection

Protection of the environment, including the marine environment, is a competence shared between the EU and its member States. It is therefore important to refer to both EU legislation and national legislation in order to have a complete picture of existing regulation.

The main instrument is the **Marine Strategy Framework Directive** (MSFD).[75] The objective of the MSFD is to achieve, by the year 2020, 'good environmental status'[76] in the marine waters, including the seabed and subsoil, of member states[77]. To achieve this aim, states have to develop marine strategies based on the ecosystem approach[78], according to the detailed procedure and timetable set by the directive[79].

Activities are divided in preparatory and operational. The preparatory stage begins with the **assessment** of marine waters[80] and continues with the determination of the characteristics for

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70 Art. 5(1) REGULATION (EU) No 1380/2013.

71 Art. 5(2) REGULATION (EU) No 1380/2013

72 Art. 3 REGULATION (EU) No 1380/2013

73 Arts. 6 and 7 REGULATION (EU) No 1380/2013. Member States can adopt conservation measures only to the extent permitted under Arts. 19 and 20 REGULATION (EU) No 1380/2013.

74 Art. 8 REGULATION (EU) No 1380/2013.

75 DIRECTIVE 2008/56/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 June 2008 establishing a framework for community action in the field of marine environmental policy, OJ L 164/19 of 25.6.2008.

76 MSFD, Art. 1(1)

77 MSFD, Arts. 2(1) and 3(1). The wording of the latter provision is somewhat obscure as it refers to the waters where a member state 'has and/or exercises jurisdiction, in accordance with the UNCLOS'. The correct reading seems to be that the MSFD applies to all maritime zones where a coastal state may exercise its sovereignty or jurisdiction, according to the relevant provisions of the law of the sea.

78 MSFD, Art. 1(3).

79 MSFD, Art. 5.

80 MSFD, Art. 8.

good environmental status[81], the establishment of a series of **environmental targets and indicators**[82] and the establishment and implementation of **monitoring programmes**[83]. The monitoring programmes are expected to be launched in July 2014 and the first report on monitoring is due by Member States in October 2014. The operational stage consists in the adoption of **measures**, integrated into a programme of measures, and their notification to the Commission[84]. The Commission is entrusted with the task of assessing whether the action of States, at both the preparatory and operational stage, meet the requirements of the MSFD[85]. Finally, special provisions address issues such as urgent measures[86], community action in cases in which state action alone could not achieve the objective of good environmental status[87], and public consultation[88].

The concept of **marine regions** is used throughout the MSFD. The Adriatic Sea is considered a sub-region of the marine region Mediterranean Sea,[89] while the Ionian Sea is part of the subregion "Ionian Sea and Central Mediterranean Sea.[90]

The MSFD attributes particular significance to existing cooperative frameworks for the protection of marine regions and subregions, in line with the consideration that in the field of the protection of the marine environment, given the absence of physical boundaries between waters appertaining to each state and the transboundary nature of the marine environment, it is essential to coordinate action by states sharing the same sea.[91] The MSFD is addressed to Member States and calls for individual action by each of them, but the need to 'take due account of the fact that marine waters covered by their sovereignty or jurisdiction form an integral part' of a marine region is stressed throughout the text.[92] In many cases, the object of the provisions is not the marine waters under the sovereignty or jurisdiction of one state, but those of a whole region or subregion. The good environmental status is to be determined at the regional or sub-regional level, and not at the state level,[93] and the measures to achieve or maintain it shall be identified 'in respect of each marine region'.[94] Furthermore, Member States are encouraged to cooperate with third states bordering the same region and to make use of existing institutional mechanisms and primarily the regional seas conventions.[95]

Another relevant aspect is the holistic approach taken by the EU in the field of marine policy, wherein the so-called 'environmental pillar', consisting in the MSFD, is just one of the pillars of the ambitious European Integrated Maritime Policy[96]. This approach is visible in a number of provisions such as Article 13(3), requiring that due consideration be given to 'sustainable

81 MSFD, Art. 9.

82 MSFD, Art. 10.

83 MSFD, Art. 11.

84 MSFD, Art. 13.

85 MSFD, Arts. 12 and 16.

86 MSFD, Art. 5(3).

87 MSFD, Art. 15.

88 MSFD, Art. 19.

89 MSFD, Art. 4(2)(b)(ii).

90 MSFD, Art. 4(2)(b)(iii).

91 MSFD, preambule par. 13.

92 MSFD, Art. 4(1). Many other provisions refer to marine regions or subregions, e.g. Arts. 5(2), 5(3) and 7(1).

93 MSFD, Art. 9(1).

94 MSFD, Art. 13(1).

95 MSFD, Art. 6.

96 See paragraph 3.1.1

development and, in particular, to the social and economic impacts of the measures envisaged' and that measures be cost-effective and technically feasible.

The goals of the Marine Strategy Framework Directive are in line with the objectives of the **Water Framework Directive- WFD**[97] that establishes a framework for the protection of inland surface waters, groundwater, transitional waters, and coastal waters. The WFD contains a set of overall objectives[98]:

- prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands;
- promotes sustainable water use based on a long-term protection of available water resources;
- take specific pollution control measures, by reducing or eliminating discharges and emissions and losses of priority toxic substances to enhance the protection and improvement of the aquatic environment;
- reduce pollution of groundwater
- contributes to mitigate the effects of floods and droughts
- undertake measures which will result in the achievement of "good water status" for all waters within a predetermined timescale.

According to Art. 2 of the WFD "Coastal water" is the "surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters." This means that in coastal waters both MSFD and WFD apply.

The WFD foresees a phased approach to reach its objective. As first step, Member States have to identify all the river basins lying within their national territory and to assign them to individual river basin districts. River basins covering the territory of more than one Member State will be assigned to an international river basin district. Competent authorities are to be designated by Member States and are in charge for the application of the rules provided in the WFD.

By 2004 Member States should have produced water analysis to be revised in 2013 and every six years thereafter, including the characteristics of each river basin district, the impact of human activity, economic analysis of water use, and the identification of areas requiring special protection[99].

By 2009, river basin management plans, including progamme of measures, were to be produced for each river basin district, taking account of the results of the analyses and studies carried out. These plans cover the period 2009-2015. They shall be revised in 2015 and then every six years thereafter[100].

The programme of measures should have been made operational in 2012.

Member States should encourage participation by all stakeholders in the implementation of the WFD, specifically with regard to the river basin management plans for river basin districts.

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97 Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L 327, 22 December 2000.

98 WFD, Art. 1

99 WFD, Art. 5

100 WFD, Art.11 and Art. 13

In addition, the WFD introduces economic analyses of water use (principle of recovery of costs), provides the general public with rights of involvement and information over river basin planning and establishes a detailed system of monitoring and reporting to the Commission.

The **Habitats Directive**[101] and the **Birds Directive**[102] provide the basis for the EU nature conservation policy. The Habitats directive prescribes the adoption of measures to maintain or restore, at favorable conservation status, natural habitats and species of wild fauna and flora of Community interest, taking into account economic, social and cultural requirements and regional and local characteristics.[103] Protection of habitats is particularly achieved through the creation of a network of protected areas, the NATURA 2000 network.[104] The Birds Directive provides a comprehensive scheme of protection for all wild bird species naturally occurring in the EU and places great emphasis on the protection of habitats for endangered as well as migratory species, especially through the establishment of a coherent network of Special Protection Areas (SPAs) comprising all the most suitable territories for these species. Since 1994 all SPAs form an integral part of the NATURA 2000 ecological network. Both the Habitats and the Birds Directive are considered to apply to the territorial waters, the exclusive economic zone and other sui generis zones up to 200 nm.

Coordination between the measures undertaken for the management of protected areas under the Habitats and the Birds Directives, which are managed by member States, and measures relating to fishing, which fall under the exclusive competence of the EU, was often not satisfactory. In order to address this issue, the 2013 CFP Regulation contains a detailed provision that purports to ensure a harmonious coordination between conservation measures adopted my member States and measures adopted under the CFP.[105]

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101 Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, OJ L 206 of 22.7.1992.

102 Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, OJ L 20, 26/01/2010.

103 Art. 2 Habitats Directive.

104 Art. 3 Habitats Directive.

105 Art. 11 Regulation 1380/2013.

1. Member States are empowered to adopt conservation measures not affecting fishing vessels of other Member States that are applicable to waters under their sovereignty or jurisdiction and that are necessary for the purpose of complying with their obligations under Article 13(4) of Directive 2008/56/EC, Article 4 of Directive 2009/147/EC or Article 6 of Directive 92/43/EEC, provided that those measures are compatible with the objectives set out in Article 2 of this Regulation, meet the objectives of the relevant Union legislation that they intend to implement, and are at least as stringent as measures under Union law.

2. Where a Member State ("the initiating Member State") considers that measures need to be adopted for the purpose of complying with the obligations referred to in paragraph 1 and other Member States have a direct management interest in the fishery to be affected by such measures, the Commission shall be empowered to adopt such measures, upon request, by means of delegated acts in accordance with Article 46. For this purpose, Article 18(1) to (4) and (6) shall apply mutatis mutandis.

3. The initiating Member State shall provide the Commission and the other Member States having a direct management interest with relevant information on the measures required, including their rationale, scientific evidence in support and details on their practical implementation and enforcement. The initiating Member State and the other Member States having a direct management interest may submit a joint recommendation, as referred to in Article 18(1), within six months from the provision of sufficient information. The Commission shall adopt the measures, taking into account any available scientific advice, within three months from receipt of a complete request.

If not all Member States succeed in agreeing on a joint recommendation to be submitted to the Commission in accordance with the first subparagraph within the deadline set therein, or if the joint recommendation is deemed not to be compatible with the requirements referred to in paragraph 1, the Commission may submit a proposal in accordance with the Treaty.

4. By way of derogation from paragraph 3, in the absence of a joint recommendation referred to in paragraph 3, in cases of urgency, the Commission shall adopt the measures. The measures to be adopted in a case of urgency shall be limited to those in the absence of which the achievement of the objectives associated with the establishment of the conservation measures in accordance with the Directives referred to in paragraph 1 and the Member State's intentions, is in jeopardy.

The **EU Directive on the assessment and management of flood risks, the "Floods' Directive",** came into force in 2007[106]. The proposed prevention and management measures are organized by river basin districts (which may cover several river basins), as established by the WFD. The measures include the preliminary assessment of risks and the establishment of flood hazard and flood risk maps of areas at risk and flood risk management plan.

It is a framework directive that requires Member States to follow a certain process:

- By 22 December 2011, Member States shall complete the preliminary flood risk assessment to identify areas of existing or foreseeable future potentially significant flood risk

- By 22 December 2013 Member States must draw up flood hazard maps and flood risk maps for all the areas posing a risk of flooding and indicate the probability of flooding and the potential damage.

- By 22 December 2015 Member States must prepare and implement flood risk management plans for each river basin district, on the basis of the maps described above.

The **Environmental Impact Assessment Directive** (EIA Directive)[107] applies to the assessment of the environmental effects of those **public and private projects** which are likely to have significant effects on the environment.[108] Projects fall under two categories:

- Those subject to mandatory EIA (listed in Annex I)
- Those subject to EIA at the discretion of States, following a "screening procedure (listed in Annex II)

EIAs are required to identify, describe and assess the direct and indirect effects of a project on the following factors:

(a) human beings, fauna and flora;

(b) soil, water, air, climate and the landscape;

(c) material assets and the cultural heritage;

(d) the interaction between the factors referred to in points (a), (b) and (c).[109]

The **Strategic Environmental Assessment** Directive (SEA Directive),[110] applies to public plans and programmes. A mandatory environmental assessment is required for all plans and programmes:

(a) which are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, town and

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5. The measures referred to in paragraph 4 shall apply for a maximum period of 12 months which may be extended for a maximum period of 12 months where the conditions provided for in that paragraph continue to exist.
6. The Commission shall facilitate cooperation between the Member State concerned and the other Member States having a direct management interest in the fishery in the process of implementation and enforcement of the measures adopted under paragraphs 2, 3 and 4.

106 Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks, OJ L 288/27 of 6.11.2007.

107 DIRECTIVE 2011/92/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, OJ L 26 of 28.1.2012. First adopted in 1985, the EIA Directive has been amended three times (in 1997, 2003 and 2009) and is now codified in Directive 2011/92/EU.

108 Art. 1(1) EIA Directive.

109 Art. 3 EIA Directive.

110 DIRECTIVE 2001/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment, OJ L 197 of 21.7.2001.

country planning or land use and which set the framework for future development consent of projects listed in the EIA Directive, or

(b) which, in view of the likely effect on sites, have been determined to require an assessment pursuant to the Habitats directive.[111]

All other plans and programmes may be subject to SEA at the discretion of the Member State, following a screening process.[112] The SEA Directive also requires transboundary consultations in cases where a Member State considers that the implementation of a plan or programme being prepared in relation to its territory is likely to have significant effects on the environment in another Member State, or where a Member State likely to be significantly affected so requests.

Offshore Energy

The **Safety of Offshore Oil and Gas Operations Directive**[113] establishes minimum requirements for preventing major accidents in offshore oil and gas operations and for limiting their consequences. It applies to operations in the territorial sea, the exclusive economic zone and the continental shelf.[114] Consequently, it is expected to increase the protection of the marine environment and costal economies against pollution. It establishes minimum conditions for safe offshore exploration and exploitation and improves the response mechanisms in the event of a major accident. The new law will apply to existing and future installations and operations. Offshore oil and gas operations will only be conducted by operators appointed by licensees or licensing authorities.
The directive contains provisions ensuring the independence and objectivity of the competent authority. It provides rules for transparency and sharing of information, cooperation between Member States, emergency response plans and transboundary emergency preparedness and response.
It is interesting to mention in the MSP frame that, in order to prevent conflicts of interest, Member States should ensure a clear separation between regulatory functions relating to offshore safety and environment and regulatory functions relating to economic development, including licensing and revenues management.

The **Renewable Energy Directive**[115] establishes a European framework for the promotion of renewable energy, setting mandatory national renewable energy targets for achieving a 20% share of renewable energy in the final energy consumption and a 10% share of energy from renewable sources in transport by 2020.
Member State shall adopt a national renewable energy action plan. The national renewable energy action plans shall set out Member States' national targets for the share of energy from renewable sources consumed in transport, electricity and heating and cooling, taking into account the effects of other policy measures relating to energy efficiency on final consumption of energy, and adequate measures to be taken to achieve those national overall targets, including cooperation between local, regional and national authorities.

111 Art. 3(2) SEA Directive.

112 Art. 3(5) SEA Directive.

113 DIRECTIVE 2013/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 June 2013 on safety of offshore oil and gas operations and amending Directive 2004/35/EC, OJ L 178 of 28.6.2013.

114 Art. 2(2) Directive 2013/30/EU.

115 DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, L 140/16, 5.6.2009.

3.2.5 The national framework

The Initial Assessment provides a first overview of the national legal framework. The description is still not homogeneous for each Adriatic and Ionian countries, depending from the information we collect until now. During the following steps of the project, we will provide a more harmonized overview of the national framework according to need of the MSP.

Albania[116]

While Albania is not an EU Member State, and as such is not bound by EU legislation, it has entered into a Stabilization and Association Agreement (SAA) with the EU as a potential candidate State. According to the SSA, Albania has the obligation to approximate the national legislation with the EU acquis within a period of 10 years after the entry into force of the SAA, which entered into force on April, 1, 2009.

Transport

Maritime transport in Albania falls under the jurisdiction of the Ministry of Public Works and Transport; and more specifically the Directory of Maritime Transport Policies. This directory is divided into the Project Implementation Unit, Port and Ship Safety Sector, and the Policy Sector on Maritime Transport. The Maritime Transport licensing is the responsibility of the Safety department.

The current national legal acts guiding Maritime transport are:

- Law on "Maritime Code" no. 9251, dated 8.7.2004;
- Decree No. 4938, dated 4.2.1972, revised on 26.4.1980, on Port Captainship;
- Law on "Port Authority" No.9130, dated 8.9.2003;

Fisheries and aquaculture

- Law on Fisheries dated 31.5.2012 in compliance with the EU acquis. The new law took into consideration the state of the fisheries sector in Albania and aims to provide support in order to further develop it in compliance with EU standards. It also aims to protect marine ecosystems, and prevent and reduce inputs that have a significant impact.
- New law "On aquaculture" in compliance with the EU acquis;

The Fisheries fall under the Ministry of Agriculture, Rural Development and Water within the General Directorate of Agriculture Services and Fisheries. The ministry is also responsible for covering institutional tasks related to the development and the proposal of policies, strategies and action plans aimed at implementing protection and management measures for the environment. The Sector of Fisheries within the Directorate of Food Safety and Fisheries is the main authority responsible for developing strategic guidelines for the sector in accordance with the policies approved by the Government. The fisheries administration falls within the Directorate of Agriculture Services and Fisheries while the Fishery Inspectorate falls under the Directorate for Environmental Control. The inspectorate includes 23 subordinate local inspectorates. The Agriculture University of Albania is hosting the "The lab for Fisheries and Aquaculture" responsible for carrying out the assessment of marine resources.

[116] Information on the legal framework of Albania is taken primarily from the Report WP 4 – Act. 4.1: Holistic management of the Adriatic Sea. Approaching to a common and legally binding MSP in Adriatic area: an integrated analysis of the legal framework, policies and planning instruments. Final Report, 15 May 2013, available at http://www.shape-ipaproject.eu/download/listbox/WP4%20action%204.1/Report%20on%20the%20analysis%20of%20legal%20framework,%20policies%20and%20planning%20instruments.pdf.

According to Article 31 of the Decision of the People's Assembly, Resolution n° 8870 of 21.3.2002, «Amendments to Law n° 7908 of 05.04.1995 on Fisheries and Aquaculture», the co-management plans include the participation of fisheries institutions and stakeholders, including here the Local Advisory Committees on Fisheries and Aquaculture. The competent Authority from the institutional point of view is defined by Law n° 77941 dated 31.05.1995, included in the Ministry of Agriculture and Food (Decision of the Council of Ministers of n° 646 of 10.11.1995). Albania is divided into 12 Provinces / Regions, each with a Director General for Agriculture directly appointed by the Minister. The institutional structure is organized as follows:

- Ministry of Agriculture: Directorate for Veterinary Services;
- Veterinary Research Institute (IKV) in Tirana;
- The Laboratory for Fishery and Aquaculture, under the Agriculture University;
- District Veterinary Offices;
- Municipal Veterinary Services.

Articles 31/1 to 31/19 of Law No 7908 of 5.4.1995 provide rules for the establishment of FMOs within the state administration. FMOs are private juridical entities established according to the Civil Code, for activities in the fishing sector. An FMO is a voluntary union of members composed of owners of fishing entities (ship-owners, establishments, or other subjects), and non-owners. There are 13 Fisheries Management Organizations (FMOs) in Albania.

Ports, fishing centres or the structures related to fishing activity may be assigned to FMO management. Any geographically determined body of water within Albania can be declared a "co-management area" and managed by an FMO according to the co-management plan. The law provides that each co-management area may have only one FMO. A co-management strategy has the following major objectives:

- Promote the exploitation of fishery resources, based on sustainable development, ensuring at the same time adequate levels to fulfill actual and future needs;
- Preserve and maintain the quality and natural diversity of the fishing resources; and
- Promote proper fishing technology;
- Avoid surplus in fishing capacity.

Environmental Protection

Protection of the environment and sustainable development are incorporated in the Constitution of Albania, which provides that the State shall aim at a healthy and ecologically adequate environment for the present and future generations' and at 'the rational exploitation of forests, waters, pastures and other natural resources on the basis of the principle of sustainable development'.[117]

- Law no.8905 dated 06.06.2002 "On the protection of the marine environment from pollution and damage", amended by Law no. 30/2013, dated 13.02.2013, which aims to protect the marine environment of the Republic of Albania from pollution damage caused by human activities at sea and in coastal zones, which spoil the quality of water, damage the marine resources, risk the fauna and flora, threaten human health and hamper the normal development of activities in this environment
- Law no.111, dated 15.11.2012,"On Integrated Management of Water Resources", which fully transpose the Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy.

[117] Art. 59(1)(d) and (dh), Constitution of the Republic of Albania, Text approved by referendum on 22 November 1998 and amended on 13 January 2007, English translation by OSCE available at http://www.osce.org/albania/41888?download=true.

- Law no. 9115, dated 24.7.2003 "On the environmental treatment of waste water", amended by Law no. 34/2013, dated 14.02.2013 which is in compliance with the directive 91/271/EEC.
- New law and the strategy on integrated management strategy of water resources;

  The preparation of the National Strategy on Integrated Management of Water Resources is going to start soon under the assistance of the World Bank.
- Law on Biodiversity Protection No. 9587, dated 20 July 2006 and being revised in 2014, establishing the legal basis for the conservation and sustainable use of biodiversity and for achieving Aichi targets. Furthermore the law is based on the Convention of Biological Diversity and other relevant EU directives such as Habitat and Wild Bird Directives.
- Law on Protected Areas No. 8906, dated 6 June 2002 and revised in 2008 based on the criteria of World Center of Nature Conservation" (IUCN)

The list of marine and coastal protected areas extends as far as the following seven sites:

- National Marine Park Karaburun-Sazan
- Protected Landscape (IUCN V) of Buna river and surrounding wetlands (including Velipoja and Viluni wetland);
- Managed Nature Reserve (IUCN IV) of Kune –Vaini-Tale,
- Managed Nature Reserve of Patok-Fushekuqe-Ishem (including the Patoku lagoon)
- Managed Nature Reserve of Rrushkulli
- National Park Divjake-Karavasta (including the Karavasta lagoon)
- Protected Landscape of Vjosa river (including the Narta lagoon)
- National Park Butrinti& the Butrinti lake
- While the following three sites enjoy international protection status:
- Butrinti lagoon (UNESCO World Heritage);
- Kune, Vaini, Patoku, Karavasta, Narta, Orikumi, Butrinti lagoons (potential special protected areas by the Barcelona Convention, and Important Bird Areas);
- Velipoja, Viluni, Karavasta and Butrinti lagoons (Ramsar Convention).

The First National Marine Park of Karaburun – Sazani, established in 2010 by Decision of the Council of Ministers No. 289, dated 28.04.2010. The 12,570 hectares area of the Karaburuni peninsula lays on the western part of the bay of Vlora and along with the Island of Sazani has been identified as a priority area by the Government of Albania. The surrounding terrestrial areas do not currently enjoy protected status.

Recently Albania has approved Laws respectively "On Environmental Impact Assessment", "On Strategic Impact assessment" and "On permitting", completing its national legal framework in accordance with the EU requirements.

Tourism

The Albanian law "On Tourism" No. 9734, dated 14.05.2007, takes into consideration tourism planning and management with regard to protection of environment and natural resources. Places with natural tourist resources are defined as touristic spots.

Spatial planning

While in 2000, Albania became a party to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its 6 protocols by the law "On the accession of the Republic of Albania to the convention "On the protection of marine

environment and coastal area of the Mediterranean sea, as well as its 6 accompanying protocols". The implementation of the ICZM protocol requirements in Albania are fulfilled through several policy documents and legal acts and regulations. There is no current specific law, dealing with ICZM.

- The Sectoral Strategy for Transportation approved by the DCM no. 1214, dated 03.09.2008, has as its main objective the establishment of a unified road transport network, which would gradually balance economic conditions and control traffic to reduce pollution and road accidents. The strategy in the field of sea transport, stresses protection of the marine environment, necessary to ensure effective protection of coastal regions and the maritime environment.
- Spatial Planning Legislation: Law No. 10119, dated on 23.04.2009 "On territory planning".

In 2009, by decision of the Albanian Government, a new structure named the Inter-institutional Maritime Operational Centre (IMOC) was established. The centre serves as an interministry institution, charged with ensuring the surveillance of the Albanian maritime space, for guaranteeing the organization, planning, coordination and direction of operations on sea, in compliance with the national and international maritime legislation in power.

The institutions of the centre involve the:

- Ministry of Interior: a 24-hour presence by means of the institutional coordinators and duty officers.
- Ministry of Defence: a 24-hour presence, as well as is in charge of the operation and maintenance of the Surveillance System of the Maritime Space.
- Ministry of Finance: a 24-hour presence through institutional coordinators and duty officers.
- Ministry of Environment, Woods and Water Administration: a 24-hour presence through institutional coordinators and duty officers.
- Ministry of Public Work, Transport and Telecommunication: coordinating capacity.
- Ministry of Agriculture, Food and Consumers Protection: coordinating capacity.
- Ministry of Tourism, Culture, Youths and Sports: coordinating capacity.

It lays within the mission and duties of the centre to assure: the i) management and control of the Albanian maritime borders, ii) life safety on the sea and iii) interaction of the state institution that have responsible and interests within the maritime space. The IMOC coordinates and leads:

- Costal Operations for the control of the maritime border;
- Costal Operations against illegal trafficking;
- Costal Operations in the war against terrorism;
- Costal Operations against organized crime;
- Search and Rescue Operations, as well as first aid on sea;
- Anti-Pollution Operations;
- Operations to protect fishing;
- Operations to preserve the ecological equilibrium and maritime environment;
- Operations for the protection and well-administration of fishing wealth (etiological biomeasurement);
- Operations for safety on the sea

Bosnia Herzegovina[118]

The Federation of Bosnia and Herzegovina is divided by the Federal Constitution in 10 regional Cantons. According to the Constitution of Bosnia and Herzegovina, the jurisdiction between the Federation and Cantons is shared with the exception of specific areas being under exclusive jurisdiction of the Canton (construction sector).

At present, there is no marine spatial planning in Bosnia and Herzegovina.

The most important legislation regarding MSP in Bosnia and Herzegovina is the Federal Law on Spatial Planning which involves:

- Federal Ministry of Physical Planning and Environment;
- Federal Ministry of Agriculture, Water Management and Forestry;
- Ministry responsible for Coastal Planning: Neretva Cantonal Ministry for Civil Engineering and Physical Planning;
- Neum Municipality.

Croatia[119]

The Republic of Croatia is divided into counties, towns, municipalities and settlements. There is no specific maritime physical planning in Croatia. Marine activities are co-ordinated by 7 different Ministries:

- Ministry of Environmental and Nature Protection;
- Ministry of Construction and Physical Planning;
- Ministry of the Maritime affairs, Transport and Infrastructure;
- Ministry of Economy, Labour and Entrepreneurship;
- Ministry of Agriculture, Fisheries and Rural Development;
- Ministry of Tourism;
- Ministry of Culture,

as well as several governmental institutions.

Relevant legislation includes:

- The Maritime Code (2013);
- The Shoreline and Marine Harbours Act (2004, 2006, 2009);
- The Marine Fishery Act (2010, 2011);
- The Environmental Protection Act (2007);
- The Nature Protection Act (2005);
- The Contingency Plan for Accidental Marine Pollution (2008).

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[118] Information on the legal framework of Bosnia-Herzegovina is taken primarily from the Report WP 4 – Act. 4.1: Holistic management of the Adriatic Sea. Approaching to a common and legally binding MSP in Adriatic area: an integrated analysis of the legal framework, policies and planning instruments. Final Report, 15 May 2013, available at http://www.shape-ipaproject.eu/download/listbox/WP4%20action%204.1/Report%20on%20the%20analysis%20of%20legal%20framework,%20policies%20and%20planning%20instruments.pdf.

[119] Information on the legal framework of Croatia is taken primarily from the Report WP 4 – Act. 4.1: Holistic management of the Adriatic Sea. Approaching to a common and legally binding MSP in Adriatic area: an integrated analysis of the legal framework, policies and planning instruments. Final Report, 15 May 2013, available at http://www.shape-ipaproject.eu/download/listbox/WP4%20action%204.1/Report%20on%20the%20analysis%20of%20legal%20framework,%20policies%20and%20planning%20instruments.pdf.

Spatial Planning

The basic physical planning positions are determined by the Physical Planning and Building Act (OG 76/07, 38/09, 55/11, 90/11, 50/12, 55/12), the Physical Planning Strategy of the Republic of Croatia (1997), and the Physical Planning Programme of the Republic of Croatia (1999)[120].

In addition Croatia adopted also the Environmental Protection Act (OG 110/07) which establishes that:

- Integrated coastal zone management (ICZM) is the dynamic process of sustainable management and use of coastal zones, simultaneously taking into account the fragility of coastal ecosystems and the landscape, the diversity of activities and use their interaction, the maritime orientation of certain activities and use their impact on marine and terrestrial components;
- Marine ecosystems are regions of ocean space encompassing coastal areas from river basins to estuaries to the seaward margins of coastal current systems and seaward boundaries of continental shelves, which are characterized by distinct productivity and trophic, bathymetric and hydrographical features of the region;
- Marine environment is the living space of organisms and their communities, defined by distinctive physical, chemical and biological features, which includes: open sea zones, estuaries and coastal marine zones including internal sea waters, territorial sea, sea bottom and seabed of those marine zones.

Strategic Environmental Assessment of Plans and Programmes (Environment Protection Act, OG 110/07) is a procedure for the assessment of likely significant impacts on the environment which may occur due to the implementation of a plan or programme.

Strategic assessment is mandatory for:

- a plan or programme, with the exception of amendments thereto, which is adopted at the state and regional level in the following sectors: agriculture, forestry, fisheries, energy, industry, mining, transport, telecommunications, tourism, waste management and water management;
- the spatial plan of a county and Spatial Plan of the City of Zagreb, with the exception of amendments thereto.

The Ordinance on Nature Impact Assessment (OG 89/07) establishes projects which are subject to mandatory nature impact assessment, the content, timeframe and manner of establishing the nature impact assessment, the method of informing the general public and the method of calculating the security for elimination of possible impacts on nature.

Maritime demesne

The Maritime demesne and seaports Act (OG 158/03, 141/06) defines the "maritime domain" as public property, which extends to one part of the state territory on the mainland, to the inner sea water and territorial sea, as well as to the corresponding seabed and subsoil, and has specific legal, functional and economic characteristics.

According to the Maritime demesne and seaports Act (OG 158/03, 141/06) the use of maritime demesne may be a general or special one. General use of maritime demesne shall mean that anyone has the right to use maritime demesne pursuant to its nature and purpose. Special use of maritime demesne shall be any use that is not a general one nor is a commercial exploitation of maritime demesne. Commercial exploitation of maritime demesne shall be the use of maritime demesne for carrying out commercial activities, involving or not the use of existing installations and other facilities on maritime demesne and with or without constructing

[120] See paragraph 3.3.1

new installations and any other facilities on maritime demesne. According to the Maritime demesne and seaports Act neither ownership nor any other property right may be acquired on maritime demesne on any grounds. Maritime demesne consists of internal sea waters and territorial sea, their seabed and subsoil, and a part of land that is by its nature intended for general use or has been proclaimed as such as well as anything that is permanently attached to such part of a land on the surface and underneath it. The seashore extends from the seaward middle-water line and embraces the belt of land delimited by the line reached by the highest waves in storms as well as the part of the land that by its nature or purpose serves for exploiting the sea for seaborne trade and sea fishing as well as for other purposes related to exploitation of the sea and the width of which is no less than 6 m measuring from the line in horizontal distance from the seaward middle-water line. The seashore also encompasses a part of land derived from strewing, in the part which serves for exploiting the sea. The National Hydrographic Institute shall establish the seaward middle-water line.

Protection of the Environment

Croatia has adopted legislation for the protection of biodiversity. Main legislative instruments include:

- The Strategy and Action Plan for the Protection of Biological and Landscape Diversity;
- Nature protection Act;
- Regulation on Protection of Wild Taxa;
- Regulation on Proclamation of the Ecological Network.

The Strategy and Action Plan for the Protection of Biological and Landscape Diversity (OG 143/08) of the Republic of Croatia is the fundamental document for nature protection, laying down long-term objectives and guidelines for the conservation of biological and landscape diversity and protected natural values, and methods for implementation thereof, in accordance with the overall economic, social and cultural development of the Republic of Croatia.

Within the meaning of the Nature Protection Act (OG 70/05, 139/08,57/11), nature is the overall biological and landscape diversity. Nature and natural assets are of interest for the Republic of Croatia and are beneficiaries of its special protection.

The Regulation on the proclamation of the ecological network (Regulation on Proclamation of the Ecological Network, OG 109/07) was adopted in October 2007. The Regulation proclaims the ecological network of the Republic of Croatia with the system of ecologically important areas and ecological corridors with conservation objectives and guidelines for protection measures which are aimed at maintaining or establishing a favourable status of threatened and rare habitat types and/or wild taxa.

The Croatian National Habitat Classification defines the following main habitat classes, with each divided into four levels of habitat types:

- Inland surface water and wetland habitats;
- Inland un-vegetated and sparsely vegetated habitats;
- Grassland, bogs, fens and tall forb habitats;
- Scrub habitats;
- Forest habitats;
- Coastal habitats;
- Marine habitats;
- Undergrounds habitats;
- Cultivated non-forested land and habitats with weeds and ruderal vegetation;
- Constructed and industrial habitats;
- Habitat complexes.

The Nature Protection Act regulates landscape planning in the State. Pursuant to Article 16, paragraphs 1 and 2 of the Nature Protection Act, an important landscape is a natural or cultivated tract of land distinguished by major landscape value and biological diversity or cultural historical value, or a landscape distinguished by unique conserved features characteristic of a particular area designated for relaxation and recreation or a particularly valuable landscape established pursuant to this Act. Projects and acts impairing the features for which the important landscape was designated as such shall not be permitted.

At the State level, the State Institute for Nature Protection, among its other specific roles, proposes the plans for protected natural areas and National Strategies for improving the management and protection of the landscape.

The Contingency Plan for Accidental Marine Pollution (OG 92/08) establishes the procedures and measures for predicting, preventing, restricting and preparedness for as well as response to accidental marine pollution and unusual natural marine phenomenon for the purpose of protecting the marine environment. The Contingency Plan is implemented in case of accidental marine pollution caused by oil and/or oil mixture if the amount of pollution exceeds 2000 m3 , hazardous and noxious substances, and in case of unusual natural marine phenomenon. A county contingency plan in case of accidental marine pollution, which is adopted by a county representative body, subject to prior approval of the central state administrative body in charge of environmental protection, shall be implemented in case of pollution caused by oil and/or oil mixtures if the amount of pollution does not exceed 2000 m3 or sudden natural phenomena at sea of minor size and intensity. The Contingency Plan does not apply in case of radioactive pollution. The Contingency Plan shall be implemented in marine areas, on seabed and marine subsoil of the Republic of Croatia which include the maritime domain, internal sea waters, territorial sea and the Protected Ecological and Fishery Zone (ZERP).

The Decision on the List of Waters of the First Order (OG 79/10) establishes the List of waters of the 1st order, which includes interstate waters, coastal waters, other major waters and canals, and torrential waters of significant power.

Within the Adriatic river basin district, all the areas designated as eutrophic, areas serving for abstraction of water intended for human consumption and areas of protected nature shall constitute a sensitive area (Decision on the designation of sensitive areas, OG 81/10). The map of the areas of this Decision is set out in the Annex which forms an integral part of this Decision, in the scale 1:25 000, with its original copy kept in Croatian Waters, and shall be delivered upon request and free of charge to state administration bodies, bodies of local and regional self-government units and legal persons vested with public authority.

The Regulation on Quality Standards for Water (OG 89/10) stipulates water quality standards for surface waters including coastal waters and territorial sea waters, and for groundwater. According to article 11, the status of surface waters shall be established by means of assessment of the ecological status and the chemical status of water bodies. The ecological status of surface waters shall be established on the basis of biological, hydromorphological, chemical and physiochemical elements supporting the biological elements, whereas the chemical status of surface waters shall be established with respect to the priority and other pollutants as follows:

Coastal waters

(a) ecological status - biological elements, composition, abundance and biomass of phytoplankton, composition and abundance of other aquatic flora, composition and abundance of benthic invertebrate fauna, hydromorphological elements, morphological conditions: depth variation, structure and substrate of the coastal bed, structure of the intertidal zone; tidal regime: direction of dominant currents, wave exposure, chemical and physiochemical elements supporting the biological elements, transparency , thermal conditions, oxygen balance, salinity, nutrients ;

(b) chemical status: chemical status in relation to priority substances, pollution by priority substances discharged into the body of water, chemical status with respect to pollutants, pollution by other substances discharged in significant quantities into the body of water). Elements applicable to artificial and heavily modified water bodies shall

be those applicable to whichever of the natural surface water bodies most closely resembles the heavily modified or artificial water body concerned.

In accordance with the regulations from the Waters Act (OG no. 153/09, 130/11) a systematic monitoring of the quality of waters is the subject of the programmes in the domain of Croatian Waters ("Hrvatske Vode"). Results of monitoring the quality of waters enable the adoption of basic planning premises for water management at the level of the Republic of Croatia and the regional level.

The Regulation on sea bathing water quality (OG 73/08) sets out standards for bathing water quality on sea beaches, establishing limit values for microbiological parameters and other characteristics of the sea. A sea beach is a developed or natural beach defined under a special regulation.

Legal protection and management of protected areas

In the Republic of Croatia, the Environmental Protection Act Official Gazette 70/2005) defines the system for protecting and conserving nature and natural values. The Act has established the following categories of protected areas:

- Strict reserve
- National park
- Special reserve
- Nature park
- Regional park
- Natural monument
- Important landscape
- Forest park
- Monument of park architecture.

The Act prescribes that protected areas can be proclaimed by the Croatian Parliament, the Government of the Republic of Croatia, and the county assemblies, depending on the category of protection. Public institutions are established to manage the protected areas.

The Government of the Republic of Croatia is responsible for establishing Public institutions for the management of national parks and nature parks, while regional self-government units, based on the decisions of county assemblies, establish public institutions for managing the other protected areas. This is illustrated in the following table.

CATEGORY	MANAGEMENT LEVEL
STRICT RESERVE	COUNTY or LOCAL
NATIONAL PARK	STATE
SPECIAL RESERVE	COUNTY or LOCAL
NATURE PARK	STATE
REGIONAL PARK	COUNTY or LOCAL
NATURAL MONUMENT	COUNTY or LOCAL
IMPORTANT LANDSCAPE	COUNTY or LOCAL
FOREST PARK	COUNTY or LOCAL
MONUMENT OF PARK ARCHITECTURE	COUNTY or LOCAL

Table 3-2 Method and level of protected area management in Croatia

The goals of nature and biodiversity protection in the County of Primorje and Gorski Kotar

The specific goal of environmental protection in the field of nature and biodiversity production is to:

- Preserve the existing richness of biological and landscape diversity in the County and to continuously care for its conservation

Activities involved in preserving the rich natural resources of the County of Primorje and Gorski Kotar:

GENERAL ACTIVITIES:

- Undertaking measures to maintain and increase the numbers within populations of threatened species and to preserve and rehabilitate their habitats
- Preventing the introduction of invasive species and mitigating the effects in cases where invasive organisms are already present
- Preserving the biological diversity of rare types of habitats and vegetation (bogs, floodplain and wetland habitats, cliffs, screes, sub-alpine grasslands, sea shores, crags and islets)
- Encouraging farming activities upon which the preservation of the biological and landscape diversity depends

ACTIVITIES IN PROTECTING THE LIVING WORLD AND HABITATS

- Preserving the numbers and diversity of endemic and rare plants and wildlife
- Preserving the biological diversity of forests
- Preserving the habitats of amphibians
- Preserving the habitats and corridors vital to migratory animals
- Restraining harmful anthropogenic factors impacting on the destruction of bogs
- Preventing the illegal poisoning of protected island wildlife
- Preventing the harmful effects resulting from the introduction of allochthonous wild animals
- Preserving the diverse types of grasslands and preventing them from becoming overgrown
- Preventing the degradation of the underground karst
- Preserving the wetlands
- Preventing the unauthorised gathering of rare and protected plants, animals and mushrooms
- Preventing the loss in the genetic diversity of indigenous sorts and breeds.

ACTIVITIES IN PROTECTING THE KARST

- Mapping underground karst habitats and protecting their living world and geological heritage
- Preserving karst watercourses (rivers and streams)

ACTIVITIES IN PROTECTING THE SEA AND COAST:

- Preventing the destruction of coastal habitats as a result of rapid tourism development
- Preserving the coraligenous biocenosis of the seabed
- Preserving the fields of marine flowering plants
- Preserving the dolphin population
- Mapping and preserving underwater caves

- Preventing the degradation of biodiversity as a result of pollution of the water area
- Mitigating degradation caused by eutrophication of the sea
- Preventing the destruction of seafloor fauna communities (especially certain types of mussels)
- Preventing the degradation of fjords
- Preventing the degradation of the seabed due to rapid tourism development

ACTIVITIES IN SETTING UP THE MONITORING OF BIOLOGICAL AND LANDSCAPE DIVERSITY

- Monitoring change over time and measuring the effects of action plans carried out
- Ensuring the monitoring of wetland habitats and other types of rare and threatened habitats (for example, bogs)

ACTIVITIES IN CONDUCTING EDUCATIONAL PROGRAMS:

- Providing continuous educational programs for all population age groups and structures
- Providing hunters with greater knowledge and information on the need to preserve biological and landscape diversity

DOCUMENTS THAT NEED TO BE DRAWN UP AND ADOPTED IN CARRYING OUT ACTIVITIES IN PROTECTING THE NATURAL HERITAGE AND PRESERVING BIODIVERSITY:

- Studies to establish priority in the protection of valuable natural areas on land
- Background studies prior to the legal procedure of proclaiming protecting areas of valuable natural heritage proposed for protection
- Decisions on the protection of and measures for protecting parts of valuable natural heritage proposed for protection
- Protection measures for protected natural heritage for which such measures have yet not been adopted
- Management plans for protected natural heritage

Cultural heritage

Croatia has an established system of measures for the protection of cultural heritage. List of protected marine areas in the Republic of Croatia are based on the Act on the Protection and Preservation of Cultural Heritage (OG 69/99, 151/03, 157/03, 87/09, 88/10, 61/11, 25/12). In situ conservation of the cultural heritage prescribed by the Cultural Heritage Register and the Act on the Protection and Preservation of Cultural Heritage Underwater archaeological localities in line with the Cultural Heritage Registry have the priority in terms of implementation of the Contingency Plan for Accidental Marine Pollution. The list of underwater archaeological localities in line with the Cultural Heritage Registry is kept at the Headquarters' command and published on the webpage of the central state administrative body competent for the sea, and it is updated annually.

Fishing and aquaculture

The fishing zones are divided as outer sea zone (more than 2 km from the shore) which is intended for all kinds of fishing in accordance with rules of sea fishing, and inner sea zone (distance from the shore is inside 2 km) which is intended for economy fishing with selected techniques of fishing, and as for sports fishing. In 2002 the Agriculture and Fishing Programme was passed in the Croatian Parliament, through which they propose to direct the fishing effort towards the open waters and towards small pelagic species (anchovies, sardines, and sprats).

The legal framework governing fisheries in the Republic of Croatia includes 3 laws:

- Marine Fisheries Act (OG 56/10, 127/10, 55/11),

- Freshwater Fisheries Act (OG 106/01, 7/03, 174/04, 10/05 i 49/05-consolidated text)
- Act on structural support and market organization in fisheries (OG 153/09, 127/10).

On the basis of these three Acts, a wide range of implementing regulation has been adopted, which further regulate specific issues. In the sector of marine fisheries, the most important implementing regulations are governing technical measures, measures directed towards protection of resources through minimum catch and landing sizes as well as designation of specially protected areas or fisheries protected areas, determination of technical characteristics of fishing gears, manner of keeping and submission of fisheries-related data and manner of issuance of fishing licenses. Specific ordinances govern sport and recreational fisheries at sea, as well as subsistence and small coastal fisheries. Another important segment relates to marine aquaculture, where ordinances determine the way farming incenses are issued as well as other detailed rules governing marine aquaculture activities. In the sector of freshwater fisheries, the ordinances govern commercial fisheries (catch quotas, manner of issuance of licenses, fishing areas), sport and recreational fisheries (fishing rights and management of resources within the management areas awarded to right holders) and freshwater farming activities.

Tourism

The Nautical tourism development Strategy of the Republic of Croatia 2009-2019 (December, 2009 and "Criteria for Planning Tourism zones in the Coastal Area of the Republic of Croatia" (Ministry of Environmental Protection and Spatial Planning, June 2009.) contains a vision and strategic goals of further development of nautical tourism in accordance with the principles of sustainable development, as well as the Action Plan for the Strategy implementation which elaborates measures, activities, carriers and deadlines of the Strategy implementation for the period 2009 - 2019.

- In physical plans of counties requirements have to be separately determined for planning and use of space for berths in nautical tourism ports and "sports ports", and particularly in ports in which within the port local waters the location of two or more types of berths is planned;
- for each planned location of nautical tourism ports in physical plans for the development of towns and municipalities an adequate building area needs to be foreseen for the necessary facilities on land and for infrastructure at sea;
- for all new marinas (regardless of their size and type of project) the impact on changes and requirements of landscape protection has to be presented in the plan;
- in physical plans for the development of towns or municipalities the requirements for the use of vessel storage and "dry marinas" needs to be determined through description and plan representation. Vessel storage can be used in certain time period for temporary storage of vessels on the dry. In physical plans of counties requirements for vessel storage in the coastal belt and outside the coastal belt have to be separately described;
- "dry marinas" are service and storage for which the following standards are recommended:

  a) the free area in the part on land has to fulfil the needs for storage of a certain number of vessels;

  b) dry marinas may include a smaller shipyard for the construction, repair and service of vessels;

  c) dry marinas have to be connected with the surrounding area by a road of adequate width which shall enable safe vessel transport.

Islands

The Islands Act (34/99, 149/99, 32/02, 33/06) is based upon the principles of the National Islands Development Programme (February 1997) and it provides for the management of island development at national, county and town / municipality levels.

In view of the demographics and economic development, islands are divided into two groups according to the Islands Act (Article 2):

- The first group includes undeveloped and insufficiently developed populated or periodically populated islands as follows: Unije, Susak, Srakane Vele, Srakane Male, Ilovik, Maun, Prvić (Kvarner Bay Islands), Goli, Sv. Grgur, Premuda, Silba, Olib, Škarda, Ist, Molat, Dugi otok, Zverinac, Sestrunj, Rivanj, Rava, Iž, Ošljak, Babac, Vrgada, Prvić (Šibenik Islands), Zlarin, Kaprije, Žirje, Veli and Mali Drvenik, Šćedro, Vis, Biševo, Sv. Andrija, Lastovo, Sušac, Vrnik, Mljet, Šipan, Lopud, Koločep, Lokrum, Kornati and islands of Žut and Sit group.
- The second group includes all populated islands (48) that have not been included in the first group and also Pelješac Peninsula.

Under this Act programmes of sustainable island and/or island group development are drawn up for islands and island groups comprising single regional and economic entities.

Programmes of sustainable island development represents a compulsory developmental programme of all coast-island counties, island and coast-island towns and municipalities. Content and methodology for the drawing of the programme of sustainable island development is prescribed by the Government of the Republic of Croatia upon recommendation of the Ministry and with previously obtained opinions of the Ministry of Environmental Protection and Physical Planning, Ministry of Finance, Ministry of Trades, Small and Medium-Sized Enterprises, Ministry of the Economy, Ministry of Culture, Ministry of Tourism, Ministry of Maritime Affairs, Transport and Communications and Croatian Water Board (Hrvatske vode), respectively.

The main medium-term goals of the island economy (National Island Development Programme) development are for the economic structure and households to be as versatile as possible. Economic conditions for the achievement of these goals should, among other things, be created by a series of co-ordinated measures of fiscal policy. These measures should aim at encouraging small and medium investors in activities which ensure a sustainable island development, the users of sustainable technologies and households who want to enlarge the number of their activities. Special encouragement should be offered to households engaging in both tourism and agriculture. Activities which should be encouraged on all Croatian islands through fiscal measures are:

- environmentally friendly agricultural production on the existing and new plantations, in the open air and in enclosed facilities (cultivation of olives, viniculture, Mediterranean fruit growing, cultivation of carob, citrus fruits and medicinal and aromatic herbs, vegetables and flowers;
- small-scale and semi-intensive sheep and goat-breeding;
- bee-keeping;
- processing of agricultural products protected by geographical indication (sheep and goat-milk cheese, honey and other apicultural products, "well-known" and other quality wines, olive canning, production of pure and extra pure olive oil, pharmaceutical and cosmetic semi-products and products);
- cultivation of shellfish, fish and other sea animals;
- coral diving;
- sponge diving;
- stone quarries;
- stone-cutting;
- manufacture of sails;
- manufacture of fishing tools;

- pottery;
- production of island souvenirs;
- small-scale tourism in the existing renewed and adapted facilities;
- small ship-building;
- private shipping by sea, road and air;
- private health services and;
- private schools.

An integral planning of sustainable development of islands will be achieved by amending the existing planning system. Besides the usual physical planning documents, programmes for full and sustainable exploitation of island resources will be devised. On the level of feasibility studies they will also contain alternative investment proposals. In this way these programmes will help the island local self-government to attract investors in the sustainable island development.

The Islands Act provides for the obligation to bring island physical plans in line with the programmes of full and sustainable exploitation of island resources. Programmes of full and sustainable exploitation of island resources will be made for each island and group of islands which makes a geographic and economic unit. The programmes will contain:

1. demographic analysis, employment and assessment of available work force;
2. analysis of present exploitation of natural and man-made resources;
3. state of infrastructure and superstructure;
4. state of natural and cultural heritage;
5. evaluation of the present state of development;
6. criteria for the protection of heritage and a full and sustainable exploitation;
7. external limitations;
8. list and accessibility of arable plots of land and island pastures which have not been cultivated or used for pasture for five (5) years or the owner of which is unknown or inaccessible;
9. list and condition of buildings which have not been used for twenty (20) years and the owner of which is unknown or inaccessible;
10. agricultural and economic plan with the principles of agricultural development;
11. principles of the development of tourism;
12. principles of fishing development;
13. principles of the development of other activities;
14. principles of the development of education, health care and cultural activities;
15. plan of necessary infrastructure;
16. plan of a network of field and other lanes used in agriculture;
17. possible varieties of full and sustainable exploitation of island resources;
18. necessary investments for each possible variety;
19. promotion of the Programme.

Economic use of natural resources-extraction of minerals stone is regulated by the Physical Spatial Plans of the Region. For economic use of natural resources it is also necessary to obtain a concession.

Greece

Level	Date	Policy framework	Implementing Department or Agency	Key Regulations and byelaws reference	ABOUT	Aims and objectives (related to MSP)
EU/Mediterranean	2000	EU Water Framework Directive (WFD) 2000 / 60/ec Transposition of Law of Water Frame-work Directive Issue No. 3199/2003	European Com-mission Ministry of Environment, En- ergy & Climate Change -Special Secretariat for Water	Key Regulations: Provisions for the coordinated elaboration of River Basin Management Plans (RBMPs) Establishment of Monitoring Networks Biological Quality Elements Byelaws-reference: Presidential Decree No A'54/2007 Determina- tion of measures & procedures for the integrated protection and man- agement of waters in compliance with the provisions of the Directive 2000/60/ establishing a framework for the Community action in the field of water	Rationalises and updates the existing water legislation by setting common EU wide objectives for water bodies; ground as well as fresh waters, rivers and coastal marine waters. It introduces an integrated and coordinated ecosystem approach to water management in Europe and this has implications and possibilities for the spatial planning of marine areas as well (Katsanevakis *et al.*, 2011). Within this framework it is expected that water bodies achieve good environmental	WFD introduces an integrated and coordinated ecosystem approach to water management in Europe and this has implications and possibilities for spatial planning of marine areas as well (inner coastal waters).

				policy	status by 2015, including the establishment of a register of protected areas (Maes, 2008).	
	2008	Marine Strategy Framework Directive (MSFD) 2008/56/EC	European Com-mission	Key Regulations: Establishment of a framework for community action in the field of marine environmental policy MSFD provides 12 qualitative descriptors of Good Environmental Status (GES), which can be considered as the bases for high level objectives. Based on these descriptors, member states should conduct an initial assessment of their waters, establish environmental targets and monitoring programs for ongoing assessment, and implement	Establishes the framework within which Member States must take necessary measures to promote sustainable use of the seas and to conserve marine ecosystems by achieving or maintaining good environmental status in their marine environment by the year 2021 (EC, 2008b). MSFD forms the pillar of the European Union Maritime Policy outlining an action plan in which Member States have to develop and implement marine strategies, targets, monitoring plans and programme measures to be	Environmental pillar of the European Union's Integrated Marine Policy. Plan of action to implement marine strategies targets and programmes measures to be developed for marine waters, taking into account the transboundary effects on the quality of the marine environment within each region/sub---regions.

				programmes of measures (marine strategies) to achieve or maintain GES in their marine waters by 2020. The MSFD specifically suggests both MPAs and MSP as possible tools to aid in the achievement of GES.	developed for its marine waters. Therefore, to properly fulfill the preparation of the marine strategies is necessary to ensure that methodologies are consistent across marine regions/sub-regions in order to facilitate the comparability of results and thus take into account transboundary effects (EC, 2008b).	
	2009	Birds Directive 1979/409/EEC - Modified version: EU Birds Directive 2009/147/EU Transposition of the Directive 2009/147/EU into the Greek legislation O.G.G. Issue No B' 1495/2009	European Com-mission Ministry of Environment, Energy & Climate Change	Key Regulations: the protection of habitats for endangered as well as migratory species, especially through the establishment of a coherent network of Special Protection Areas (SPAs) comprising all the most suitable territories for these species	Legislation regarding Nature Conservation. Through the history, they have been main drivers for MSP development in Europe providing a framework for identification and classification of Special Protection Areas for rare, vulnerable or regularly occurring migratory species and Special Areas	Network of protected areas across the EU, known as Natura 2000 for protection of habitats, animals and plants, either in land as in marine environment.

					of Conservation (SAC). Together the SACs and the SPAs create a network of protected areas across the EU known as Natura 2000 Network for protection of habitats, animals and plants, either in land as in marine environment (Douvere and Ehler, 2009).	
	1992	Habitats Directive 92/43/EEC Law for the Environmental Protection 1950/86 Modified version: Law for the protection of Biodiversity O.G.G. Issue No A' 60/2011 Transposition of the Directive	European Com-mission Ministry of Environment, Energy & Climate Change	Key Regulations: priorities for the conservation of natural habitats and of wild fauna and flora; selection, designation and protection of a network of sites through- out Europe known as Special Areas of Conservation (SACs) Byelaws-reference: - Spatial Management Plan		Network of protected areas across the EU, known as Natura 2000 for protection of habitats, animals and plants, either in land as in marine environment.

		2009/147/EU on the conservation of wild birds into the Greek legislation O.G.G. Issue No B' 1495/2009		of the National Marine Park of Zakynthos O.G.G. Issue No D'1161/1993 -Law for the determination of 25 Protected Areas in Greece 3044/2002 Issue No 197/2002 - Spatial Management Plan of the National Park Mesologgi Aitolikou lower reaches and estuaries Acheloos Evinos Echinades and islands O.G.G. Issue No D'477/2006 -Spatial Management Plan of Kotychi- Strofylia Wetlands O.G.G. Issue No D'159/2009		
	2007	Floods Directive 2007/60/EC	European Commission	Key Regulations: on the assessment and management of flood risks	This Directive now requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and	

					humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. With this Directive also reinforces the rights of the public to access this information and to have a say in the planning process.	
	1997	Environmental Impact Assessment Directive 97/11/EC	European Com-mission	Key Regulations: brought the EU legislation in line with the UN ECE Espoo Convention.		
	2001	Strategic Environmental Assessment Directive (2001/42/EC)	European Com-mission	Key Regulations: requires certain public plans and programmes (P&P) to undergo an environmental assessment.	This is to ensure that environmental consequences of certain P&P are identified and assessed during their preparation and before their adoption. This includes the preparation of an environmental report in which the likely significant effects on the environment and the reasonable	Identifies, describes, evaluates and reports the environmental effects of certain plans and programmes.

					alternatives are identified, as well as carrying out consultations.	
	2009	Renewables Directive 2009/28/EC amends and repeals the 2001 Directive on Electricity Production from Renewable Energy Sources	European Commission	Key Regulations: requires that 20 percent of the energy consumed within the European Union is renewable.	Members States were obliged to notify the European Commission by 30 June 2010 of a National Renewable Energy Action Plan which sets out the road map of the trajectory. Member States have to submit Progress Reports explaining their implementation of the Directive and their progress towards their targets, as is required by Article 22 of the Directive. Greece has not yet created a NREP	
	2002	Common Fisheries Policy (CFP) Regulation (EC) No 2371/2002	European Commission	Key Regulations: There are regulations to achieve the main objectives of CFP: (1) fisheries	Aims to minimize the impact of fisheries in the marine ecosystem and to provide sustainable	CFP establishes the precautionary principle, sustainable exploitation

		Adoption of the Council Regulation (EC) concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, Issue No 1967/2006 to the Greek Legislation O.G.G Issue No A'60/2007		overcapacity reduction; (2) long term management plans; (3) ecosystem based approach to fisheries; (4) stakeholders involvement in management processes; (5) selective uses of public funds for activities coherent with CFP; (6) bilateral fisheries agreements; and (7) integration of CFP in a broader maritime context	economic and social	and progressive implementation of EBM to fisheries management.
	2007	Green Paper on a Future Maritime Policy for the EU 2007	European Com-mission	Key Regulations: ecosystem-based approach to the management of human activities	Replaces compartmentalized resource management with a holistic and integrated ecosystem-based approach to the management of human activities while simultaneously encompassing all elements of maritime activity	
	2007	EU Blue Book on Integrated Maritime	European Com-	Key Regulations:		The first

		Policy 2007	mission	Spatial planning approach which equally covers on and offshore areas.		document to officially refer to *Integrated Maritime Spatial Planning (IMSP)*. The Blue Book recognizes that IMSP will yield its full benefits only if all coastal Member States introduce such systems, use compatible and comparable systems, and learn from each other's experience (Zehden, 2008).
	2008	EU Roadmap for MSP 2008	European Com-mission	Key Regulations:Using MSP according to area and type of activity Defining objectives to guide MSP Developing MSP in a transparent manner Stakeholder participation		Setting out the key principles for MSP.

				Coordination with MS Ensuring the legal effect of National MSP Cross border cooperation-consultation Achieving coherence between terrestrial and MSP strong data and knowledge base Incorporating monitoring and evaluation in the planning process		
	2013	Proposed Directive for MSP and ICZM 2013/0074 (COD)		Key Regulations: To support sustainable economic growth in the marine waters and coastal zones of the EU.		
	2002	Integrated Coastal Zone Management Recommendation 2002		Key Regulations: recommending improved coordination of actions taken by all authorities concerned both at sea and on land, in managing sea land interaction	Does not refer to marine spatial planning. Nevertheless the document provides a basis for it as part of the requirement of Member States to develop ICZM	Requires Member States to improve coordination of actions taken by all authorities concerned both at sea and on land, in

					strategies.	managing sea-land interaction.
	1976	Barcelona Convention 1976 the Convention for the Protection of the Mediterranean Sea against Pollution 1995 (Amended version of the Barcelona Convention of 1976) ICZM Protocol to the Barcelona Convention (2009/89/EC	Contracting parties -UNEP	Key regulations: Specific measures against pollution due to dumping from ships and planes, against pollution due to discharges from ships, against pollution caused by prospection for, and exploitation of, the continental shelf, the sea- bed and its subsoil, against land- based pollution, to protect bio- logical diversity, against pollution due to transboundary movements of dangerous wastes, to monitor pollution	Protocols were formulated and agreed that prescribe agreed measures, procedures and regulations to apply the Convention. Its initial objective was to address the marine pollution control but over the years its scope was broadened to integrate coastal zone planning and management. Although no concrete MSP initiatives have been set up within this Convention and despite focusing on environmental issues, the Convention as a well-established platform of cooperation is taking steps regarding strengthening the	Transboundary Diagnostic Analysis for the Mediterranean Sea. Strategic Action Programs addressing main transboundary concerns: land based pollution and loss of diversity. Collective effort of Mediterranean Countries for protection of the environmental resources (Strategic Partnership for the Mediterranean Sea Large Marine Ecosystems).

					bonds between the different countries in the Region, hence facilitating a joint action on MSP (DG Mare, 2011).	
	2006	Directive 2006/7/EC of the European Parliament and of the council concerning the management of bathing water quality and repealing Directive 76/160/EEC Ministerial Decision "Quality and management measures of bating waters re- pealing Directive 2006/7/EC	European Com-mission Ministry of Environment, Energy & Climate Change	Key Regulations: High-level protection of bathing waters (a) monitoring and classification of bathing water quality (b) management of bathing water quality (c) provision of information to the public on bathing water quality		
	2006	Council Regulation (EC) Issue No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean	European Com-mission	Key Regulations: 1. (A) conservation, management and exploitation of living aquatic resources where such activities are pursued, (B) marketing of fishery products		

		Sea Transposition of the Council Regulation (EC) Issue No 1967/2006 into the Greek legislation O.G.G Issue No A'60/2007	Ministry of Maritime Affairs	caught in the Mediterranean Sea. 2. This Regulation shall not apply to fishing operations conducted solely for the purpose of scientific investigations, which are carried out with the permission and under the authority of the Member State or Member States concerned		
National		General Framework for Spatial Planning and Sustainable Development	Ministry of Environment, Energy and Climate Change	L. 2742/1999 for Spatial Planning & Sustainable Development;		
	2009-2014 15 years plan	General Framework Plan for Sustainable Tourism Spatial Planning in Greece	Ministry of Environment, Energy and Climate Change	L. 2742/1999 for Spatial Planning & Sustainable Development		
	2000 Revised 2010	National Framework for Spatial Planning of Aquaculture.	Ministry of Environment, Energy and Climate Change	L. 2742/1999 for Spatial Planning & Sustainable Development		
		Special Framework for Spatial Planning and Sustainable Development for Renewable Energy	Ministry of Environment, Energy and Climate Change	L. 2742/1999 for Spatial Planning & Sustainable Development		

		Sources				
		Special Framework for Spatial Planning and Sustainable Development for Industry	Ministry of Environment, Energy and Climate Change	L. 2742/1999 for Spatial Planning & Sustainable Development		
Legislation for Marine Environment	2011	Law for the Environmental Protection Modified version: Law for the protection of Biodiversity O.G.G. Issue No A' 60/2011 First version: 1986 Modified version: 2011	Ministry of Environment, Energy and Climate Change	Legislation for environment and planning Refers to BiodiversityMarine parks		
	1993 & 1999	Presidential Decrees of 1993 and 1999 establishing the Marine Parks of Sporades and Zakynthos respectively;		Marine Parks		
	1997	L. 2508/97 regulating the spatial planning on the municipality level (including the urban as well as the		concerns sustainable urban planning		

		rural space), regarding the aspect of Sustainable Urban Development				
	1999	L. 2742/1999 for Spatial Planning & Sustainable Development;		concerns the territorial spatial planning in the national and regional levels		
	1998	P.D. 55/1998 (Gov. Gazette A' 58) for the Protection of the Marine Environment;		In 2008, Greece signed the Mediterranean Protocol on Integrated Coastal Zone Management.		
	2011	L. 3983/2011 for the National strategy for the protection and management of the marine environment		Compliance with Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 and other provisions		
	2001	L. 2971/2001 on Coasts and Beaches (also making reference to ports);				
Legislation for shipping	1994	L. 2252/1994		Law by which Greece has ratified the International Convention OPRC		

				1990		
	2002	Presidential Decree 11/2002 (on Contingency Plans).				
Legislation for Underwater cultural heritage	2002	L. 3028/2002 and related Ministerial Decisions on the Protection of Underwater Cultural Heritage;				
	2003	Ministerial Decision of 2003 (OJ 1701/19-11-2003) characterizing ship wrecks as cultural goods;				
	2004	Joint Ministerial Decision of 2004 (OJ 336/11-2-2004) with restrictions for mooring and diving.				
Regional/local		Regional Framework for Spatial Planning and Sustainable Development of the Region of Western Greece				
	2004	Regional Framework for Spatial Planning and Sustainable Development of the Region of Ionian		URBANIZATION	Urban Plan of Ilia Coastal Zone O.G.G. Issue No D'1161/1993 Continuous Urban	

		Islands O.G.G Issue No 56/2004 15 Year Plan 2004-2019			Plan of Mesologgi O.G.G. Issue No 406/1989 Modified version: O.G.G. Issue No 1336/1992 Urban Plan of Astakos O.G.G. Issue No 1263/1987	
		Regional Framework for Spatial Planning and Sustainable Development of the Region of Epirus				
	2005	Management Plans for the three Industrial Areas (Astakos, Anti- kira, Thisvi) 2005		INDUSTRY		
		Areas of Integrated Development of Aquaculture in Ecinades Is-lands		AQUACULTURE		
		Areas of Integrated Development of Aquaculture in Ionian Islands		AQUACULTURE		
	1999 – revised 2003	Spatial Management Plan of the National Marine Park of		BIODIVERSITY		

		Zakyn-thos O.G.G. Issue No D'1161/1993 Modified version: O.G.G. Issue No D'906/1999				
	2006	Spatial Management Plan of the National Park Messolonghi Aito-likou lower reaches and estuaries Acheloos Evinos Echinades and islands O.G.G. Issue No D'477/2006		BIODIVERSITY		
	2009	Spatial Management Plan of Ko- tychi-Strofylia Wetlands O.G.G. Issue No D'159/2009		BIODIVERSITY		

Italy

Italy has not adopted yet any legislative instrument mandating MSP. However, Italy has adopted numerous legislative instrument governing different aspects of relevance for MSP, including those implementing the main European directives.

Importantly, Italy presents a complex picture when it comes to identifying the institutions and bodies that have responsibility for the planning of maritime activities. In the first place, following the adoption of a federal model, competence to adopt laws and regulations is now divided between the central government and the regions, according to three models:

(1) **Exclusive legislative power of the State**: in the field expressly identified, the State has exclusive power to adopt laws and regulations. Regions may exercise regulatory powers in these fields only if – and to the extent that – the State delegates such powers.

(2) **Concurrent** legislative power between the State and the Regions: in the fields expressly identified by the Constitution. In the subject matters covered by concurring legislation, legislative powers are vested in the Regions, except for the determination of the fundamental principles, which are laid down in State legislation.

(3) **Exclusive legislative power of the Regions**: in all other subject matters not included under (a) and (b) above.

The **State** has **exclusive legislative powers** in the following subject matters:[121]

a) foreign policy and international relations of the State; relations between the State and the European Union; right of asylum and legal status of non-EU citizens;

b) immigration;

c) relations between the Republic and religious denominations;

d) defence and armed forces; State security; armaments, ammunition and explosives;

e) the currency, savings protection and financial markets; competition protection; foreign exchange

system; state taxation and accounting systems; harmonisation of public accounts; equalisation of financial resources;

f) state bodies and relevant electoral laws; state referenda; elections to the European Parliament;

g) legal and administrative organisation of the State and of national public agencies;

h) public order and security, with the exception of local administrative police;

i) citizenship, civil status and register offices;

j) jurisdiction and procedural law; civil and criminal law; administrative judicial system;

k) determination of the basic level of benefits relating to civil and social entitlements to be guaranteed throughout the national territory;

l) general provisions on education;

m) social security;

n) electoral legislation, governing bodies and fundamental functions of the Municipalities, Provinces and Metropolitan Cities;

o) customs, protection of national borders and international prophylaxis;

[121] Art. 117(1) Italian Constitution, as modified by Law

p) weights and measures; standard time; statistical and computerised co-ordination of data in state, regional and local administrations; works of the intellect;

q) protection of the environment, the ecosystem and cultural heritage.

Concurring legislation applies to the following subject matters:

a) international and EU relations of the Regions;

b) foreign trade;

c) job protection and safety;

d) education, subject to the autonomy of educational institutions and with the exception of vocational education and training;

e) professions;

f) scientific and technological research and innovation support for productive sectors;

g) health protection;

h) nutrition;

i) sports;

j) disaster relief;

k) land-use planning;

l) civil ports and airports;

m) large transport and navigation networks; communications;

n) national production, transport and distribution of energy;

o) complementary and supplementary social security;

p) co-ordination of public finance and the taxation system;

q) enhancement of cultural and environmental assets, including the promotion and organisation of cultural activities;

r) savings banks, rural banks, regional credit institutions;

s) regional land and agricultural credit institutions

In the second place, complexity is added due to the diverse bodies that have the authority to adopt administrative regulations and to enforce these regulations, on land and at sea. In particular, enforcement activity is at the moment carried out by four principal bodies: the Coast Guard, the Revenue Police (Guardia di Finanza), the Carabinieri Force and the Police.[122]

Protection of the environment

The main normative instrument is the Code of the Environment, which is complemented by a significant number of laws and regulations.[123] The code of the Environment addresses environmental impact assessments, the protection of the soil against desertification, the protection and management of water resources, waste management and disposal, protection of the air and the reduction of atmospheric emissions, compensation for environmental damage. It endorses the main environmental principles that are contained in international instruments: sustainable development, the precautionary principle, preventive action and action at the root of the problem and the "polluter pays" principle.

[122] A proposal for the rationalisation of these forces is currently under the exam of the Parliament.
[123] Legislative Decree 3 April 2006, n. 152.

Italy has established a network of 27 marine protected areas within its territorial sea, which include ten areas inscribed in the SPAMI list. Furthermore, Italy, France and Monaco have established a marine protected area for the protection of cetaceans which includes portions of the ecological protection zone in the Ligurian Sea (the Pelagos Sanctuary).[124] Italian legislation provides for the possibility to establish further marine protected areas. Marine protected areas comprise the waters, seabed and coastal areas that present a relevant interested due to their natural, geomorphological, physical and biochemical characteristics.[125]

Legislative Decree 190/2010 has transposed the MSFD in Italy. The decree establishes a framework to develop strategies directed to the marine environment and the adoption of measures necessary to achieve and maintain Good Environmental Status by 2020 (Art. 1). The Ministry of the Environment, Land and Sea (MATTM) is the Reference/Competent Authority in Italy for the coordination of activities under the decree. According to Art. 4, for a coordination purpose MATTM appointed a Technical Committee, established within the Ministry itself by a special decree.
The Committee is composed of (Art. 5):

- Three representatives of the Ministry of the Environment, one of whom shall be the appointed chairman;
- Two representatives of the Ministry of Agriculture and Forestry;
- One representative from each of the following Ministries: Ministry of Infrastructure and
- Transport, Ministry of Health, Ministry of Defence, Ministry of Foreign Affairs, Ministry of Education, University and Research, Ministry of National Heritage and Culture, Ministry of Economic Development and the Department for Regional Affairs;
- One representative from each region and autonomous province;
- One member representing the Union of Italian provinces;
- A representative of the National Association of Italian Municipalities.

The Higher Institute for Environmental Protection and Research (ISPRA) provide its scientific-technical support to MATTM activities.

The Italian decree (art.5-7) identifies actions to be implemented:

- The initial assessment of the current environmental status of marine waters;
- Determination of characteristics of good environmental status of waters;
- Establishment of environmental targets;
- Definition of a monitoring programme;
- Definition of a programme of measures designed to achieve or maintain a good environmental status of marine waters.

Other relevant legislative instruments for the protection of the environment include:

- Legislative Decree 152/2006, implementing the Water Framework Directive (2000/60/CE) (see paragraph 3.3 concerning the plans relevant for the coastal Adriatic areas.
- Law 8 February 2006, n. 61, authorising creation of "Ecological Protection Zone (EPZ)" beyond the outer limits of the territorial sea. Notably, within the future ecological protection zones the State has also the competence to protect underwater cultural heritage.
- Decree of The Ministry of Environment 24 January 1996: "Discharge in the sea or in areas contiguous to it of materials from dredging and other earthworks - The granting of authorizations under Article 11 of Law 10 May 1976, n. 319". The Decree, concerning the environmental aspect related to the discharge in the sea of marine sediment dredging, provides a series of preliminary activities necessary to get such permission, with the aim to protect marine resources from uncontrolled discharges.
- National Law No. 157 of 11 February 1992 as supplemented by Act Oct. 3, 2002 n.221 (transposition of the EU Birds Directive);

[124] Agreement of 25 November 1999, ratified by Law 11 October 2001, n. 391.
[125] Art. 25, Law 31 December 1982, n. 979.

- The Presidential Decree 8 September 1997 n. 357 as amended by Presidential Decree 120 of 12 March 2003 (transposition of the EU Habitats Directive). This decree gives to the Regions the responsibility of the identification of Natura 2000 sites (see par. 3.3). Furthermore the Ministry Decree 25/03/2005 assigns to the Regions also the task of identify management and conservation measures for Special Protection Areas (SPAs) and the Community Importance Sites (SCI).
- Law n. 979 of 1982 and Law n. 394 of 1991 on Marine Protected Areas

Offshore mineral resources

The principal legislative act is Law 21 July 1967, n. 613, on the exploration for and exploitation of liquid and gaseous hydrocarbons in the territorial sea and the continental shelf. Law 613/67 regulates prospection, exploration and exploitation for liquid and gaseous hydrocarbons at sea and deals with institutional and procedural aspects.

Exploration and exploitation of hydrocarbons is permitted only within specific areas ("maritime zones") designated by the State and identified by a letter. Seven "maritime zones" have been designated so far, accounting for approximately 40% of the Italian continental shelf:

- Zone A: Northern and Central Adriatic Sea.[126] A significant portion of this zone has been closed to any activity until the Council of Ministers ascertains definitively the absence of environmental concerns.[127]
- Zone B: Central and Southern Adriatic Sea.[128]
- Zone C: South Tyrrhenian Sea, Channel of Sicily, South Ionian Sea.[129] The area around the Egadi Islands is now closed to any activity.[130]
- Zone D: Southern Adriatic Sea and Ionian Sea.[131]
- Zone E: Ligurian Sea, Tyrrhenian Sea, Sea of Sardinia.[132] The area of the Gulf of Napoli and the Gulf of Salerno is now closed to any activity.[133]
- Zone F: Adriatic and Ionian Sea (beyond the outer limits of Zone D).[134]
- Zone G: South Tyrrhenian Sea and Channel of Sicily (beyond the outer limit of Zone C).[135] The area around the Egadi Islands is closed to any activity.[136]

Environmental concerns are at the basis of a series of legislative limitations which affect the possibility to carry out exploration and exploitation of mineral resources. In particular, current legislation prohibits any activity, including prospecting, exploration and exploitation, outside the "maritime zones" (A-G) declared by the Ministry of Economic Development and described above. Furthermore, within the seven "maritime zones" any activity is prohibited

- in specifically designated areas: the Gulf of Naples, the Gulf of Salerno, the waters around the Egadi Islands and in the northern Adriatic Sea;[137]

[126] Law 613/67.
[127] Law 9 January 1991, n. 9, as modified by Legislative Decree 25 June 2008, n. 112.
[128] Law 613/67.
[129] Law 613/67, as extended by Ministerial Decree 27 December 2012.
[130] Law 9 January 1991, n. 9.
[131] Law 613/67.
[132] Law 613/67, as modified by Ministerial Decree 9 August 2013.
[133] Law 9 January 1991, n. 9.
[134] Ministerial Decree 13 June 1975, as modified by Ministerial Decree 30 October 2008.
[135] Ministerial Decree 26 June 1981, as modified by Ministerial Decree 29 March 2010 and by Ministerial Decree 9 August 2013.
[136] Law 9 January 1991, n. 9.
[137] Law 9 January 1991, n. 9.

- within any protected marine and coastal area, regardless of the means of protection as long as they are protected for environmental reasons under national or regional legislation or by EU or international acts;[138]
- within 12 nm from the baselines from which Italy's territorial waters are measures, as well as within 12 nm from the outer limit of any marine or coastal protected area.[139]

The central (State) administration is competent for all activities relating to hydrocarbons at sea, also following the devolution of competencies in the area of energy to the regions.

The General Directory for Energy and Mining Resources of the Ministry of Economic Development is responsible for the mining sector, on land and offshore. Acting as the National Mining Office for Hydrocarbons and Geothermal Energy (UNMIG), it is in charge of all activities relating to the evaluation of requests for the research and exploration of oil, gas, geothermic and energetic resources and supervises the coordination of activities aiming at the exploitation of these resources. UNMIG also produces guidelines and programmes for the development of mining in Italy.

Exploration permits and exploitation licenses for mineral resources at sea are granted by the Ministry of Economic Development, following the adoption by the Ministry of the Environment of an EIA/SIA Decree, which contains the opinion of the Ministry of the Environment and may prescribe specific obligations or prohibitions which bind the licensee. The Ministry of Economic Development is supported by the Commission for Hydrocarbons and Mineral Resources (Commissione per gli idrocarburi e le risorse minerarie, CIRM). CIRM has a consultative role and its opinions, while not binding, are necessary for the completion of the procedure.[140]

Impact assessment

Italian legislation adopted in compliance with EU legislation[141] requires the conduct of a strategic environmental assessment (SEA) or an environmental impact assessment (EIA).[142]

A SEA is required for all plans and programmes that may have a significant impact on the natural environment and the cultural heritage. In particular, a SEA is required for all plans and programmes for the evaluation and management of the quality of the air and for the agricultural, forestry, fisheries, energy, industrial, transport, waste, water, telecommunications, tourism territorial planning sectors and which define the framework of reference for approval, authorisation, area of activities or any other aspect of the execution or projects.

An EIA is required for projects that may have a significant negative impact on the natural environment and the cultural heritage. All projects relating to the exploitation of mineral resources of the continental shelf require an EIA. Furthermore, projects relating to the exploitation of mineral resources which serve exclusively or essentially for the development and testing of new methods and products and will not be used for more than two years, as well as projects that constitute extension or modification of other projects, will require an EIA if it is considered that they may produce significant negative impacts on the environment.

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[138] Art. 6, par. 17, Legislative Decree 3 April 2006, n. 152.

[139] Art. 6, par. 17, Legislative Decree 3 April 2006, n. 152.

[140] Presidential Decree 14 Maggio 2007, n. 78 . CRIM brings together representatives from all administrations that have an interest in the exploration and exploitation of mineral resources, representatives of the regional and local administrations and experts. CIRM has three functions: exploration and exploitation of mineral resources (CIRM "A"), safety of exploration and exploitation (CIRM "B"), and royalties (CIRM "C").

[141] DIRECTIVE 2001/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment, OJ L 197 of 21.7.2001 and DIRECTIVE 2011/92/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, OJ L 26 of 28.1.2012.

[142] Art. 6 Legislative Decree 3 April 2006, n. 152.

Montenegro[143]

Montenegro is a candidate State to the EU and has accepted to align its national legislation to the EU aquis.[144]

Spatial planning

At the moment, there is no legal or any other policy document that would have the character of the Integrated Maritime Policy. Different activities at sea and on the coast are regulated by different laws, strategies and programs. The spatial planning policy in Montenegro is set by the spatial plans that are divided in strategic – development plans and regulating plans.

The Law on Spatial Development and Construction of Structures (adopted in 2008) is the key legal document that prescribes the obligation and procedure for drafting spatial plans of different levels[145].

Relevant legislation

The following legislation is relevant:

- Law on Spatial Development and Construction of Structures (No. 51/08)
- Law on Coastal Zone (No.14/92)
- Water Law (No.27/07)
- Law on the Sea (No.17/07)
- Ports Law (No.51/08)
- Nature protection law (No.51/08)
- Law on environment (No. 48/08)
- Law on maritime navigation (No.19/78)
- Law on maritime fisheries and mariculture (No. 56/09)
- Law on protection of the protection of the sea from boats (No. 20/11)
- Law on Ratification of Convention on the protection of the marine environment and coastal areas of Mediterranean (Barcelona convention) and its protocols
- Law on Strategic Environmental Assessment (No. 80/05) and Amendments to the Law on Strategic Environmental Assessment (No. 59/11)
- Law on Ratification of the Multilateral Agreement among the countries of South-Eastern Europe for implementation of the Convention on environmental impact assessment in a transboundary context, (No. 02/09)
- Law on exploration and production of carbohydrates (No 41/11)
- Decree on conditions for maritime ports divided by type of maritime transport and purpose (No. 20/11)

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[143] Information on the legal framework of Montenegro is taken primarily from the Report WP 4 – Act. 4.1: Holistic management of the Adriatic Sea. Approaching to a common and legally binding MSP in Adriatic area: an integrated analysis of the legal framework, policies and planning instruments. Final Report, 15 May 2013, available at http://www.shape-ipaproject.eu/download/listbox/WP4%20action%204.1/Report%20on%20the%20analysis%20of%20legal%20framework,%20policies%20and%20planning%20instruments.pdf.

[144] Accession negotiations have started on 29 June 2012 and are currently undergoing.

[145] See paragraphe 3.3.1

- Decree on order in ports and other parts of the coastal sea and internal waters (No. 41/06)
- Decree on underwater activities in Montenegrin waters (No. 66/06)

The Ministry of Sustainable development and Tourism has a leading role. With regard to marine policy, beside the Ministry of Sustainable development and Tourism, key competences also lie within the Ministry of Transport and Maritime Affairs and Ministry of Agriculture and Rural Development in charge of water management and fisheries.

Slovenia[146]

Slovenia is an EU Member State and has adopted national legislation implementing EU directives.

Slovenia has adopted a Resolution on the National Maritime Development Programme (OG RS, No. 87/2010), taking into account, inter alia, the guidelines and policies of the European Union in the maritime sector. The Resolution on the National Maritime Development Programme was drawn up on the basis of the Maritime Code. The central part of the Resolution introduces new instruments for implementation, monitoring and supplementing the National Maritime Development Programme of the Republic of Slovenia. The final chapters provide the maritime legal framework in Slovenia, i.e. internal legal resources, relevant European legislation and international conventions, ratified to date by the Republic of Slovenia. There is also an overview of the international conventions to be ratified in the future.

The following legislative acts are particularly relevant:

- Maritime Code of 2004 (OG RS, Nos. 26/01, 110/02-ZGO-1, 2/04, 37/04-UPB1, 98/05, 49/06, 120/06-UPB2 and 88/10), regulating the sovereignty, jurisdiction and control of the Republic of Slovenia over the sea, navigational safety in territorial waters and inland maritime waters, protection of the sea against pollution from vessels and legal regime of ports;
- Waters Act of 2002 (OG RS, No. 67/2002, Act Amending the Water Act, OG RS, No. 57/2008);
- Nature Conservation Act of 2007 (OG RS, No. 56/99);
- Marine Fisheries Act of 2006 (OG RS, No. 115/06).

Spatial Planning

The Spatial Planning Act does not cover the issues of maritime spatial planning, but it also applies to the sea. The Decree Amending the Decree on the Types of Spatial Planning of National Significance (OG RS, No. 68/2005) lies down that spatial regulations important for the spatial development of the Republic of Slovenia also include the spatial regulations for the seabed, thus providing that:

- the Spatial Planning Act also applies to the sea (seabed);
- maritime spatial planning is under jurisdiction of the State and not under municipal jurisdiction.

[146] Information on the legal framework of Slovenia is taken primarily from the Report WP 4 – Act. 4.1: Holistic management of the Adriatic Sea. Approaching to a common and legally binding MSP in Adriatic area: an integrated analysis of the legal framework, policies and planning instruments. Final Report, 15 May 2013, available at http://www.shape-ipaproject.eu/download/listbox/WP4%20action%204.1/Report%20on%20the%20analysis%20of%20legal%20framework,%20policies%20and%20planning%20instruments.pdf.

A "Maritime Spatial Plan" has not yet been drawn up. However, some uses of the sea area have been defined on the basis of sectoral rules outside the formal spatial planning framework, namely the areas of nature protection and cultural heritage, fishing reserves, waterway corridors, etc.

The Resolution on the National Maritime Development Programme of the Republic of Slovenia also contains a chapter on spatial planning, which points out only the aspects related to the preparation of spatial plans for maritime transport (ports, waterways, transport safety facilities, etc.), taking into account the basic strategic framework provided by the Ordinance on Spatial Planning Strategy of Slovenia. The Ordinance, *inter alia*, defines the principles of coherent and coordinated development of transport and settlement networks in relation to construction of public economic infrastructure. The document sets out the main principles and concepts of transport networks in the Republic of Slovenia and also defines the role of the Port of Koper in international public transport and long-distance transport links.

The area is therefore regulated by the following legislation:

- Spatial Planning Act – Informal Consolidated Version;
- Decree on the Types of Spatial Planning of National Significance – Informal Consolidated Version (OG RS, Nos. 95/07, 102/08 and 26/10).

Environmental protection

In Slovenia, the authority responsible for the implementation of the Directive 2008/56/EC is the Ministry of Agriculture and the Environment (hereinafter referred to as the Ministry), including its constituent bodies. The platform for transposition of the Directive into the Slovenian national law is Article 59a of the Water Act, specifying that a marine environment management plan has to be prepared to achieve the strategic goals in the field of water management. The tasks are shared by the Ministry (Environment Directorate – Water Division) and its affiliated body – the Slovenian Environment Agency (ARSO) with its offices by river basins (Adriatic and Danube) and sub-basins (Soča River, which flows into the Adriatic Sea). Another body within the Ministry is the Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning.

To ensure the implementation of the Directive 2008/56/EC, the Ministry prepared a framework plan of action for the first planning period 2008-2015.

The Ministry of Agriculture and the Environment is responsible for preparing and reporting to the Commission on the implementation of Marine Strategy. It also notifies the Government and the National Assembly of the Republic of Slovenia, as well as the general and professional public. The Ministry is also responsible for the harmonisation of particular contents of the Directive at the regional level and the Adriatic sub-region.

The key professional tasks in relation to the implementation of the Directive 2008/56/ES are carried out by the Institute for Water of the Republic of Slovenia, Marine Biology Station Piran and Institute of the Republic of Slovenia for Nature Conservation with the participation of Fisheries Research Institute of Slovenia, Slovenian Environment Agency and other specialised professional institutions.

Sectoral task force (within the Ministry) and inter-sector task force (with other ministries) are also envisaged.

The Ministry of Agriculture and the Environment, including its constituent bodies, is responsible for the implementation of the Water Framework Directive (WFD).

The waters of Slovenia are divided among those of the Danube river basin district and those of the Adriatic Sea river basin district. The Danube river basin district includes the Mura, Drava and Sava sub-basins, whereas the Adriatic Sea river basin district includes the basins of the Soča River and all Adriatic rivers, along with the sea. To facilitate management, every sub-basin is divided into smaller units called water bodies.

The River Basin Management Plan defines the management approach to achieving good status of its waters by 2015. The Plan envisages reciprocal coordination and cooperation of all people and institutions in Slovenia. A water management plan always encompasses the entire river basin or sub-basin, describes its characteristics, discusses the existing activities, analyses the environmental burdens, presents the findings of regular monitoring of water status, defines the objectives and necessary measures for the achievement of good water status as well as the required financial resources. In view of the characteristics of the Slovenian territory where all river sub-basins span over country borders, planning has been coordinated with the neighbouring countries.

The key chapters of the River Basin Management Plan cover the water quality, flood protection and water use. These are the areas where different or conflicting interests arise, favouring either development or protection of water resources, namely the conflicts between spatial development and preservation of water bodies, discharge of waste water and preservation of watercourse quality as well as between intensive agriculture and preservation of sufficient drinking water supply.

The River Basin Management Plan was adopted in August 2011 by Decree on the River Basin Management Plan for the Danube Basin and the Adriatic Sea Basin. (OG RS, No. 61/2011). Slovenia transposed the principles and provisions of the Water Framework Directive into the national law through the following regulations:

Water Act (OG RS, Nos. 67/02, 2/04);

Environment Protection Act (OG RS, No. 41/04);

Nature Conservation Act (OG RS, Nos. 56/99, 31/00, 110/02-ZGO-1, 119/02-ZON-A and 41/04- ZON-B);

Public Administration Act (OG RS, Nos. 52/02, 56/03, 83/03, 110/03, 134/03 and 36/04);

Act Ratifying the Convention on Co-operation for the Protection and Sustainable Use of the River Danube (Danube River Protection Convention) (OG RS-MP, No. 12/98);

Act Ratifying the Convention for the Protection of the Mediterranean Sea Against Pollution, the Protocol for the Prevention of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft, and the Protocol concerning Cooperation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency (OG RS, No. 12/1997);

Decree on the Chemical Status of Surface Waters (OG RS, No. 11/2002);

Decree on the Quality of Underground Water (OG RS, No. 11/2002);

Decree on the Emission of Substances and Heat in the Discharge of Waste Water from Pollution Sources (OG RS, No. 35/1996);

Rules on the Delimitation of River Basins and Sub-basins and of Relevant River Basin Districts with Class I Waters (OG RS, No. 82/03);

Rules on Methods for Determining Water Bodies of Underground Water (OG RS, No. 65/03);

Rules on Methods for Determining Water Bodies of Surface Water (OG RS, No. 65/03);

Rules on Determining Water Bodies of Groundwater (OG RS, No. 63/2005);

Rules on Determining and Classification for Water Bodies of Surface Water (OG RS, No. 63/2005);

Decree on the Quality Required of Surface Waters Supporting Fresh-water Fish Life (OG RS, Nos. 46/02 and 41/04-ZVO-1);

Decree on the Quality Required of Water Supporting Marine Bivalves and Gastropods (OG RS, Nos. 46/02 and 41/04-ZVO-1);

Rules on Determining Marine Areas where the Quality of Water Is Suitable to Support Marine Bivalves and Gastropods (OG RS, No. 106/04);

Rules on the Designation of Surface Water Sections Important for Freshwater Fish Species (OG RS, No. 28/05).

The authority responsible for flood issues is the Ministry of Agriculture and the Environment which implements the tasks in relation to water management, specified in detail by the Water Act. The scope of activities includes the preliminary flood risk assessment, identification of the areas of potential significant flood risks (Article 5 of the Flood Directive), production of flood hazard and flood risk maps for such areas and drawing up the flood risk management plans in plans in accordance with the provisions of the Flood Directive 2007/60/EC. Implementation of the Flood Directive is regulated by the Decree on the Establishment of Flood Risk Management Plans (OG RS, No. 07/10), by which Slovenia has transposed the majority of the Flood Directive provisions into the national law.

In Slovenia, the requirements of the Flood Directive are implemented through the following regulations:

- Water Act (OG RS, Nos. 67/02, 110/02);
- Act Amending the Water Act (OF RS, No. 57/08);
- Rules on Methodology to Define Flood Risk Areas and Erosion Areas Connected to Floods and Classification of Plots into Risk Classes (OG RS, No. 60/07);
- Decree on Conditions and Limitations for Constructions and Activities in Flood Risk Areas (OG RS, No. 89/08);
- Decree on the Establishment of Flood Risk Management Plans (OG RS, No. 7/2010).

The main objectives of Slovenia's policy for nature protection are contained in the National Nature Conservation Programme 2005-2015 (NNCP), which is a part of the National Environmental Action Programme 2005-2012 (NEAP). These objectives are:

1) To establish a comprehensive nature conservation system and implement it in an efficient manner.

2) To preserve the high level of biodiversity and to halt the decline in biodiversity by:

a) maintaining or achieving a favourable status of endangered species and habitat types;

b) maintaining or achieving a favourable status of species' habitats and habitat types for which areas important for biodiversity conservation are designated (areas of ecological importance, Natura 2000 areas, Ramsar localities);

c) introducing efficient and coordinated nature conservation in protected areas through management plans and other measures;

d) raising the standard of all procedures involving wild animals;

e) ensuring sustainable use of the components of biodiversity and the sustainability of activities that affect the natural world.

3) To preserve a favourable conservation status of large carnivore species and to reduce conflicts.

4) To preserve as many natural systems of biogenesis as possible.

5) Valuable natural features:

a) to preserve those features characterised as a valuable natural feature of a certain species and to measure all other features to the greatest extent possible;

b) to ensure the recovery of damaged or destroyed valuable natural features;

c) to ensure that valuable natural features are used in a way that does not threaten them;

d) to ensure the *ex situ* protection of valuable natural features whose preservation in the wild (in their natural habitat) is not possible.

To achieve the objective 2 (preserve the high level of biodiversity) and following a planned measure of the NEAP/NNCP, the Natura 2000 Management Programme 2007-2013 was adopted by the Government in 2007 which sets more detailed conservation objectives for the Natura 2000 sites to achieve a favourable status for endangered species and habitat types of EU importance. Biodiversity conservation is also dealt with by the Biodiversity Conservation Strategy of Slovenia (2001-2011).

Nationally designated protected areas account for around 13%, with one National Park (Triglav), 7 regional and landscape parks, and a number of reserves and places of outstanding natural beauty. There are further 35 protected areas, designated at the local level.

On 29 April 2004, the Slovenian Government issued a regulation defining the Slovenia's Natura 2000 areas (Decree on Special Protection Areas (Natura 2000 Areas)). A total of 286 areas were included: 260 on the basis of the Habitats Directive (SCI) and 26 on the basis of the Birds Directive (SPA).

Relevant legislation includes:

- Nature Conservation Act with Regulations (OG RS, Nos. 56/99, 31/00, 119/02, 22/03,
- 41/04, 96/04 – Official Consolidated Text);
- Cave Protection Act with Regulations (OG RS, No. 02/04);
- Triglav National Park Act (OG RS, No. 52/10);
- Škocjan Caves Regional Park Act (OG RS, No. 57/96);
- Škocjan Inlet Nature Reserve Act (OG RS, No. 20/98)

Environmental impact assessment (EIA) has been implemented in Slovenia since 1993. An application for environmental consent must include a project plan with relevant supporting documentation, as well as an environmental impact report prepared according to a defined procedure and audited by an authorized person. Based on these documents, the Slovenian Environmental Agency (ARSO) carries out an environmental impact assessment with the involvement of other stakeholders. The ARSO subsequently grants or refuses an environmental consent. It may stipulate certain conditions, limitations or instructions for mitigating negative environmental impacts.

Strategic Environmental Assessment (SEA) is obligatory for plans, programmes and policies with a significant environmental impact. These include all plans that contain projects for which an EIA is required (e.g. all infrastructure programmes), plans for the Natura 2000 nature protection areas, spatial planning acts, and various sectoral programmes at the local and national levels. In addition, the Ministry of Agriculture and the Environment has the power to require a SEA for any other plan or programme if the Ministry considers that it may have a significant environmental impact, although this sometimes leads to duplication with the EIA. The SEA has been implemented at the national level in the case of operational programmes for rural development, regional development, fisheries and cross-border cooperation. At the local level, SEAs are required for spatial development strategies and land use plans.

The following regulations apply in this area:

- Environment Protection Act (OG RS, Nos.. 39/06, 49/2006, 66/2006-odl. US, 33/2007-ZPNačrt, 70/2008 and 108/2'09);
- Nature Conservation Act (OG RS, No. 96/2004);
- Decree on Special Protection Areas (Natura 2000 Areas) (OG RS, No. 49/2004);
- Decree Amending the Decree on Special Protection Areas (Natura 2000 Areas) (OG RS, Nos. 110/2004, 59/2007 and 43/2008);

- Decree on the Categories of Activities for Which an Environmental Impact Assessment Is Mandatory (OG RS, Nos. 78/2006, 72/2007, 32/2009 and 95/2011);
- Decree Laying down the Content of Environmental Report and on Detailed Procedure for the Assessment of the Effects of Certain Plans and Programmes on the Environment (OG RS, No. 73/2005);
- Decree on the Criteria for Determining the Likely Significance of Environmental Effects of Certain Plans, Programmes or Other Acts and Its Modifications in the Environmental Assessment Procedure (OG RS, No. 9/2009).

3.2.6 Maritime zones

States who undertake maritime spatial planning must take into account the conventions, laws and regulations illustrated in the previous sections, relating to the **substantial regulation** of the activities and sea uses that come into play for maritime spatial planning. In addition, it is necessary to take into account the legal rules that divide maritime space into a number of geographically delimited areas, the so-called **'maritime zones'** wherein one or more States may exercise their **jurisdiction**.
Maritime zones may be created by each State separately, according to the rights attributed to it by international law **('unilateral coastal zones'**) or may be adopted through an international organisation on behalf of a number of States (**'other maritime areas'**).

'Jurisdiction' as used in this section indicates the right of a State to exercise its power. Jurisdiction can be legislative (i.e. the power to adopt laws and regulations), enforcement (i.e. the power to enforce its laws and regulations, including operating controls, arresting persons, seizing property) and adjudicative (the power of a State's courts to hear disputes). Boundaries, land and maritime, divide the areas of land and sea within which States exercise their jurisdiction.

Unilateral coastal zones

Land territory (including islands and the shore)

The land territory of a State is subject to the sovereignty of that State, which includes full legislative, enforcement and adjudicative jurisdiction. Within its territory, a State can devolve certain powers to local entities, such as regions, provinces or municipalities. This can be done through a constitutional provision, by law or in any other way allowed by the domestic legal system.

Baselines and Internal waters

Baselines provide the starting point for the measurement of all maritime zones that a State can claim. The normal baseline is the low-water line along the coast as marked on large-scale charts officially recognized by the coastal State.[147] States may however draw straight baselines if the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in its immediate vicinity.[148] Special rules apply to closing lines for the mouths of rivers,[149] for bays, including historical bays,[150] for ports,[151] for roadsteads[152] and for low-tide elevations.[153]

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147 Art. 5 UNCLOS.

148 Art. 7 UNCLOS.

149 Art. 9 UNCLOS.

150 Art. 10 UNCLOS. The general rule prescribes closing lines of no more than 24 nm in length and applies the rule of the semi-circle. These rules do not apply to historical bays (but the UNCLOS does not define "historical bays").

151 Art. 11 UNCLOS.

Internal waters include all the waters landwards from the baseline used by the State to measure its maritime zones. Internal waters are subject to the sovereignty of the coastal State. The only exception to sovereignty is provided in Art. 8(2) UNCLOS, which provides that where the establishment of a straight baseline has the effect of enclosing as internal waters areas which had not previously been considered as such, a right of innocent passage shall exist in those waters.

Territorial sea

The territorial sea extends up to 12 n.m. from the baselines.[154] The coastal State enjoys sovereignty in the territorial sea.[155]

All other States enjoy the right of innocent passage through the territorial sea.[156] Passage is considered innocent as long as it is not prejudicial to the peace, good order or security of the coastal State.[157] The right of innocent passage means that the coastal State cannot stop vessels that are exercising this right and has only limited regulatory powers concerning navigations. In particular, the coastal State may adopt laws and regulations, in conformity with the provisions of the UNCLOS and other rules of international law, in respect of all or any of the following:

(a) the safety of navigation and the regulation of maritime traffic;

(b) the protection of navigational aids and facilities and other facilities or installations;

(c) the protection of cables and pipelines;

(d) the conservation of the living resources of the sea;

(e) the prevention of infringement of the fisheries laws and regulations of the coastal State;

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152 Art. 12 UNCLOS.

153 Art. 13 UNCLOS.

154 Art. 3 UNCLOS.

155 Art. 2 UNCLOS.

156 Art. 17 UNCLOS.

157 Art. 19(1) UNCLOS. The following activities render passage non innocent, according to Art. 19(2) UNCLOS:

(a) any threat or use of force against the sovereignty, territorial integrity or political independence of the coastal State, or in any other manner in violation of the principles of international law embodied in the Charter of the United Nations;

(b) any exercise or practice with weapons of any kind;(c) any act aimed at collecting information to the prejudice of the defence or security of the coastal State;

(d) any act of propaganda aimed at affecting the defence or security of the coastal State;

(e) the launching, landing or taking on board of any aircraft;

(f) the launching, landing or taking on board of any military device;

(g) the loading or unloading of any commodity, currency or person contrary to the customs, fiscal, immigration or sanitary laws and regulations of the coastal State;

(h) any act of wilful and serious pollution contrary to this Convention;

(i) any fishing activities;

(j) the carrying out of research or survey activities;

(k) any act aimed at interfering with any systems of communication or any other facilities or installations of the coastal State;

(l) any other activity not having a direct bearing on passage.

(f) the preservation of the environment of the coastal State and the prevention, reduction and control of pollution thereof;

(g) marine scientific research and hydrographic surveys;

(h) the prevention of infringement of the customs, fiscal, immigration or sanitary laws and regulations of the coastal State.[158]

Contiguous zone

The contiguous zone extends up to 24 n.m. from the baselines. In this zone, the coastal State can exercise its jurisdiction to prevent and punish infringement of its customs, fiscal, immigration or sanitary laws and regulations within its territory or territorial sea.[159]

Archaeological contiguous zone

While the UNCLOS does not expressly provide for the creation of maritime zones for the protection of archaeological and historical objects, some States have instituted 24 nm archaeological contiguous zones for the protection of their underwater cultural heritage, referring to the powers granted under Art. 303(2) UNCLOS. This concept is now endorsed in the 2001 CPUCH.[160]

Exclusive economic zone

The exclusive economic zone includes the waters, airspace, seabed and subsoil beyond the territorial sea and extends up to 200 n.m. from the baselines. In this zone, jurisdiction is divided between the coastal state and other states, according to the following scheme:

The costal State has **sovereign rights** concerning exploration, exploitation, conservation and management of **natural resources**, both living and non-living, and with regard to other activities for the economic exploitation and exploration of the zone, such as the **production of energy from the water, currents and winds**.

The coastal State also has **jurisdiction** concerning the establishment and use of artificial islands, installations and structures; **marine scientific research**; the protection and preservation of the **marine environment**.

The coastal State has the exclusive right to construct and to authorize and regulate the construction, operation and use of:

(a) **artificial islands**;

(b) **installations and structures** for the purposes provided for in article 56 and other economic purposes;

(c) installations and structures which may interfere with the exercise of the rights of the coastal State in the zone.

The coastal State has exclusive jurisdiction over such artificial islands, installations and structures, including jurisdiction with regard to customs, fiscal, health, safety and immigration laws and regulations. The coastal State may also establish **safety zones** around such artificial islands, installations and structures.

Fishing and the conservation of marine resources within the exclusive economic zone fall under the exclusive jurisdiction of the coastal State. The UNCOS provides specific rules concerning Stocks occurring within the exclusive economic zones of two or more coastal States or both within the exclusive economic zone of a State and the high seas,[161] highly migratory

158 Art. 21(1) UNCLOS.

159 Art. 33 UNCLOS.

160 Art. 8 UNCLOS.

161 Art. 63 UNCLOS.

species,[162] marine mammals,[163] anadromous species[164] and catadromous species[165] that require concerned States to cooperate towards a better protection and management of these species. While the coastal State has the exclusive right to allow access to the living resources in its exclusive economic zone, the UNCLOS provides some preferential treatment for land-locked and geographically disadvantaged States.[166]

Other States enjoy the **freedom of navigation and overflight and of the laying of submarine cables and pipelines**, and other internationally lawful uses of the sea related to these freedoms, such as those associated with the operation of ships, aircraft and submarine cables and pipelines.

While the UNCLOS did not provide for any rights of the coastal State concerning protection of the **underwater cultural heritage**, the CPUCH has set up an articulated procedure for the reporting and notification of any finding in the exclusive economic zone and the continental shelf[167] and has granted to the coastal State the power to take measures as a matter of urgency.[168]

Sui generis zones

A peculiarity of the Mediterranean Sea, which has also affected the Adriatic region, is the creation of *sui generis* maritime zones, which incorporate some, but not all, the elements of the exclusive economic zone. These can be fishing zones, ecological zones or mixed zones. While their legality has been questioned, it seems more in line with practice to accept that if a State can create an exclusive economic zone, it can also create a lesser zone, in accordance with the principle "in maior stat minus".

Albeit not unlawful, the institution of such zones by coastal States may add complexity and uncertainty. In fact, their legal regime – and the division of powers between the coastal State and other States – cannot be found in the UNCLOS or in other generally accepted international norms, but has to be reconstructed on the basis of national legislation. In any event, *sui generis* zones cannot attribute to the coastal State more rights than it would have in an exclusive economic zone.

Continental shelf

The continental shelf includes the seabed and subsoil beyond the territorial sea and extends up to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines where the outer edge of the continental margin does not extend up to that distance.[169] The coastal State exercises sovereign rights for the purpose of exploring the continental shelf and exploiting its natural resources, which include the mineral and other non-living resources of the seabed and subsoil together with "living organisms belonging to sedentary species, that is to say, organisms which, at the harvestable stage, either are

162 Art. 64 UNCLOS.

163 Art. 65 UNCLOS.

164 Art. 66 UNCLOS.

165 Art. 67 UNCLOS.

166 Arts. 69 and 70 UNCLOS, respectively.

167 Art. Art. 9 CPUCH.

168 Art. 10 CPUCH.

169 Art. 76 UNCLOS provides detailed criteria for the determination of the outer limit of the continental margin, for the purpose of applying the continental shelf legal regime. Since the width of the Adriatic and Ionian seas does not allow for an extension of the continental shelf beyond 200 n.m., these rules will not be analysed here.

immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil".[170]

High seas

The high seas include all waters not subject to national jurisdiction. In the high seas, vessels are subject to the exclusive jurisdiction of the flag State.[171]

In the high seas, all states enjoy the freedoms of the high seas, which include:

(a) freedom of navigation;

(b) freedom of overflight;

(c) freedom to lay submarine cables and pipelines;

(d) freedom to construct artificial islands and other installations;

(e) freedom of fishing;

(f) freedom of scientific research.

Freedoms of the high seas shall be exercised by all States with due regard for the interests of other States in their exercise of these freedoms. This means that all activities mentioned above may be subject to conditions and limitations to ensure their harmonious coexistence, adopted by multilateral treaty or through the competent international organization.

Other maritime areas

In addition to the maritime zones described in the previous section, which are instituted by the coastal states, areas of sea can be subject to special regimes on the basis of a decision of an international organization.

SPAMIs. The SPA Protocol to the Barcelona Convention introduced the list of Specially Protected Area of Mediterranean Importance (SPAMI list). A SPAMI may be established in the marine and coastal zones subject to the sovereignty or jurisdiction of the Parties and in areas situated partly or wholly on the high sea. SPAMIs may include sites that are of importance for conserving the components of biological diversity in the Mediterranean; contain ecosystems specific to the Mediterranean area or the habitats of endangered species; are of special interest at the scientific, aesthetic, cultural or educational levels.

MARPOL Special Areas. The MARPOL defines certain sea areas as 'special areas' and requires the adoption of special mandatory methods for the prevention of sea pollution, for technical reasons relating to their oceanographical and ecological condition and to their sea traffic. The entire Mediterranean Sea, including the Adriatic-Ionian Sea, is a Special Area under Annex I and Annex V.

Particularly Sensitive Sea Areas (PSSAs). A Particularly Sensitive Sea Area (PSSA) is an area that needs special protection because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities. Protection is granted through the IMO.[172] When an area is approved as a PSSA, specific measures can be used to control the maritime activities in that area, such as routing measures, strict application of MARPOL discharge and equipment requirements for ships, such as oil tankers; and installation of Vessel Traffic Services (VTS). A proposal to approve the Adriatic Sea a PSSA has not reached agreement yet.

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170 Art. 77 (3) UNCLOS.

171 Art. 92(1) UNCLOS.

172 The criteria and procedure for the approval of a PSSA are contained in IMO Resolution A.982(24) Revised guidelines for the identification and designation of Particularly Sensitive Sea Areas (PSSAs).

SAR regions. Following the adoption of the 1979 SAR Convention, IMO's Maritime Safety Committee divided the world's oceans into search and rescue areas, in each of which the countries concerned have delimited search and rescue regions for which they are responsible. SAR regions are established solely for the purpose of coordinating maritime SAR activities from a rescue coordination centre and therefore may have different extent from the maritime zones claimed on the basis of UNCLOS.

Fisheries Restricted Areas and other areas designated by the GFCM. A Fisheries Restricted Area (FRA) as endorsed by the GFCM FRA is a geographically defined area in which all or certain fishing activities are temporarily or permanently banned or restricted in order to improve the exploitation and conservation of harvested living aquatic resources or the protection of marine ecosystems.[173]

In 2006 the GFCM recommended the establishment of three areas where fishing with towed dredges and bottom trawls is prohibited. One of these areas, the "Lophelia reef off Capo Santa Maria di Leuca" is included in Focus area 2.

3.2.7 The Adriatic-Ionian Sea Legal Status

The Adriatic Sea is part of the Mediterranean Sea and is itself a semi-enclosed sea. According to Art. 123 UNCLOS, States bordering an enclosed or semi-enclosed sea should cooperate with each other in the exercise of their rights and in the performance of their duties under this Convention.[174]

Extension of coastal states' maritime jurisdiction

Albania, Croatia and Italy have established systems of **straight baselines** along parts of their coast. Italy claims a historical bay (the Gulf of Taranto).

All Adriatic States have a **territorial sea**. With the exception of Greece, which claims a 6 n.m. territorial sea (according to Law 230 of 17 September 1936), all other Adriatic States claim 12 n.m. However, due to the geography of the area, the territorial sea of Bosnia Herzegovina is enclaved within the internal waters of Croatia. It is also uncertain whether the territorial sea of Slovenia extends up to 12 n.m.

Beyond the territorial sea a distinction has to be made between the seabed and subsoil, on one hand, and the water column, on the other. Due to the reduced width of the Adriatic Sea, where the maximum distance between opposite coasts is less than 400nm, **all the seabed and subsoil falls under the regime of the continental shelf**. This is because the *legal* concept of continental shelf, as endorsed in Art. 76 UNCLOS, is partly different from the *geological*

173 See recently Resolution GFCM/37/2013/1 on area based management of fisheries, including through the establishment of Fisheries Restricted Areas (FRAs) in the GFCM convention area and coordination with the UNEP-MAP initiatives on the establishment of SPAMIs.

174 Art. 123 UNCLOS (Cooperation of States bordering enclosed or semi-enclosed seas): States bordering an enclosed or semi-enclosed sea should cooperate with each other in the exercise of their rights and in the performance of their duties under this Convention. To this end they shall endeavour, directly or through an appropriate regional organization:

(a) to coordinate the management, conservation, exploration and exploitation of the living resources of the sea;

(b) to coordinate the implementation of their rights and duties with respect to the protection and preservation of the marine environment;

(c) to coordinate their scientific research policies and undertake where appropriate joint programmes of scientific research in the area;

(d) to invite, as appropriate, other interested States or international organizations to cooperate with them in furtherance of the provisions of this article.

concept. In legal terms, all seabed and subsoil within 200 nm from the baselines is considered as continental shelf, notwithstanding its geological configuration. In other words, there are no parts of the international seabed area in the Adriatic-Ionian Sea. As to the waters above the continental shelf, different regimes are applicable.

A **contiguous zone** is mentioned in Italian legislation. It is however uncertain whether Italy has already established this zone.[175] Italy has also claimed an **archaeological contiguous zone**.

Croatia and Slovenia have both proclaimed **exclusive economic zones**. In 2003, due to political considerations, Croatia declared an **ecological and fisheries protection zone**, which combines the two zones mentioned earlier and comes, in fact, very close to an exclusive economic zone. In 2005 Slovenia also proclaimed an **ecological zone** beyond its territorial sea (Ecological Protection Zone and Continental Shelf of the Republic of Slovenia Act, 22 October 2005). At the end of 2011, Italy instituted the first of its '**ecological protection zones**' on the basis of the 2006 law authorizing their creation in the Ligurian Sea.[176]

	Albania	Bosnia-Herzegovina	Croatia	Greece	Italy	Montenegro	Slovenia
Baselines	√		√		√		
Territorial sea	√	?	√	√[177]	√	√	√
Contiguous zone					?		
Archaeological cont. zone					√		
Fisheries zone			√				
Ecological zone			√		[178]		√
Exclusive economic zone			√				√

175 At present, Italy has never adopted a national act aimed specifically at establishing a contiguous zone. However, Italy has introduced legislative measures which *de facto* refer to the existence of an Italian contiguous zone, such as art. 11 *sexies* of the law of 30 July 2002, n. 189 (*Changes in Regulations on the Matter of Immigration and Asylum,* so called "Bossi-Fini" law), which amended art. 12 of the legislative decree n. 286 of 25 July 1998 (*Single Text of Immigration Laws*, so called "Turco-Napolitano" law). In addition, according to art. 6, para. 2 of the Decree of the Ministry of the Interior of 14 July 2003 (*Provisions to counter illegal immigration*), units of the *Guardia di Finanza* are allowed to fight against irregular migration in an area beyond the territorial sea which corresponds to the area internationally defined as contiguous zone. Thus, in light of the domestic provisions, it is reasonable to assert that Italy envisages a contiguous zone where the competent Italian authorities could exercise a limited control to prevent and punish infringement of immigration regulations within its territory or territorial sea.

176 Presidential Decree No 209 of 27 October 2011 adopted on the basis of Law No 61 of 8 February 2006: Istituzione di zone di protezione ecologica oltre il limite esterno del mare territoriale (2006) 147/52 Gazzetta Ufficiale della Repubblica Italiana 5

177 6 nm.

178 No Italian ecological protection zone in the Adriatic-Ionian Sea.

Continental shelf	√		√	√	√	√	√

Table 3-3 Extension of jurisdiction of the Adriatic coastal States

Existing boundaries

While any State is free to **proclaim** their coastal zones unilaterally, if their coastal zone(s) overlap with those of a neighbouring State, they cannot **delimit** the respective extension of the zones unilaterally, but must agree upon a boundary with their neighbouring States (articles 15, 74 and 83 UNCLOS). The **delimitation** of maritime zones is usually effected by **treaty** between the two States and is legally binding only if the treaty is duly ratified (or accepted as binding by other means) by both States.

The **territorial sea** has been delimited between Italy and the former Yugoslavia (1975; Croatia and Slovenia have succeeded in the agreement).

A 1999 agreement between Bosnia-Herzegovina and Croatia, for the delimitation of Croatian internal waters and Bosnian territorial sea, is not in force as it has not still been ratified by both parties.

Continental shelf delimitation agreements have been concluded between Italy and the former Yugoslavia (1968; Croatia, Montenegro and Slovenia have succeeded to the agreement), Greece and Italy (1977) and Albania and Italy (1992). Concerning Greece's agreement with Italy, the continental shelf boundary consists of fifteen segments, fourteen turning points, and two terminal points and runs in a general north-south direction for 268.0 nautical miles. The depth of water in the boundary region varies from less than 800 meters to nearly 4,000 meters. The northern terminus of the boundary is the point of closest approach to the coasts of Greece and Italy, situated 22.0 and 20.1 nautical miles from the respective coasts. The southern terminus lies 168.9 nautical miles from the coast of Sicily and 163.4 nautical miles from the Greek island of Stamfani (Zakynthos) (USDS, 1982).

A provisional agreement between **Croatia and Montenegro** for the delimitation of their maritime boundary has been adopted in 2002.[179] The agreement provisionally applies to the internal waters and the territorial sea of the two states, while it does not delimit their continental shelf and other jurisdictional zones. It contains complex arrangements of a provisional nature concerning the closing line of the Bay of Boka Kotorska and creates a special zone wherein both States are granted powers concerning the protection of the marine environment, fishing and the enforcement of laws and regulations.

Greece and Albania have adopted a treaty for the delimitation of their respective continental shelf areas and other maritime zones to which they are entitled under international law (Tirana, 27 April 2009). Ratification of the agreement is still pending, also following a decision by the Constitutional Court of Albania stating that the agreement was in violation of the Albanian Constitution.

Pending delimitations

The following boundaries still need to be defined in the Adriatic-Ionian region:

- Croatia-Slovenia
- Albania-Montenegro

In the case of boundaries delimiting only the continental shelf, it is not clear whether these have been formally extended to the delimitation of the superjacent water column.

179 Protocol on the interim regime along the southern border between the Republic of Croatia and Serbia and Montenegro (Grbec, 2014)

The delimitation of the maritime area between Croatia and Slovenia involves not only a complex geographical situation but also legal issues relating to the Slovenian claims that the waters of the entire bay of Piran be considered as Slovenian internal waters and that Slovenia is entitled to a maritime area beyond its territorial sea, to be reached by a high seas corridor cutting through Croatian territorial waters; the two States also disagree on the legal status of a text containing principles for the delimitation of their maritime areas which was initialled by the Parties representatives in 2001 but has not been either signed or ratified afterwards. In 2009 the two States agreed to submit the dispute to arbitration. The arbitral tribunal was constituted in 2012 and is currently examining the case.

3.2.8 How the existing regulatory framework is limiting, conditioning and can be suitable for MSP

From the above overview of the jurisdictional framework in the Adriatic-Ionian Sea, it is possible to draw some preliminary conclusions.

In the first place, **the division of the sea into maritime zones by the UNCLOS will constitute the basis for any MSP activity**. This is so not only because the UNCLOS has been ratified by all States in the region, but also because all other legal instruments are based upon the UNCLOS zonal approach. For example, the MSP Directive clearly states that it shall not affect the sovereign rights and jurisdiction of Member States over marine waters which derive from relevant international law, particularly UNCLOS (Article 2 MSP Directive).

In the second place, it should be underlined that there are **numerous international, EU and domestic legislative and regulatory acts** that are relevant for MSP in the Adriatic-Ionian Sea. All of these **need to be taken into account when conducting the planning**. The adoption of the MSP Directive by the EU sets the legal framework for the elaboration of plans. While the Directive is not binding for non-EU Member States (Albania, Bosnia-Herzegovina, Montenegro), the latter are also likely to implement its content on the basis of their bilateral agreements with the EU.

Third, while there is no uniform regulation, most states in the region have already undertaken, often on a voluntary basis, activities that come close to MSP. Any future work will therefore require that activities be coordinated to the extent possible. This requirement is also highlighted in the MSP Directive, which provides that States may include or build on existing national policies, regulations or mechanisms that have been or are being established before the entry into force of this Directive, provided they are in conformity with the requirements. In other words, **EU Member States should interpret and apply existing legislation in accordance with the MSP Directive objectives and requirements**.

Fourth, Adriatic-Ionian States are members to a number of **global and regional international organizations** – such as GFCM, ICCAT, the Barcelona Convention Secretariat – which could provide an appropriate forum, as well as the appropriate institutions and procedures, for the **harmonization of maritime spatial planning**, as also provided by the MSP Directive (Articles 11 and 12).

At the same time, there are a number of issues that may affect MSP by coastal States in the Adriatic-Ionian Sea. The main legal issues include the following.

a. High seas pockets

Some coastal States have not extended fully their jurisdiction. Albania, Greece, Montenegro and Italy have not claimed any exclusive economic zone or sui generis zone beyond the territorial sea. As a consequence, parts of the Adriatic-Ionian waters fall still under the regime of the high seas, and coastal States do not have any right (or duty) beyond those generally applicable to all states.

This is particularly so with respect to Focus area 2, which includes portions of high seas between Albania, Greece and Italy.

In the long run, this situation is likely to be addressed by coastal States, possibly with the extension of their jurisdiction to cover all areas of the Adriatic and Ionian Sea. In the short term however, plans will need to limit themselves to areas where coastal States can exercise jurisdiction under current law of the sea rules.

b. Divergent maritime zones

The divergent types of maritime zones claimed by coastal States may also pose some issues. Even when coastal States have proclaimed zones, their practice is not consistent and again does not allow for a maximum exercise of jurisdiction. For example, only Italy has proclaimed a 24 nm archaeological contiguous zone, while only Croatia and Slovenia have declared exclusive economic zones. This has an impact on cross-border MSP, since the States involved may not be granted the same rights.

This is particularly so for Focus area 1.

While the long term solution is the uniformisation of maritime zones, this outcome is not likely to be achieved soon. It will be therefore particularly important to design maritime spatial plans in such a way as to avoid the unwelcome effect of cross-border effects deriving from unregulated activities taking place in areas that are not subject to the jurisdiction of the coastal States.

c. Lack of clear boundaries

In many cases, coastal States have not agreed upon maritime boundaries delimiting their respective maritime entitlements. As a consequence, there are significant areas in which two or more States may advance claims. MSP in these areas needs to take into account this factual situation. Particular attention should be paid to advancing proposals that involve all interested parties, also in application of Arts. 74(3) and 83(3) UNCLOS, while at the same time not prejudicing (or being perceived as prejudicing) the interests of each State.

This is particularly so for Focus area 1, given the present dispute between Croatia and Slovenia on the boundary between the two States and the access of Slovenia to the high seas. At the same time, the dispute might be settled soon following the submission of the dispute to an arbitral tribunal last year. If the dispute is settled, then MSP in the region will need to take the resulting boundary into account.

d. Different applicable standards

In some cases, States in the region are bound by different substantial standards relating to activities relevant for MSP. This is primarily due to the fact that not all coastal States are members of the EU and are therefore not bound by the detailed EU regulations, directives and decisions. To a lesser extent, this is also due to the fact that not all States are parties to all the relevant treaties.

While a State cannot be obliged to apply legal rules that do not bind it, there is the necessity to coordinate measures on both sides of the border so as to ensure that measures taken by one State are not frustrated by actions undertaken or allowed by the other.

3.3 Survey of planning systems and relevant planning tools

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The basin area of the Adriatic Ionian Region is mainly regulated by institutional agreements and strategic initiatives[180] rather than regulative plans. In this perspective, the following survey – mainly based on Shape analysis[181] and on specific questionnaires sent to all Adriplan project partners – offers a reconstruction of the existing planning framework at national and regional level. At the moment the analysis is not homogeneous for each Adriatic and Ionian countries, depending from the information we collect until now. Further information will be collected during next steps of the project.

3.3.1 Regional and local plans affecting coastal areas (strategic and land use planning)

(Divided in Regions/Countries where datas are available. ***The data are updated at the 19/05/2014. The IA includes basic information and data provided by technical and institutional partners. The IA will be further developed****)*

ITALY

In Italy, the planning documents related to the management of maritime spaces are diverse and heterogeneous. Considering Regional and local plans, it emerges that strategies and management actions are partially fragmented. This heterogeneity can be partially attributed to the allocation of planning competences. In general terms, spatial planning is under regional competences. For what concerns coastal areas and, more specifically, territorial waters (i.e. waters within the 12 n.m., established in accordance with UNCLOS 1982), these are included – as already highlighted in the legal framework, in the Italian maritime state property, which is part of the state public property. Competences over planning and management are divided among the state, the regions and the provinces, and some specific sectoral competences (e.g. issuing of licences and concessions) have been even decentralized at the municipal level. The allocation of competences on coastal and marine areas is shown in Figure 3-2.

[180] See paragraph 3.1.4

[181] Shape Report WP 4 – Act. 4.1: Holistic management of the Adriatic Sea. Approaching to a common and legally binding MSP in Adriatic area: an integrated analysis of the legal framework, policies and planning instruments. Final Report, 15 May 2013, available at http://www.shape-ipaproject.eu/download/listbox/WP4%20action%204.1/Report%20on%20the%20analysis%20of%20legal%20framework,%20policies%20and%20planning%20instruments.pdf.

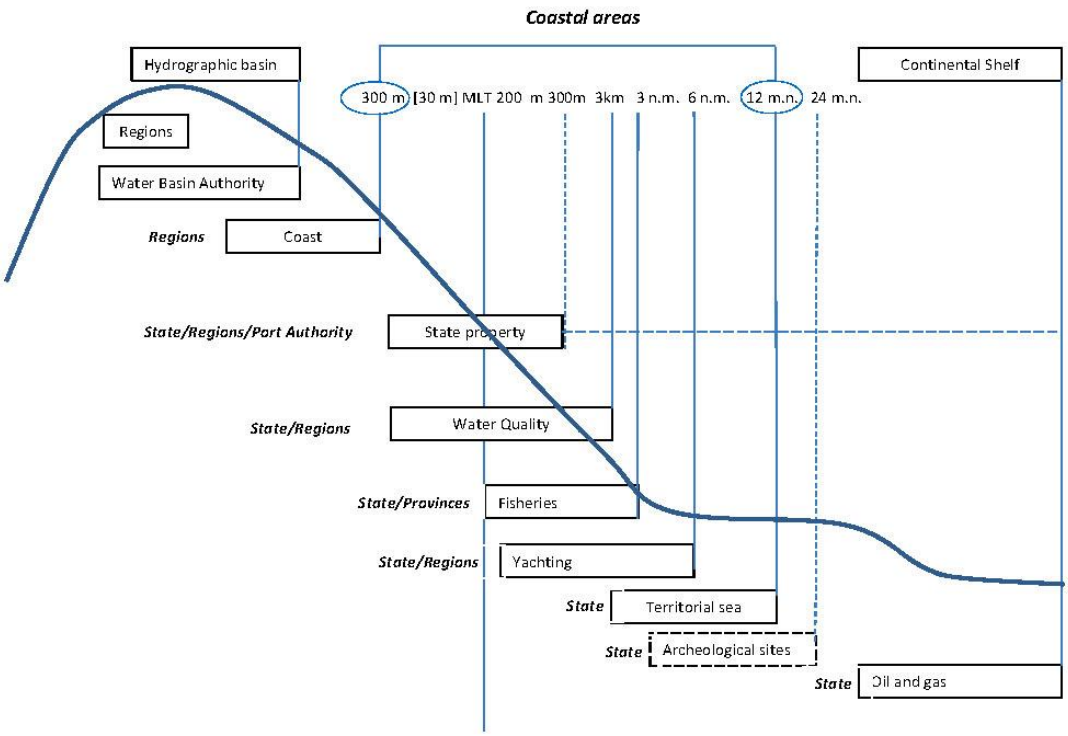

Figure 3-2 Competences on coastal and marine areas in Italy (from Shape project, 2013)

Within the Italian context, strategic and land use plans that can affect coastal areas include:

- Regional plans, including specific territorial plans regulating specific areas within the regional boundaries ("Piani d'area");
- Provincial plans ("Piani Territoriali di Coordinamento Provinciale");
- ICZM plans;
- Municipal plans;
- Port Regulatory Plans.

Given that planning structures partially differ from region to region, it is worth to consider different regional planning systems.

Veneto Region

Relevant legislative and planning tools to be mentioned concern the Regional Landscape Plan currently in preparation, the Municipal Territorial Plan and the Shoreline management plans.

1. The Municipal Territorial Plans (PAT) set targets and conditions for sustainability of interventions and changes and are drawn from municipalities. In particular, the plans identify the geographical area with the corresponding objectives of protection, rehabilitation and enhancement, identify the sites affected by natural habitats of Community interest and define the appropriate measures to avoid or reduce adverse effects on habitats and species of flora and fauna. They identify as well areas for parks and nature reserves of municipal interest and they determine the maximum quantities of agricultural area convertible into zones with destination different than agricultural.

2. The Shoreline management plans, as foreseen by the Regional Law 33/2002 "Consolidated Regional Laws on Tourism", are adopted to provide large scale assessments and long-term policy frameworks associated with reducing the risk of the effects of coastal processes on both the natural and developed environment. Area Plans such as Palav, Palalvo, and the "Delta Po Area Plan" represent specific planning instruments that appear to be particularly relevant for the management of complex coastal areas.

- The "Territorial Plan of Lagoon and Venetian Area (PALAV)" defines the planning rules for a wide territory which includes 17 municipalities distributed around the Venice lagoon. The Plan identifies and describes the features, among others, of coastlines and environmental systems within the Venice lagoon: artificial reefs, sandy beaches, lagoon water environments, typical habitats (sandbanks, mudflats, etc.), lagoon islands, reclaimed areas, marshes, fish farms, and for all these habitats the Plan describes " the framework of public and private actions in a field of utilization of available resources, with the purpose of their preservation";
- The "Territorial Plan of the Lagoons and Coastal Area of Eastern Veneto (Palalvo)" is related to the territory of the eastern Veneto region, in particular it refers to the municipalities of Caorle, Concordia Sagittaria, Portogruaro, S. Stino Livenza, S. Michele al Tagliamento. The Plan is divided in several systems: (i) system of areas of natural and environmental interest, (ii) system of historical-cultural heritage and water governance, (iii) new urban identity, (iv) urban open spaces, (v) historical and natural conservation areas, (vi) lagoon and coastal restoration measures. The plan has been adopted in 1998 but never approved;
- The "Delta Po Area Plan" refers to the municipalities of Rosolina, Porto Viro, Taglio di Po, Porto Tolle, Corbola, Ariano del Polesine and small portion of the municipalities of Loreo and Papozze. As previously highlighted the contents are articulated in several systems: lagoon and coastal environmental system, environmental and landscape system, tourism development, etc.

Emilia Romagna Region

The main Emilia-Romagna regional planning tools concern shoreline planning, coastal defence and territorial water use management:

1. The Regional Territorial Plan, approved by legislative assembly decision n.276, 3/2/2010, among several issues, takes in account the management of urban growth in coastal areas in relation whit tourism development and the physical defence of coast from erosion;

2. the Landscape Regional Plan (1993) takes in account the landscape, the historical and cultural aspects of territory, especially concerning:

- Art. 12 Coastal zone system;
- Art. 13 Redevelopment areas of coast and shoreline;
- Art. 15 Conservation zone of coast and shoreline;
- Art. 16 Marine Holiday camp

3. the Municipal Plans (PRG) – see PAT for the Veneto Region

For what concerns the allocation of competences at the regional level, the Emilia-Romagna Region has the competence in planning touristic and leisure activities on the state property, on

the shoreline and on the territorial water. Emilia-Romagna Regional law n 9/2002 give to the Region the competence in administrative functions connected to the management of the state property, the shoreline and the territorial water.

In particular, the Emilia Romagna Region has competence in:

- Planning the lining for the management of touristic and leisure activities on the state property, the shoreline and the territorial water;
- Eligibility of Shoreline Plans.

With Regional law 9/2002, Municipality has competence for the Seashore Plan. As expected by the Regional Council Deliberation n. 468/2003, by adopting the seashore plans, the municipalities regulate the bathing activities, the use of maritime public property and of territorial sea:

Especially with the seashore plans, municipality mainly have to:

- individuate areas for new licences;
- individuate free beaches, define planning rules and approach for future project;
- Define service, toilets and facilities and determinate the contents;
- Take care of road (cycling and promenade) and accessibility whit special care to the
- fee use, the architectural barriers and landscape and natural environment;
- individuate and regulate marginal areas, promoting the environment requalification;
- Defining multifunctional areas;
- defining type and quantity of moorings;
- Identifying areas of special ecological value to be protected (as SCI or SPZ);
- Regulate the access of motors and cars.

The most important legislative tools for this topic are listed below:

- Emilia-Romagna Regional Law n.9, 31/5/2002 "Administrative functions on the state property, the shoreline and the territorial water".
- Ordinance 1/2012 that regulate the bathing use of the Emilia-Romagna sea water.

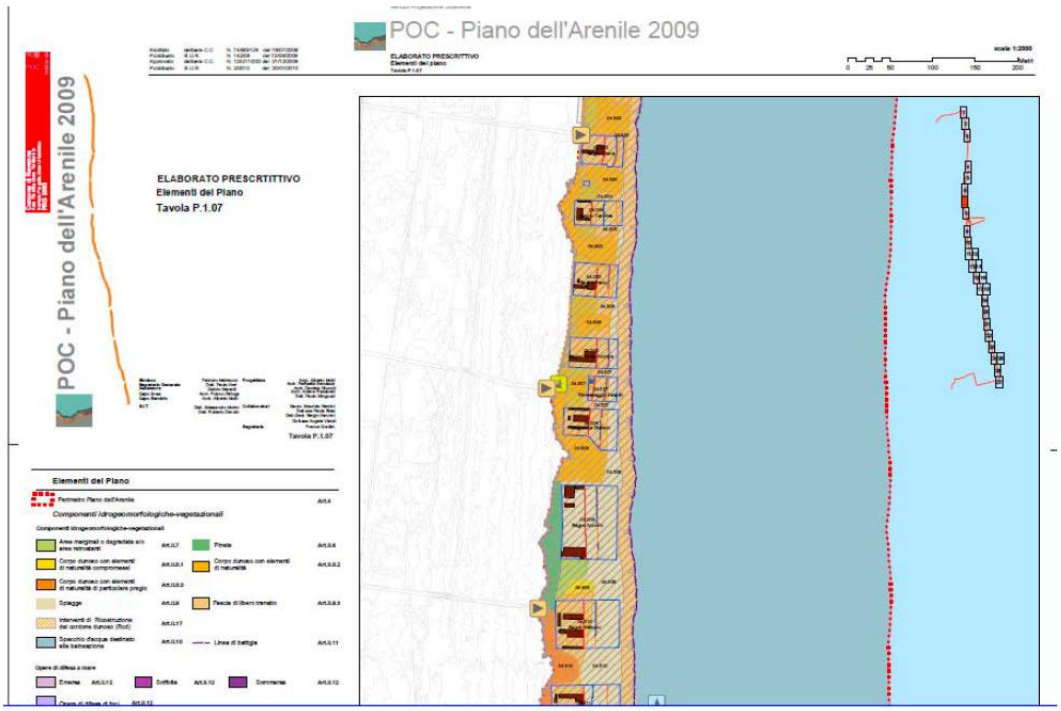

Figure 3-3 Example of seaside plan of Ravenna (source Shape, 2013)

<u>Friuli Venezia Giulia</u> (to be updated)

Friuli Venezia Giulia is a 'special administrative region', so that it administrative and planning structure partially differ from the one of the other Italian regions analyzed.

At a regional level, three plans have been developed that can affect the regulation of coastal areas by assuming a specific ICZM perspective. These are:

- the Territorial Government Plan (PGT), instituted by R. L. No 22 of December 3, 2004. This sets the goals for strategic spatial planning at the regional level;
- the Regional Landscape Plan (PPR), launched to give effect to D. Lgs. No 42 of January 22, 2004. The plan, which is a tool aimimg at safeguarding landscape values and at managing territorial transformation, has been only partially developed;
- the Regional Plan of Water Protection (PRTA), approved by Resolution of Regional Council No. 2000 of November 15, 2012.

<u>Abruzzo Region</u> (to be updated)

With respect to strategic planning on coastal and maritime areas, Abruzzo has approved a regional maritime state property plan (PDM – "Piano Demanio Marittimo). The plan, approved in 2004, has been recently updated (regional deliberation n. 186, 11/03/2013). This plan aims at:

- safeguarding the sustainable development of uses insisting on the maritime state property;
- enabling touristic operator to maximize their activities;

- promoting an homogeneous development of coastal activities at the regional level;
- providing services and structures required by beach tourism;
- promoting ICZM;
- safeguarding the areas with the higher risk of erosion.

Marche Region (to be updated)

The Marche Region adopted the Integrated Coastal Zone Management Plan (promoting the protection and sustainable use of the coast) with the Regional Law (No. 15 of 14 June 2004) "Discipline of the functions in matter of defence of the coast" of 2004. The main goal of the ICZM plan is to define how the beach needs to be reconstructed in order to protect the infrastructure and the environment. In order to align the economic pressures linked to the tourism sector with the quality and protection of the coast, the plan defines the following objectives and actions:

- Nourishment of the coast and defence from the erosion process;
- Optimisation of the marine structures through the re-use of the cliff;
- Harmonisation between the public uses and the tourist uses;
- Protection and valorisation of the coast with nature and landscape values;
- Monitoring of coastal and water dynamics and natural ecosystems;
- Coordination with the neighbouring regions[182].
-

It is worth mentioning also the Regional Landscape Plan (PPR – Piano Paesaggistico Regionale), which establishes the goals to be achieved for adopting an holistic approach to landscape planning and management.

Also municipal land use plans (PRG – Piani Regolatori Generali) of coastal municipalities have to be considered, since they affect the development of coastal areas.

Puglia Region (to be updated)

The main planning tool existing in the Apulia Region to manage coastal areas is the Regional Coastal Plan (PRC – Piano Regionale Costiero), approved with DGR 2273/2011. It regulates the uses insisting on the shoreline and within the maritime domain property under regional competences. More specifically, the Regional Coastal Plan of the Apulia Region aims at:

- promoting the sustainable development of touristic activities through a proper allocation of tourism related activities. The zoning activities also takes into account the environmental pressures related to specific recreational uses;
- safeguarding areas with high environmental and ecological values (SIC, ZPS, etc.), as well as the main landscapes;
- defining areas where specific interventions are required to face coastal erosion;

[182] Information retrieved from the EC – Maritime Affairs Coutry reports on MSP: http://ec.europa.eu/maritimeaffairs/documentation/studies/documents/italy_01_en.pdf.

- indirectly promoting coastal defence[183].

The PRC provisions are adopted at the local level through the municipal coastal plans (PCC - Piani Comunali Costieri), as established by the regional law 17/2006.

Another tool to be mention is the Thematic Territorial Urban Plan for the Landscape (PUTTP – Piano Urbanistico Territoriale Tematico per il Paesaggio), approved on the 15/12/2000 with Regional deliberation n. 1784. The plan aims at protecting and safeguarding territorial and particularly landscape resources. It will be replaced by a new landscape plan (PPTR), adopted in 2013, which has not yet entered into force.

All the strategic guidelines established by the regional landscape plan described above are then applied at the local level by municipalities, through local planning tools (PRG).

Calabria Region (to be updated)

Regional planning tools relevant for maritime and coastal space include:

- the Regional Territorial Landscape Framework ("Quadro Territoriale Paesaggistico Regionale"), approved by the Regional Deliberation 377/2012;
- the Regional Harbour Masterplan (Masterplan Portualità Calabrese);
- the Development Urban Plans (PSU – Piani di Sviluppo Urbano);
- the Integrated Territorial Plans (PIT – Piani Integrati Territoriali);
- and the the Strategic Urban Plans.

Sicily Region (to be updated)

Since Sicily has a special administrative status, urban, spatial and territorial planning are under exclusive regional competence.

In Sicily, methodological guidelines for developing plans in coastal areas are partially included in the Regional Landscape Plan (PTPR _ Piano Territoriale Paesistico Regionale), approved in 1999.

The only landscape plan approved (i.e. the one of interest for the province of Trapani) does not interest the ADRIPLAN study area. Some plans have been adopted but not approved. This is the case of the following landscape plans (PPs):

- PP for the Egadi Archipelago;
- PP for regional areas 6-7-10-11-15 in the province of Caltanissetta;
- PP for regional area 9 in the province of Messina;
- PP for the regional areas 15-16-17 in the province of Ragusa;
- PP for the regional areas 14-17 in the province of Ragusa.

At the municipal level, the main planning tool is the land use plan (PRG – Piano Regolatore Generale). PRGs can strongly affect the development of coastal activities, setting the rules for

[183] Source: http://www.europuglia.it/SHAPE/Raffaella_Bologna.pdf.

urban development at the local level. Provisions about coastal areas can also be provided by the Provinclial Territoral Plans (PTP) of the Sicilian provinces.

Slovenia[184]

Slovenia does not have a specific legislation for coastal zone management, but the regulation of coastal zones is attributed to the national spatial planning legislation. The most significant acts in this respect are the following:

- Spatial Planning Act, published on the Official Gazette of the Republic of Slovenia, nr. 33/07. Even if MSP is not explicitely included in the act, the law can also be applied to coastal and maritime areas;
- Spatial planning of arrangements of national significance, published on the Official gazette of the Republic of Slovenia, nr. 80/10. In this act, the spatial arrangements at the sea are recognised as spatial arrangements of national significance.

The Spatial Planning Act establishes three kinds of plans: national, municipal and intra-municipal. The Ministry of the Environment and Spatial planning - Spatial planning Directorate is responsible at the national level, while municipalities are responsible at the local level. More specifically, the competences are allocated as follows:

- "The State is competent to determine the objectives of spatial development, determine the policies and guidelines for spatial planning at all levels, plan spatial arrangements of national significance and supervise the legality of spatial planning at the municipal level;
- Municipalities are competent to determine the objectives and guidelines for spatial development at local level, determine the land-use and set the conditions for spatial development and plan spatial arrangements of local importance at terrestrial level" (EC-Maritime Affairs 2011).

Notably, since territorial waters are conceived as a national public good, MSP lies with the State, and all the strategic interventions to be implemented within the sea have to be issued on the basis of the National Spatial Planning Act (2007). Notably, the competence for setting down of strategic objectives and initiatives to be implemented within the Slovenian Territorial Waters is shared among diverse institutional stakeholders, listed in the spatial planning of arrangements of national significance (2010).

For what concerns ICZM, Slovenia has incorporated Integrated Coastal Zone Management into the Regional Development Strategy and Programme for South Primorska (RDP)[185].

Finally, Slovenia also approved a Spatial Development Strategy. This is the basic strategic spatial development document and an integrated planning document which implements the concept of sustainable spatial development[186].

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[184] Information retrieved from EC-Maritime Affairs 2011: Country reports. see: http://ec.europa.eu/maritimeaffairs/documentation/studies/documents/slovenia_01_en.pdf.

[185] The second programme period (2007-2013) also incorporates the results of the Costal Area Management Programme (CAMP), an UNEP-MAP financed programme concerning spatial development and management, tourism development, control of land-based water pollution and nature protected areas.

Croatia

Territorial organizations in the Republic of Croatia are counties, towns, municipalities and settlements. The Croatian coastal area belongs to the country's most valuable economic and natural assets (see socio-economic indicators).

Croatia is characterized by the predominance of a sectoral approach in regulating uses (EC-Maritime Affairs 2011: 6). For what concerns the allocation of competences with respect to spatial planning, it can be stated that Croatia displays a centralized planning structures, with all the relevant initiatives being established at the national level.

The basic physical planning positions are determined by:

- the Physical Planning and Building Act (OG 76/07, 38/09, 55/11, 90/11, 50/12, 55/12);
- the Physical Planning Strategy of the Republic of Croatia (1997);
- and the Physical Planning Programme of the Republic of Croatia (1999).

The Physical Planning Strategy of the Republic of Croatia (1997) is a starting document for the interpretation of basic positions. According to it, the main starting point for planning the area of the Croatian Adriatic is reduced to four requirements:

- protection of the area is given precedence over other requirements and interests;
- extension of building areas has to be planned on sites away from the coast;
- in the coastal area realization of a public interest is given precedence over other interests;
- islands have to be planned as unique planning units, regardless of the number of local-self-government units, while smaller uninhabited islands cannot be included in building areas.

Under provisions of the Physical Planning Act, the Strategy is the basic physical planning document used for the project development decisions, land-use planning in smaller areas, and development of the local land-use plans. The Physical Planning Strategy goals are:

- Maintaining of preserved areas;
- Systematic remediation of threatened areas;
- Ensuring minimization of space degradation in new spatial development programs;
- Keeping the current share of anthropogenic areas;
- Stipulating development of medium-size urban communities.

Among major spatial development problems, the most pronounced ones is un-rational space use, uncontrolled growth of large cities, neglect of rural areas and areas along the state border, the occupancy of large areas for building purpose (particularly in the segment referring to settlements and industrial zones expanding over high-quality agricultural land), low quality mass construction, at the coast with an extremely large share of illegal construction, with underdeveloped infrastructure in some segments and generally unsolved questions of waste disposal. Decisions in the field of spatial development have to be based on an interdisciplinary

[186] The strategy is available at : http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/publikacije/drugo/en/sprs_eng.pdf.

approach. With this objective the necessity is pointed out to promote coordination between departments and participation of all relevant subjects in programmes, projects and plans, and in particular to take the spatial component into consideration already at the preparatory stages, in order to consider on time all aspects and possible effects of measures in space, as well as to avoid conflicts. Therefore it is necessary, among other, to create and advance regulation, especially the legal basis for urban reallocation and expropriation as precondition for efficient orientation of settlement planning, particularly from the position of safeguarding public interests, to secure professional qualification at all levels, particularly at the local one. Based on the adopted Physical Planning Strategy, and in accordance with the Physical Planning Act, the Ministry prepared the Physical Planning Programme for the Republic of Croatia which sets up measures and course of action for its implementation.

In the protected coastal area special criteria shall be applied, the aim of which is to strengthen practices of spatial protection and economy, as well as to prevent, within the possibilities of physical planning, various abuses of space which, sometimes, were rooted in planning documents.

For what concerns more specifically ICM and MSP, the main legislative acts to be considered are the Physical Planning and Building Act (2007) and the Regulation on Protected Coastal Area Development and Conservation (2004). The former prescribes the preparation of a specific coastal regulation. The key provisions of the Act include:

- Protected coastal area (PCA) instrument has been proclaimed including the coastal belt of 1000 meters on mainland and all islands, and a 300 m marine belt;
- restrictive conditions for construction and legal extension within the PCA in new local physical plans;
- any construction of residential or tourist buildings within PCA can take place only upon adoption of regulatory development plan approved by the County Planning Institute, the State Development Control Office and Ministry. No construction can take place before the land for public spaces (streets, public facilities) has been allocated and equipped with basic infrastructure;
- New residential and tourist developments outside settlements are allowed outside a 70 m coastal belt. Within this 70 m belt allowed interventions include: open public spaces such as recreation areas, playgrounds, seafront promenades and beaches, tourist catering and entertainment facilities, and coastal infrastructure (ports, dry marinas and other uses which by their very nature require coastal location);
- tourism development planning is no longer local-level responsibility but is moved up to the county plans. All seven coastal county spatial plans are presently being amended by designating tourist development areas.

The latter lays down for the planning, development and utilisation of the protected coastal area and for the purpose of its conservation.

Key challenges to sustainable development of the Republic of Croatia, according to Strategy for Sustainable Development of the Republic of Croatia (OG 30/09), among the other key challenges is protection of the Adriatic Sea, coastal area and islands. The sea is a large and important area of the Republic of Croatia (35.4% of the total surface area) both in relation to the protection of nature and the environment and the conservation of biodiversity as well as in relation to a large number of various activities (maritime transport, construction of transport and municipal infrastructure, tourism and nautical tourism, economic activities associated with

fisheries). All of the above is of great importance and interest for the sustainable development of the Republic of Croatia. Reduce the loss of marine and coastal biodiversity and increase the number of protected areas is one of the activities for overall objectives of the Strategy for Sustainable Development of the Republic of Croatia.

In June 2009 the Ministry of Environmental Protection and Spatial Planning adopted "Criteria for Planning Tourism zones in the Coastal Area of the Republic of Croatia". These establish new tourism zones in physical plans of countries are planned in protected coastal areas, almost exclusively along the coastline. It is of outmost importance to move tourism zones away from the coastline, in order to free the coast from construction, particularly sub-standard construction- regardless whether this refers to organized tourism construction or spontaneous construction. New construction has to be planned as far away from the coast as possible, i.e. on the border and/or outside the protected coastal area. In the coastal area hotel construction has to be of high quality with a function tending to all-year utilization.

Basic guidelines and criteria in the procedure of preparation of Physical Plans of County and Physical Plans of towns and municipalities, between others, are:

- Counties are obliged to implement uniform planning of islands areas and to equalize their provisions for the implementation of physical plans towns or municipalities in the part relating to general requirements for building and spatial development (including tourism zones);
- Constriction of tourism accommodation capacities for needs of national parks should be direct outside the boundaries of their scope;
- In physical plans of counties and in physical plans for the development of towns and municipalities it is obligatory to prepare an evaluation of landscapes for new and existing not built-up and undeveloped tourism locations;
- For tourism zones planned on peninsulas and islands or their parts which are narrower than 250 m it is mandatory to prove in the plan argumentation the possibility of carrying out the planned designation and to establish landscape protection requirements;
- In protected areas of nature and cultural heritage protection it is not allowed to plan extensions of existing not built-up tourism zones and change of designation of hotel into tourist settlements or of campsites into tourist settlements.

Montenegro

The spatial planning policy in Montenegro is set by the spatial plans. The basic characteristic of the spatial planning documents is that they cover all relevant areas and components that can have a physical change in the area those plans are covering. Spatial plans are divided in: (a) strategic – development plans that have regional character and are adopted for the longer period, and (b) regulating plans that represent the urbanistic solutions for the strategic targets from the development plans.

It was noted in the earlier time that spatial plans in Montenegro do not take into account, or at least not in the adequate manner, the sea area. For that reason, the 1995 Law on planning and development of space proposed the development of the Spatial plan for the coastal area.

However, the adoption of this plan in 2007, did not resolve this problem, since this plan, although it took into account the territorial sea of Montenegro, did not give the clear guidelines for the development of activities, protection and use of the marine area.

Another important aspect of the spatial planning system in Montenegro is the principle of integrated planning, which ensures that all spatial plans have social, economic, environmental and spatial components. The spatial planning system represents the basis for the integrated management.

The main problems are the undeveloped practice of sea-use planning and poor harmonization of sectoral programs for the management of different activities in the same space.

Different activities at sea and on the coast are regulated by different laws, strategies and programs that should be harmonized, but in practice, the level of harmonization is low. At the same time, the management of these activities is divided among different institutions on state and some on local levels. The highest level of integration in spatial and management sense is achieved in the area on management of the coastal zone in Montenegro. The coastal zone is defined by law as integrated area of the land strip and territorial sea with one managerial institution. In practice the problems represents that currently defined coastal zone in Montenegro is only a part of the Coastal area as defined by the ICZM Protocol of Barcelona Convention, and the institution in charge of the management of the coastal zone has limited jurisdiction, especially at the sea.

The Law on Spatial Development and Construction of Structures (adopted in 2008) is the key legal document that prescribes the obligation and procedure for drafting spatial plans of different levels in Montenegro; Formal and planning basis for programmed spatial development is a Five-Year Programme of Spatial Development, which, for the areas of public asset, are enacted by the Government. It has already been said that strategies and plans for certain sectors are proposed by relevant bodies and enacted by the Government.

Spatial plan of the Republic of Montenegro is adopted in 2008 and it represents the Montenegrin strategy for spatial development. This plan gives the guidelines for the development of the three Montenegrin regions, Northern, Central and Coastal, as well as: the policy of use of land and development of functions and economic activities in the Republic; elements of the long term policy of spatial organization, plans of the basic infrastructure systems and basic technical systems and the manner of their integration with the infrastructure systems in the surrounding area; elements of natural and cultural heritage protection; strategic environmental impact assessment, elements of protection of an interest for national defence; elements of prevention and protection against natural and industrial hazards; areas and modalities of cross-border and international cooperation in the field of physical planning; guidelines for the preparation of spatial plans of smaller territorial units, identification of areas of high significance to the Republic; guidelines and measures for the implementation of the plan; areas and zones of public interest; concession areas; methods, phases and schedule of implementation.

The following strategic documents are relevant for Maritime Spatial Planning in Montenegro:

- Spatial plan of the Republic (2008)
- Spatial plan for the coastal zone (2007)
- National Biodiversity strategy and Action Plan (2009) the impacts on habitats
- National Sustainable Development Strategy (2006)
- National Strategy for Integrated Coastal Zone Management (draft only) (2007)

- National plan for search and rescue at sea (No.04/06)

In 2011, the Government adopted the Decision on the Preparation of the Special Purpose Spatial Plan for the Coastal Zone of Montenegro (Official Gazette 23/11). The Spatial plan of a special purpose area shall be prepared and adopted for national parks, coastal zone, natural reserves, recreational and tourist areas, etc.

The spatial plan of a special purpose area shall include specifically:

- assessment of the current state of development and land-use;
- the status and directions of development in relation to the immediate surrounding;
- regimes of development and land-use and zone boundaries; measures for the protection of landscape values;
- Strategic Environmental Impact Assessment (SEA);
- other measures and requirements which correspond to the needs and characteristics of the purpose of the area for which the plan is being prepared.

Article 2 of the Decision on the Preparation of the Special Purpose Spatial Plan for the Coastal Zone of Montenegro (Official Gazette 23/11), defines the area of the coastal zone for which this spatial plan is being prepared as including the territories of the six coastal municipalities, territorial sea and internal coastal waters, excluding the territories that belong to the National Park "Lovcen" in municipality Budva and the National Park "Skadarsko jezero" in municipality Bar. The marine border of the coastal zone is the outer border of the territorial sea.

The Law mandates coordination in drafting state planning documents, such as Spatial plan of Montenegro, Spatial plan of Coastal Zone (public maritime domain) and the future spatial plan for the area of special purpose for the Coastal Zone. However, on operational level, in the implementation of plans and programmes of specific sectors (such as Tourism Development Strategy, Fisheries Strategy, Biodiversity Strategy, etc.), coordination is not obligatory.

For what concern the spatial planning, it should be noted that in Montenegro it is, in general, well-developed, comprehensive and integrated. However, it was noticed that there was a lack of plans or adequate solutions for the coastal and marine area issues. The current planning Law does not foresee the development of sea-use plans. Therefore it is necessary to use this opportunity to introduce this new type of plans in Montenegro (PAP/RAC, 2007). Based on the results obtained, adequate changes in legislation should be proposed by which the sea-use plans would get appropriate place in the planning system.

Albania *(to be updated)*

Albania does not currently have a specific strategy for ICM. The development of coastal areas and the management of coastal activities are regulated through a fragmented legislative framework, which mainly relies on sectoral policies and provisions (see section 3.3.3. for more details). The competences on coastal zones management are mainly shared between the Ministry of Environment, Forestry and Water Administration and the Ministry of Public Affairs, Transport and Telecommunications. Also other national Ministries (i.e. he Ministry of Tourism, Culture, Youth and Sports and the inter-ministerial Council for Territorial Development) have responsibilities related to coastal management.

Even if a ICM plan has not been developed, a Coastal Zone Management plan was approved in 2004. It results from (1) the Coastal Area Management Programme (CAMP) for the central

Albanian coastal region and (2) the Albanian Coastal Zone Management plan (northern and southern regions).

For what concerns MSP, a regulatory and planning framework has not been established yet, and competences over the development of MSP procedures have no been set.

Bosnia-Herzegovina *(to be updated)*

The regulatory framework for spatial planning is established by the Federal law on Spatial Planning[187].

Currently, there is no ICM or MSP in the country. As reported by the EC (Maritime Affairs 2011) "there are no legislative instruments, mechanisms or procedures for coastal management, and bodies or agencies for integrated management of the coastal area are not present:

- Coastal area planning and management have not been implemented in practice;
- No strategic governmental documents defining the country's direction towards its coastal zone;
- Several documents mention the importance of the coastal area and guidelines for its arrangement are given; however, these guidelines do not take into account a sustainable development of the coastal zone;
- There is no institutional context for a systematic and permanent management of the coastal area in Bosnia and Herzegovina; management of the coastal area on the Cantonal level is realised through several Cantonal departments (e.g. for spatial management, environmental protection, inspection); however, in general, there is no integration among them"[188].

Greece *(to be updated)*[189]

A comprehensive framework for ICM and MSP does not currently exist in Greece. The planning system is mainly centralized at the national level even if some plans are also established at lower institutional and administrative levels, through a process of administrative decentralization that started in the '80s and '90s.

The main responsibility for (Maritime) Spatial Planning at the national and regional level lies with the Ministry of Environment, Energy and Climate Change. In order to develop integrated spatial plans, the Ministry often collaborates with other Greek Ministries, such as Ministry of Maritime Affairs, Islands and Fisheries; the Ministry of Citizen's Protection and the Ministry of Culture and Tourism. The Ministry of Environment, Energy and Climate Change also collaborates with regional authorities in establishing specific planning frameworks.

The Greek planning system can be synthetically be described as follows.

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[187] PAP/RAC, 2007, National Report on Current Policy, Procedures, Legal Basis and Practice of Marine Spatial Planning in Bosnia and Herzegovina, Mostar.

[188] Source: EC-Maritime Affairs 2011: http://ec.europa.eu/maritimeaffairs/documentation/studies/documents/bosnia_and_herzegovina_01_en.pdf.

[189] Sources: EC – Maritime Affairs 2011: http://ec.europa.eu/maritimeaffairs/documentation/studies/documents/greece_01_en.pdf.

At a national level, the main planning instrument is the "General Framework for Spatial Planning and Sustainable Development", provided by law 2742/1999 and updated through a join Ministerial decision in 2008. The GFSPSD *de facto* is a multi-sectoral plan containing guidelines for the organization, management and development of the Greek territory. These guidelines cover the following topics (IsoCaRP 2002[190]):

- main national development poles and axes;
- technical infrastructures;
- productive sectors;
- metropolitan areas, in relation with their relation with the wider territorial context in which they are embedded;
- management of natural resources and protection of national cultural heritage;
- creation of viable administrative units.

The second planning tool provided by the law 2742/1999 is constituted by the "Special Frameworks for Spatial Planning and Sustainable Development". These are *ad hoc* guidelines covering specific areas or sectors. In 2002, a draft was proposed for a Special Framework for Spatial Planning and Sustainable Development in Coastal Areas and Islands" was proposed, but it has never been approved, since the integration of the ICZM objectives into different sectoral policies and plans was considered as a more preferable option[191] (see next section of sectoral planning tools for more details). However, a "National Framework for Spatial Planning of Coastal Areas and Islands" has been recently adopted to guide policy to provide a common platform through ICM.

At a regional level, the main planning instrument is provided by the "Regional Frameworks for Spatial Planning and Sustainable Development". Established with the law. 2742/1999, it acts as a Regional Territorial Plan, and it contains guidelines concerning all factors that can have a long-term impact on the development and spatial structure of the Region. Regional Frameworks establish guideline in accordance with the provisions established by the General Framework for Spatial Planning and Sustainable Development and by the Special Frameworks for Spatial Planning and Sustainable Development. They are implemented through Regional Spatial Programs (RSPs), which designate specific actions and measures necessary to fulfill the objectives set by the regional framework. Other planning tools implemented at the regional or sub-regional level include:

- "Special spatial plans" (elaborated following the national or regiona frameworks for spatial planning);
- "Regulatory plans";
- and "Urban Development Control Zones" (applied in areas outside the statuary town plans).

Finally, at the local level the most relevant planning tools are the "General Urban Plans" (GUP), which are developed at the regional level and which establish guidelines and objectives for

[190] ISoCaRP (2002), Planning in Greece, Special bulletin in the frame of the 38th international planning congress edited by El. Beriatios, Athens.

[191] Ministry of Environment, Physical Planning and Public Works, 2006, Report of Greece on Coastal Zone Management, Athens.

urban spatial development. GUPs are developed together with the 'Town Plan Study", which provide detailed land use and development guidance.

Relevant strategic plans are shown in Table 3-4.

3.3.2 Sectoral plans from EU directives (ICZM plans, Natura 2000 Management Plans, other coastal and marine area related plans or indications)

Italy

For what concern the aspects of Biodiversity protection the most important legislative decrees include the Italian transposition of the EU Directive on habitats (92/43/CEE) and "birds" (79/409/CEE). The Habitats Directive requires Member States to propose Sites of Community Importance (SCIs) for the conservation of natural habitat types, and once these areas have been formally adopted by Commission Decision, to designate them as Special Areas of Conservation (SACs) within 6 years. The Birds Directive requires Member States to designate special protection areas (SPA) for the conservation of species listed in Annex I (endangered as well as migratory species requiring conservation).

Together SPAs and SACs form the Natura 2000 network of protected areas. The Italian transposition of these two Directives is:

- National Law No. 157 of 11 February 1992 as supplemented by Act Oct. 3, 2002 n.221 (implementation of the Birds Directive);
- The Presidential Decree 8 September 1997 n. 357 as amended by Presidential Decree 120 of 12 March 2003implements Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. This decree gives to the Regions the responsibility of the identification of Natura 2000 sites. Furthermore the Ministry Decree 25/03/2005 assigns to the Regions also the task of identify management and conservation measures for Special Protection Areas (SPAs) and the Community Importance Sites (SCI).

Several other legislative actions concerning the biodiversity protection are referred to the Regions, such as: the approval of technical procedures for the implementation of the Management Plans, the adoption of specific measures for the safeguard and the protection of beaches and maritime-coastal habitats; the use of new criteria to regulate dredging activities in ports; the interventions for promoting the protection and the development of the coastal area and the creation of wildlife protection areas.

Other form of biodiversity preservation include the already mentioned "Ecological Protection Zone (EPZ)" beyond the outer limit of the territorial sea (Law no. 61/2006) and the marine protected areas (instituted with law n. 979 of 1982 and Law n. 394 of 1991).The marine protected areas include a marine environment characterized by relevant interest from a natural, geomorphological, physical, biochemical point of view, with particular regard to coastal and marine flora and fauna. Up today in the Adriatic Sea, along the Italian coast, there are 3 Marine Protected Areas: the Natural marine reserve of Miramare (Friuli Venezia Giulia), the Tremiti Islands (Puglia) and the Torre Guaceto area (Puglia).

Always concerning the definition of protected areas in the sea, the Decree of Ministry of Environment, 17 October 2007, as amended (Ministerial Decree of 22 January 2009 (10

February 2009) sets the minimum uniform criteria for the definition of conservation measures relating to "Special Areas of Conservation (SAC)" and "Special Protection Areas (SPA).

At national level particularly relevant is the National Strategy for Biodiversity which aims at protecting and preserving the marine and coastal environment against degradation and loss of biodiversity; furthermore the Strategy ensures the sustainable use of marine and coastal resources through the application of an ecosystem approach to the long term coastal management. Based on the EU directive (92/43/CEE), Italy is carrying out the implementation of marine Natura 2000 network. For this purpose MATTM (Ministry of the Environment, Land and Sea) and SIBM (Marine Biology Italian Society) are collaborating to the scientific review of habitat and species concerning Habitat Directive. Moreover MATTM started a reference work with the Italian regions to clarify the responsibilities of marine Natura 2000 network management. Some Italian regions proposed a motion for the extension of existing marine SCI areas or for the identification of new ones. In the following paragraphs each region will summarize its own proposals.

In Italy an ICZM National Strategy is under development. There is not a specific National Policy regarding ICZM coupled with that of special "ad hoc" planning and programming tools. Nevertheless it has to be highlighted that at regional level there are several relevant initiatives highly correlated with ICZM policies. In many Italian regions in fact the definition of ICZM instruments is going on (for the Adriatic area: Abruzzi and Marche regions), while other Regions are modifying/updating their ICZM plans (e.g. expanding it to the marine field in the Emilia Romagna Region) by using the ICZM recommendation as reference. At National level, Ministry for Environment and Land and Sea protection (MELS) is defining the roadmap working plan (topics, timelines and actors), in agreement with the Regions, the Local authorities and competent Central administrative offices, to elaborate the Italian "National Strategy for Integrated Coastal Zone Management" as decided in the October 10th, 2007 Unified Conference in the technical department; additionally, a permanent Technical team pertaining to ICZM is going to be established. At national level, legal instruments were adopted to update current sectoral policies, in order to transpose EU directives. No legal instrument is specifically concerning ICZM, but most of them have important implications on the implementation of the ICZM process.

Veneto Region

In particular for what concern the biodiversity protection and valorization, the Regional Law No. 15 of 12.07.2007: "Interventions for promoting the protection and development of the coastal area of the Veneto and the creation of wildlife protection areas" aims to protect and repopulate areas of marine and fishery resources of the sea. This goal is reached through the establishment of protected areas at sea (Areas of Biological Protection) for the biodiversity conservation without neglecting the importance of the marine tourism development. These areas called "tegnùe" are rocky outcrops which rise from the seabed; they are extremely important ecological niches, with many rocky recesses, inhabited by algae, molluscs and other species of animals and plants. The tegnùe areas are oases of natural fish repopulation (for example bream, seabass and octopus), the marine biodiversity of these areas has become a shelter, while for other species, such as squid and cuttlefish, this is the ideal habitat to lay eggs. According to their location, in the "tegnùe", there are different environmental conditions that are influenced by the prevailing environmental factors, such as the lighting, the hydrodynamic currents, and the quality of the water body and of the substrate, and also the richness of freshwater rivers that flow into the coastlines Veneto and Friuli. The different combination of these elements leads to a remarkable variety of fish species. See Figure 3-4 for their location at the sea. Along the coast the regional law August 16, 1984, No.40 "Rules for

the establishment of regional parks and reserves", aims to protect and enhance the natural environment in areas of particular interest. The Region establishes regional parks and reserves, financing them; it also encourages the establishment, by Provinces, Municipalities, Mountain Communities and their Associations, of regional parks and natural reserves of local interest.

Other forms of biodiversity protection include the creation and subsequent management of natural protected areas (parks and reserves) and areas included in the European ecological network Natura 2000. This network consists of territorial areas designated as Sites of Community Importance (SCI) and Special Protection Areas (SPA) in relation to the presence of habitats, animal and plant species listed in Annexes I and II to Directive 92/43 "Habitat" and species listed in Annex I to Directive 79/409/EEC "Birds" and other migratory species that regularly return to Italy. 17 of these sites including both SCI and SPAs are along the Veneto coast. Recently (Giunta Regionale Resolution No. 220 01/03/2011) two new marine SCI have been defined in two areas in front of the Veneto coast: SCI IT 3250047 „Tegnùe di Chioggia" and the SCI IT 3250048 "Tegnùe di Porto Falconera" (see Figure 3-3 and Figure 3-4 and Figure 3-5).

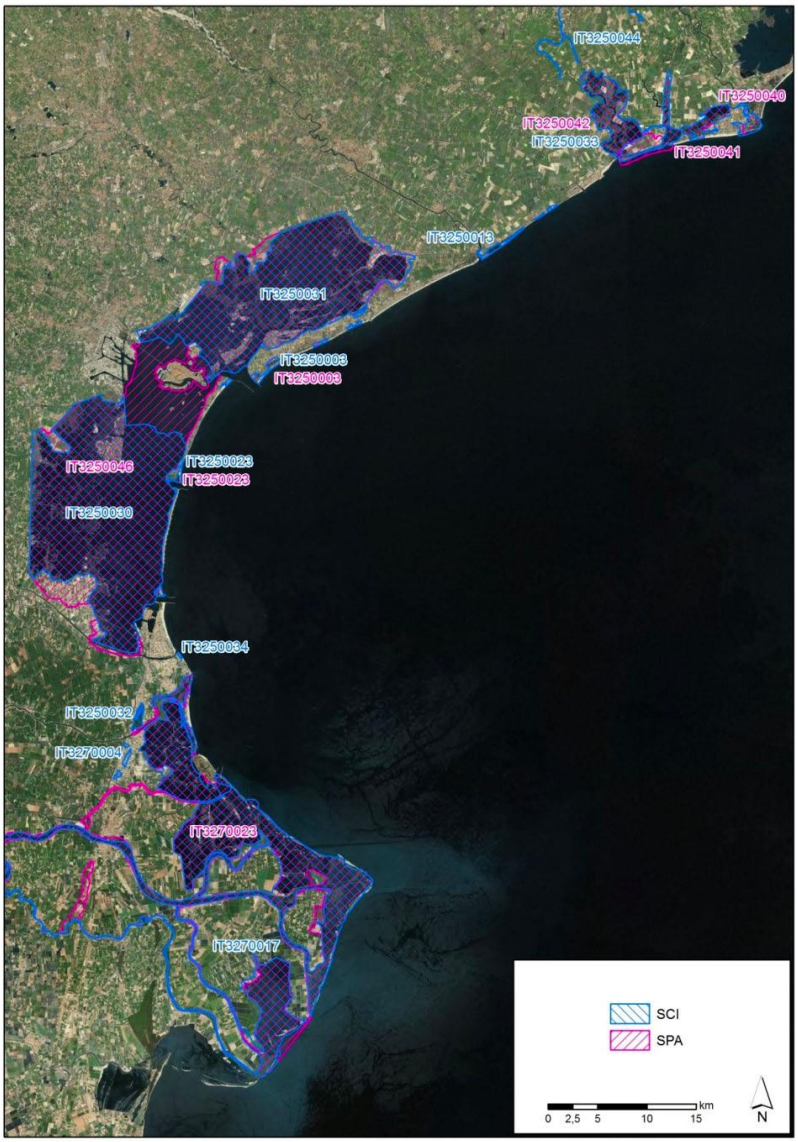


Figure 3-4 SIC e ZPS in Veneto Region (source Shape, 2013)

Emilia Romagna Region

Protected areas and the Natura 2000 network (Sites of Community Importance (SCI) and Special Protection Areas (SPA) represent for Emilia-Romagna Region a useful system of protection of the natural resources and conservation of habitats and biodiversity. The Regional Service for the Park and Forest Resources manages the regional system of protected areas and of Natura 2000 network by issuing roles, planning and allocating financial resources in accordance to the Regional Law n 6/2005 and the Regional Law n 24/2011.

In the sea space, Emilia-Romagna Region has instituted the SCI "Paguro" with DGR ER 242/10 cod IT4070026 (Figure 3-5). In 1988 the Regional Law n. 27 instituted the Po river delta Park and in 2011 with regional law n 24/11 it was instituted the managing subject. The Park is regulated by the Master Plan of the coast of regional park of Po river delta, document elaborated in cooperation whit the province of Ferrara and Ravenna, Emilia-Romagna Region and EU. The Master plan is a local managing tool. It is strongly experimental and innovative but is not prescriptive. The master plan has three main objectives: to enhance knowledge, to regulate and to set up strategies.

The most important legislative tools for this topic are listed below:

- Emilia-Romagna Regional Law n.6, 17/2/2005 "Roles to manage the regional protected areas and network Natura 2000".
- Emilia-Romagna Regional Law n.27, 2/7/1988, n. 27 "Institution of regional park of Po river delta".
- Emilia-Romagna Regional Law n. 24, 23/12/2011, Institution of managing subject for parks and Biodiversity of Po river Delta.
- Regional Administration Directive n.1191 of 30/07/07 for the monitoring and managing of SCI and SPA and Guidelines.

Figure 3-5 SCI "Paguro" (source: Shape, 2013)

Emilia-Romagna Region has more than 30 years of experience in coastal defence. The first regional law is the n. 7 of 1979; in 1983 the Region approved the first Coast Plan which envisaged using the Beach nourishment as a soft system of erosion contrast. In 2001 the competence on coast defence was transferred to the Regions.

In 2005 the Emilia-Romagna Region approved the guideline for the integrated coastal zone management (GIZC in Italian) Regional Council Resolution n. 645, 20/1/2005. Beside coastal defence the ICZM provide to give the address to several sectoral policy and plans taking in account issues as environmental protection and the improving of fishing, tourism, infrastructure and ports.

The article 21 of national law 179/2002 gives to the Region the competence to authorize the dumping of gravel and sand for beach nourishment. Dumping activity are limited from seashore line up to max 3 nautical miles as regulated by Ministerial Decree of 26 January 1996 and Legislative decree 152/2006 art. 109.

The most important legislative tools for this topic are listed below:

- Emilia-Romagna Regional Law n.7,13/3/1979 "Work of Emilia-Romagna Region for coastal defence in order to protect civil and industrial buildings to save environment and tourism".
- Regional Council Resolution n. 645, 20/1/2005 Guide line for the integrated coastal zone management (GIZC in Italian).

Abruzzo Region

The Natura 2000 network and management plan is well developed in the Abruzzo Region; in fact, the regional implementation of the Directive 92/43/EEC has allowed the identification of n.53 Sites of Community Importance (SCI) and 134 ZPS sites. Moreover, in Abruzzo, there are three national parks and a mountain regional park: Parco Nazionale d'Abruzzo, Parco Nazionale del Gran Sasso, Parco Nazionale della Maiella e Parco Regionale Velino-Sirente. There are also some areas, such as the Area Marina Protetta Torre del Cerrano and Parco Nazionale della Costa chietina that concern the marine and marine-terrestrial areas.

Six SCI are in marine areas: Marina di Vasto, Punta Aderci, Lecceta di Torino di Sangro, Grotta delle Farfalle, Punta Acquabella, Ripari di Giobbe. Moreover, there are 27 regional reserves, of which seven terrestrial and marine surfaces.

The National Ministerial Law "Establishment of biological protection zones in the marine waters (ZTBs)" has identified one area for the protection of fishery resources in the offshore marine waters of the Abruzzo Region: Fossa di Pomo. Another law on this topic was later adopted (MIPAF, June 1998), according to the EC Regulation n.1967/2006, for the prohibition/ management of the fishery activities in the ZTBs.

Concerning the offshore marine area, a bill was proposed to the Senate of the Italian Republic in order to ban the prospecting, research and cultivation of liquid hydrocarbons in the offshore Adriatic marine waters in front of the Abruzzo Region.

There are also 4 requests for applications for further drilling for oil exploration in the central part of Abruzzo and for permissions for the cultivation of oil in the marine environment, all located off the coast.

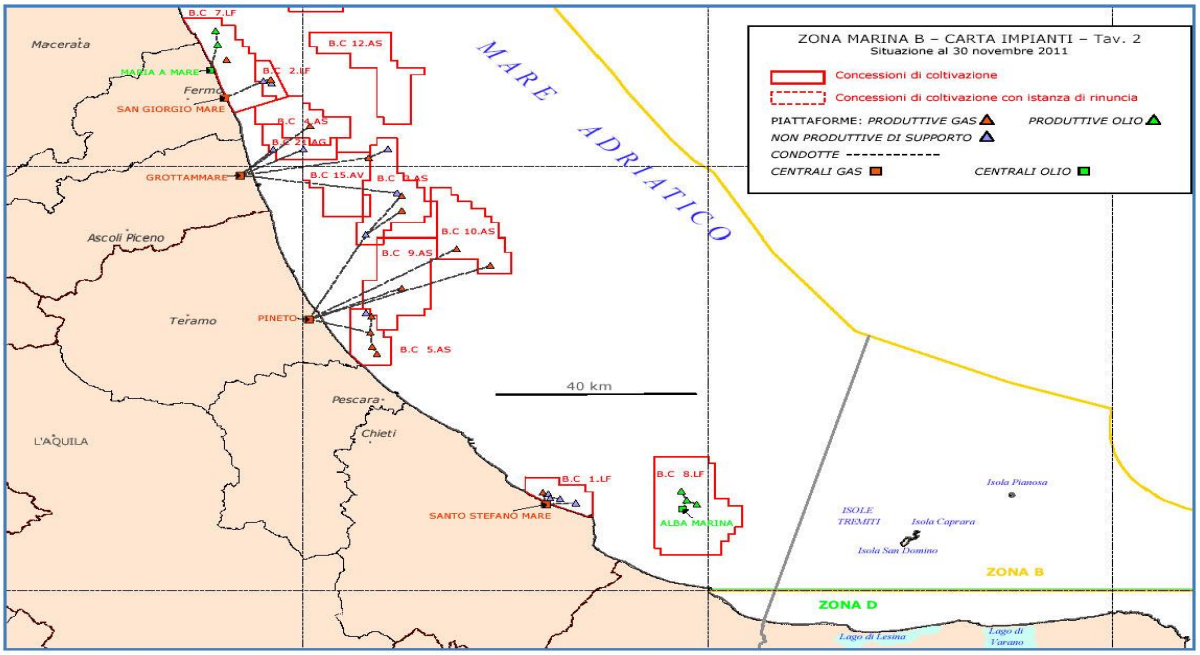


Figure 3-6 Hydrocarbon production concessions along Abruzzo coastal line (source: Shape, 2013)

Puglia Region

The Natura 2000 network and management plan is well developed in the Puglia Region; in fact, the regional implementation of the Directive 92/43/EEC has allowed the identification of n. 77 Sites of Community Importance (SCI). Three sites are fully marine, "Posidonieto Isola di San Pietro-Torre Canneto (IT9130008)", "Posidonieto Capo San Gregorio-Punta Ristola (IT9150034)" and "Posidonieto San Vito-Barletta (IT9120009)", while eighteen sites cover both terrestrial and marine surfaces: Isole Tremiti (IT9110011), Duna di Campomarino (IT9130003), Torre Colimena (IT9130001), Bosco Tramazzone (IT9140001), Stagni e saline di Punta della Contessa (IT9140003), Torre Guaceto e Macchia S. Giovani (IT9140005), Litorale brindisino (IT9140002), Palude del Conte-Dune di Punta Prosciutto (IT9150027), Porto Cesareo (IT9150028), Palude del Capitano (IT9150013), Litorale di Ugento (IT9150009), Alimini (IT9150011), Le Cesine (IT9150032), Torre Veneri (IT9150025), Aquatina di Frigole (IT9150003), Montagna Spaccata e Rupi di San Mauro (IT9150008), Rauccio (IT9150006), Litorale di Gallipoli e Isola S. Andrea (IT9150015). The full list of SCI is reported in the Decree of Ministry of Environment dated 3 July 2008.

Moreover, in the Puglia region there are two Nature Reserves – Marine Protected Areas "Isole Tremiti" (Ministry Decree dated 14 July 1989) and "Torre Guaceto" (Ministry Decree dated 12 April 1991), and one Marine Protected Area – "Porto Cesareo" (Ministry Decree dated 12 December 1997).

Finally, three wetlands of international interest (Ramsar sites) are located in the Puglia Region: "Le Cesine", "Saline di Margherita di Savoia", "Torre Guaceto". Their surfaces are included in the above mentioned protected areas.

Further, the Puglia Region signed a Memorandum of Understanding (DGR n. 1808, dated 6 October 2009) for the Interregional Action Plan, proposed by the Italian Ministry for the Environment, for the protection of sea turtles. This Interregional Action Plan is targeted to the monitoring, conservation and management of sea turtles.

The National Ministerial Decree "Establishment of biological protection zones in the marine waters (ZTBs)", dated 18 February 2004, has identified two areas for the protection of fishery resources in the marine waters offshore the Puglia Region; another National Ministerial Decree on the subject was later adopted (22 January 2009) according to the E.C. Regulation n. 1967/2006, for the prohibition/management of the fishery activities in the ZTBs .

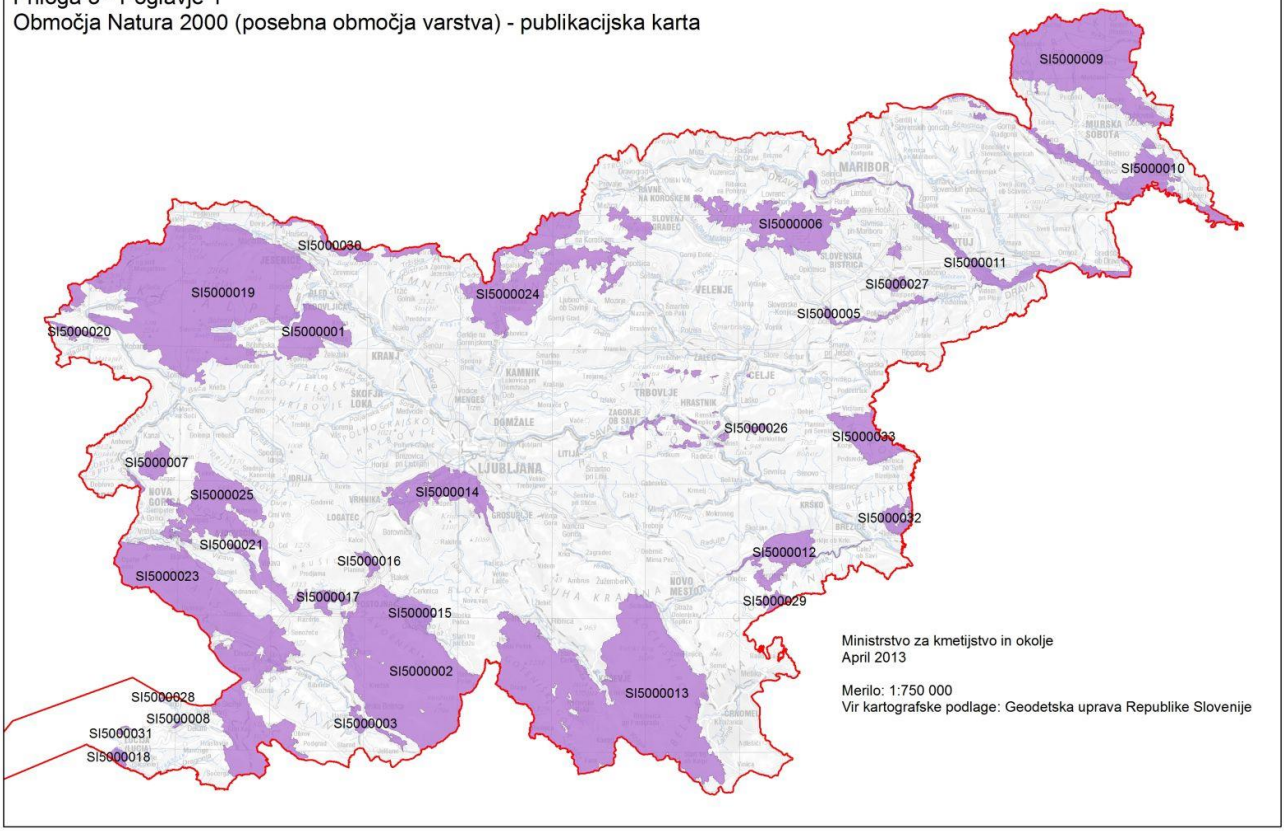
Moreover, some Regional Government existing Acts can be considered as precursors for the governance of the maritime-marine system. The main ones are:

- Regional Law n. 21 "Provisions relating to mining", dated 12 November 2004, regulated mining activities and the cultivation of quarries (the marine ones also) according to the "habitat" 92/43/EC and the "birds" 79/409/EC directives;
- Regional Law n. 17 "Rules governing the protection and use of coast", dated 23 June 2006, regulated the coastal regional planning according to the ICZM concepts.

Slovenia *(to be updated)*

The Natura 2000 Network is well developed in Slovenia. Natura 2000 sites were designated in 2004, and the network has been enlarged in 2013. There are 31 sites for birds conservation and 323 sites for the conservation of habitats types (see Figure 3-7). Natura 2000 sites, which are mainly forested, also include coastal environments.

Priloga 3 - Poglavje 1
Območja Natura 2000 (posebna območja varstva) - publikacijska karta



Priloga 3 - Poglavje 2
Območja Natura 2000 (posebna ohranitvena območja) in
potencialna Natura 2000 območja (potencialna posebna ohranitvena območja) - publikacijska karta

Figure 3-7 Natura 2000 Sites in Slovenia (Source: Slovenian Government)[192].

As already highlighted in the previous section on strategic planning tools, Slovenia has incorporated ICM in the Regional Development Strategy and Programme for South Primorska (RDP). The main strategic orientations of the RDP for the period 2007-2013 can be summarized as follows:

- Upgrading the efficiency of land use planning;
- Protection of cultural heritage;
- Protection of the coastal landscape;
- Protection and better use of the coastal strip;
- Coordination of sea use, by implementing sea use planning with neighbouring regions in Italy and Croatia.

Croatia

Also in light of the fact that Croatia only recently joined to the EU, the implementation of Community law in the country has not yet been completed. For what concerns the designation of national sites to be included in the Natura 2000 Network, Croatia initiated in 2008 a project – called 'Institutional Building and implementation of Natura 2000 in Croatia' – aimed at supporting the government in the definition of areas to be included in the network, as well as in the consultation with the general public and with land users. Currently, a draft proposal of sites to be included in the network has been formulated by the National Institute for Nature Protection[193].

For what concerns ICM, the Croatian Spatial Planning law – as previously highlighted - does not require *ad hoc* coastal zone planning and management, since it implicitly set that coastal protection considerations should be integrated into regional, municipal and local planning.The efforts to employ the ICM methodological approach seem to be still limited (UNEP-MAP).

Greece

For what concerns the state of Natura 2000 network in Greece, this includes 241 Sites of Community Importance (SCI) and 202 Special Protected Areas (SPA)[194].

For what concerns ICM, despite the adoption of a "National Framework for Spatial Planning of Coastal Areas and Islands", there is not a specific planning tool design to manage and coastal areas following the ICZM methodological approach. The framework is expected to act as a guidance for the development of operative ICM and MSP plans in the future.

3.3.3 Sectoral plans from National legislations

Italy

[192] http://www.natura2000.gov.si/index.php?id=16&L=1.
[193] More information available at: http://www.natura2000.hr/.
[194] Source: http://www.ekby.gr/ekby/en/Natura2000_main_en.html.

The review of Italian Sectoral Plans is currently under development. It will be structured considering in particular national and regional plans. The plans analysed until now are reported in the table below (see Table 3-4).

Veneto Region

Emilia-Romagna Region

Friuli Venezia Giulia Region

Marche Region

Abruzzo Region

Puglia Region

Calabria Region

Silicia Region

Slovenia

In the case of Slovenia, the most important legislative acts – that constitute the basis for Slovenian sectoral policies – are the following:

- Water Act, published on the Official gazette nr. 67/02, regulates the integrated management and the protection of national waters (inland, maritime, and groundwater);
- Environmental Protection Act, puslished on the Official gazette nr. 41/04;
- Nature Conservation, published on the Official gazette nr. 56/99. This provides the measures for the preservation of biotic diversity and the system of valuable natural features protection with the aim to contribute to the conservation of nature;
- Maritime code, published on the Official gazette of the Republic of Slovenia nr. 26/01, amendments. The Code regulates the sovereignty, jurisdiction and control of the Republic of Slovenia over the sea, navigational safety in territorial waters and internal waters, protection of the sea against pollution from vessels and legal regime of ports;
- Marine Fisheries Act, published on the Official gazette nr. 115/06. This act sets the main goals and measures concerning marine fishery.

Croatia[195]

In Croatia, sectoral legislation is predominant over strategic planning. Important laws in this respect include:

- the Maritime Code (1994 and 1996);
- the Shoreline and Marine Harbours Law (2003);
- the Law on Marine Fishery (2010);

[195] Source: EC-Maritime Affairs 2011: Country Reports: Croatia. Online via: http://ec.europa.eu/maritimeaffairs/documentation/studies/documents/croatia_01_en.pdf.

- the Environmental Protection Law (2007);
- the Law on the Protection of Nature (2005) which regulated the establishment of MPAs;
- the Strategy of Croatian Tourism Development 2010 (2003).

Montenegro *(to be updated)*

no data

Albania

Coastal and maritime management in Albania does not have a specific strategy. The development of coast-related initiatives is grounded on diverse sectoral policies. The main legislative acts underlying single-sector strategies are the following:

- Law on City Planning (1993, amended in 1998);
- Law on Environmental Protection (2002, amended in 2008);
- Law on the Development of Tourism Priority Zones (1993);
- Law on Fishing and Fish Farming (1995);
- Law on Water Resources (1996);
- Law on Water Supply and Sanitation Sector Regulation (1996);
- Laws and regulations relevant to coastal development (among others: Law on Protected Areas, amended in 2008);
- Law on the establishment and operation of land protection and administration structures and the Law on establishment of forest guard;
- Law on Biodiversity Protection (2006);
- Regulatory framework on the preparation of Environmental Impact Assessments (EIA-s) and a draft law on Strategic Environmental Impact Assessments (SEA-s).

Greece

In Greece great importance is attributed to sectoral policies and legislation. The most important legislation with regard to ICZM and MSP has been partially discussed in the section related to the regulatory framework and in the previous section on strategic spatial planning. They can be briefly summarized as folows[196]:

→ Legislation for Environment and Planning:

- L. 1650/1986 for the Environment (providing also for Marine Parks);
- Presidential Decrees of 1993 and 1999 establishing the Marine Parks of Sporades and Zakynthos respectively;

[196] Source: EC-Maritime Affairs 2011. Available online at: http://ec.europa.eu/maritimeaffairs/documentation/studies/documents/greece_01_en.pdf

- L. 2742/1999 for Spatial Planning & Sustainable Development;
- General Framework for Spatial Planning at national level (Joint Ministerial Decision, 2008);
- Regional Spatial Plans for Northern Aegean, Southern Aegean, Crete and Ionian islands Regions; 8 more Regional Spatial Plans (2003) for the other coastal Regions;
- L. 2971/2001 on Coasts and Beaches (also making reference to ports);
- National Framework for Spatial Planning of Coastal Areas & Islands (under preparation – due by autumn 2010);
- National Framework for Spatial Planning of Aquaculture;
- P.D. 55/1998 (Gov. Gazette A' 58) for the Protection of the Marine Environment;
- In 2008, Greece signed the Mediterranean Protocol on Integrated Coastal Zone Management.

→ Legislation for Shipping:

- L. 2252/1994 (Law by which Greece has ratified the International Convention OPRC 1990);
- Presidential Decree 11/2002 (on Contingency Plans).

→ Legislation for Underwater Cultural Heritage:

- L. 3028/2002 and related Ministerial Decisions on the Protection of Underwater Cultural Heritage;
- Ministerial Decision of 2003 (OJ 1701/19-11-2003) characterising ship wrecks as cultural goods;
- Joint Ministerial Decision of 2004 (OJ 336/11-2-2004) with restrictions for mooring and diving.

More specifically, considering the Greek spatial system described above, relevant sectoral planning tools at the national level are provided by the Special frameworks for Spatial Planning and Sustaibable Development. These are:

- the Special Framework Plan for Renewable Energy Sources, which provides specific regulation concerning offshore wind parks;
- the Special Framework Plan for Tourism, which defines the conditions for marine and coastal tourism development; proposes the promotion of scuba diving; provides a framework for development of nature tourism in protected areas, including the national marine parks of Zakynthos and N. Sporades;
- the Special Framework Plan for Industry.

Furthermore, a Framework for Spatial Planning of Aquaculture (with emphasis on Mariculture) was developed.

Sectoral plans have been implemented also at the regional level. Of particular interest in a ICZM perspective is the Regional Framework for Tourism.

The following table shows the planning tools. The Table has been completed according to the questionnaires results or to information from partners. The list is **not complete**, and it will be updated following the acquisition of new information from institutional partners. The following table is updated to the 19/05/2014.

Table 3-4 *Summary of datas on planning tools (based on questionnaires survey)*

National level – Strategic Plans

STATE	LEAD PLANNING AGENCY	PLAN TITLE	Themes Spatial Plans							
			Coastal Defence	Coastal urbanization /Land Use	Maritime Spatial Planning	Energy	Maritime Transport	Coastal Transport	Tourism	Other
IT	VPA	PORT REGULATORY PLAN		x			x	x		
IT	VPA	Pot - Operation triennial plan		x			x	x		cleanup of contaminated area
IT	VPA	Port Waste management plan								Environmental activity
GR	Ministry of Environment, Energy & Climate Change	General Framework for Spatial Planning and Sustainable Development	x	x		x	x	x	x	spatial planning

Regional level – Strategic Plans

STATE	LEAD PLANNING AGENCY	PLAN TITLE	Themes Spatial Plans							
			Coastal Defence	Coastal urbanization /Land Use	Maritime Spatial Planning	Energy	Maritime Transport	Coastal Transport	Tourism	Other
IT	Puglia Region	PPTR (territorial thematic landscape plan)	x	x		x				
IT	Puglia Region	Coastal Plan	x	x	x			x		
IT	Molise region - Service maritime domain and Economy of the Sea	Beach Municipal Plans	x	x					x	
IT	Veneto Region	Territorial Plan of Lagoon and Venetian Area (PALAV)								The plan defines the planning rules for a wide territory which includes 17 municipalities distributed around the Venice lagoon. The Plan identifies and describes the features, among others, of coastlines and environmental systems within the Venice lagoon: artificial reefs, sandy beaches, lagoon water environments, typical habitats (sandbanks, mudflats, etc.), lagoon islands, reclaimed areas, marshes, fish farms, and for all these habitats the Plan describes " the framework of public and private actions in a field of utilization of available resources, with the purpose of their preservation".
IT	Veneto Region	Territorial Plan of the Lagoons and Coastal Area of Eastern Veneto (PALALVO)								The "Territorial Plan of the Lagoons and Coastal Area of Eastern Veneto (Palalvo)" is related to the territory of the eastern Veneto region, in particular it refers to the municipalities of Caorle, Concordia Sagittaria, Portogruaro, S. Stino Livenza, S. Michele al Tagliamento. The Plan is divided in several systems: system of areas of natural and environmental interest, system of historical-cultural heritage and water governance, new urban identity, urban open spaces, historical and natural conservation areas, lagoon and coastal restoration measures. The plan has been adopted in 1998 but never approved.
IT	Veneto Region: (Municipalities of Rosolina, Porto Viro, Taglio di Po, Porto Tolle, Corbola, Ariano del Polesine and small portion of the municipalities of Loreo and Papozze)	Delta Po Area Plan								the contents are articulated in several systems: lagoon and coastal environmental system, environmental and landscape system, tourism development, etc
IT	Veneto Region	Regional Territorial Coordination Plan (PTRC)	x	x			x	x	x	
HR	Institute for physical planning of the Region of Istria	spatial Plan of the Region of Istria	x			x	x	x	x	
GR	Ministry of Environment, Energy & Climate Change	Regional Framework for Spatial Planning and Sustainable Development of the Region of Western Greece.								regional development
GR	Ministry of Environment, Energy & Climate Change	Regional Framework for Spatial Planning and Sustainable Development of the Region of Epirus								regional development
GR	Ministry of Environment, Energy & Climate Change	Regional Framework for Spatial Planning and Sustainable Development of the Region of Ionian Islands								regional development
GR	Ministry of Environment, Energy & Climate Change	General Framework for Spatial Planning and Sustainable Development	x	x		x	x	x	x	spatial planning

Provincial level – Strategic Plans

STATE	LEAD PLANNING AGENCY	PLAN TITLE	Themes Spatial Plans							
			Coastal Defence	Coastal urbanization /Land Use	Maritime Spatial Planning	Energy	Maritime Transport	Coastal Transport	Tourism	Other
IT	Province of Venice	The Province Territorial Coordination Plan (PTCP)		x		x		x	x	
IT	Province of Rovigo	The Province Territorial Coordination Plan (PTCP)		x		x		x	x	
IT	Province of Venice	The Province Territorial Coordination Plan (PTCP)		x		x	x	x	x	
HR	Institute for psyhical planning County Primorsko-goranska	Phisycal plan of Primorsko-goranska Qounty	x	x	x	x	x	x	x	

Local level – Strategic Plans

STATE	LEAD PLANNING AGENCY	PLAN TITLE	Themes Spatial Plans							
			Coastal Defence	Coastal urbanization/Land Use	Maritime Spatial Planning	Energy	Maritime Transport	Coastal Transport	Tourism	Other
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Zakynthos		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Lefkada		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Preveza		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Louros		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Fanari (Preveza)		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Igoumenitsa		x						Urban planning

GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Parga		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Filippiada (Preveza)		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Arta		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Kompoti (Arta)		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Corfu		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change	General Urban Plan of Lefkimmi (Corfu)		x						Urban planning
GR	Ministry of Environment, Energy & Climate Change & Ionan Island Region	Plan for spatial and settlement organisation for open cities of Palaiokastrites (Corfu)								spatial planning
GR	Ministry of Environment, Energy & Climate Change & Ionan Island Region	Plan for spatial and settlement organisation for open cities of Laganas (Zakynthos)								spatial planning
GR	Ministry of Environment, Energy & Climate Change & Ionan Island Region	Plan for spatial and settlement organisation for open cities of Arkadion (Zakynthos)								spatial planning
GR	Ministry of Environment, Energy & Climate Change & Ionan Island Region	Plan for spatial and settlement organisation for open cities of Alikes (Zakynthos)								spatial planning
GR	Ministry of Environment, Energy & Climate Change & Ionan Island Region	Plan for spatial and settlement organisation for open cities of Pylareon (Kefalonia)								spatial planning
GR	Ministry of Environment, Energy & Climate Change & Ionan Island Region	Plan for spatial and settlement organisation for open cities of Livathou (Kefalonia)								spatial planning
GR	Ministry of Environment, Energy & Climate Change & Ionan Island Region	Plan for spatial and settlement organisation for open cities of Apollonion (Lefkada)								spatial planning

GR	Ministry of Environment, Energy & Climate Change & Epirus Region	Plan for spatial and settlement organisation for open cities Thesprotikon (Preveza)		x						spatial planning
GR	Ministry of Environment, Energy & Climate Change & Epirus Region	Plan for spatial and settlement organisation for open cities of Zallogos (Preveza)		x						spatial planning
GR	Ministry of Environment, Energy & Climate Change & Epirus Region	Plan for spatial and settlement organisation for open cities of Peta (Arta)		x						spatial planning
GR	Ministry of Environment, Energy & Climate Change & Epirus Region	Plan for spatial and settlement organisation for open cities of Filotheis (Arta)		x						spatial planning
GR	Ministry of Environment, Energy & Climate Change & Epirus Region	Plan for spatial and settlement organisation for open cities of Sagiades (Thesprotia)		x						spatial planning
GR	Ministry of Environment, Energy & Climate Change & Epirus Region	Plan for spatial and settlement organisation for open cities Syvota (Thesprotia)		x						spatial planning
GR	Ministry of Environment, Energy & Climate Change & Epirus Region	Plan for spatial and settlement organisation for open cities Perdikas (Thesprotia)		x						spatial planning
GR	Ministry of Environment, Energy & Climate Change	Zone of Urban Development Control of Zakynthos		x						
GR	Ministry of Environment, Energy & Climate Change	Zone of Urban Development Control Argirades (Corfu)		x						urban planning

GR	Ministry of Environment, Energy & Climate Change	Zone of Urban Development Control Pilareou (Kefalonia)		x						urban planning
GR	Ministry of Environment, Energy & Climate Change	Zone of Urban Development Control Argostoliou (Kefalonia)		x						urban planning
GR	Ministry of Environment, Energy & Climate Change	Zone of Urban Development Control Liksouriou (Kefalonia)		x						urban planning
GR	Ministry of Environment, Energy & Climate Change	Zone of Urban Development Control Lefkadas		x						urban planning
GR	Ministry of Environment, Energy & Climate Change	Special Spatial Plan of Corfu								spatial planning
GR	Ministry of Environment, Energy & Climate Change	Special Spatial Plan of Lefkada-Zakynthos								spatial planning
GR	Ministry of Environment, Energy & Climate Change	Special Spatial Plan of Kefalonia-Ithaki								spatial planning
GR	Ministry of Environment, Energy & Climate Change	Special Spatial Plan of Paksi-Antipaksi								spatial planning
GR	Ministry of Environment, Energy & Climate Change	Special Spatial Plannig Ionian seaside								spatial planning
IT	Municipality of Caorle	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Campagna Lupia	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Cavallino – Treporti	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Chioggia	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Eraclea	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Jesolo	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Mira	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Musile di Piave	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of San Michele al Tagliamento	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Venezia	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Ariano nel Polesine	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Porto Tolle	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Porto Viro	PAT - Plan land use and Plan of action								spatial planning

IT	Municipality of Rosolina	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Taglio di Po	PAT - Plan land use and Plan of action								spatial planning
IT	Municipality of Chioggia	Piano Regolatore del Porto di Chioggia					x			
HR	Faculty of Architecture University of Zagreb	Phisycal plan for City of Rijeka		x	x	x			x	
HR	Faculty of Architecture University of Zagreb	General urban plan of Rijeka		x	x				x	

National level – Sectoral Plans

STATE	LEAD PLANNING AGENCY	PLAN TITLE	Themes Sectoral Plans												
			Energy	Land Transport	Sea Transport	Infrastructure	Port	Avifauna	Marine Protected Areas	Coastal Protected Areas (Natura 2000 sites)	Water/drainage basins - from Water Framework Directive 2000	Fishing	Aquaculture	Tourism	Other
GR	Ministry of Environment, Energy & Climate Change	Special Framework for Spatial Planning and Sustainable Development for Industry													Industry
GR	Ministry of Environment, Energy & Climate Change	Special Framework for Spatial Planning and Sustainable Development for Renewable Energy Sources	x												
GR	Ministry of Environment, Energy & Climate Change	Special Framework for Spatial Planning and Sustainable Development for Tourism												x	
GR	Ministry of Environment, Energy & Climate Change	Special Framework for Spatial Planning and Sustainable Development for Aquaculture										x	x		

Regional level – Sectoral Plans

STATE	LEAD PLANNING AGENCY	PLAN TITLE	Themes Sectoral Plans												
			Energy	Land Transport	Sea Transport	Infrastructure	Port	Avifauna	Marine Protected Areas	Coastal Protected Areas (Natura 2000 sites)	Water/drainage basins - from Water Framework Directive 2000	Fishing	Aquaculture	Tourism	Other
IT	Puglia Region	PEAR (Energetic Enviromental Regional Plan)	x												
IT	Puglia Region	PTA (Defense water plan)				x					x				
IT	Puglia Region	PAI (hydrogeologic al plan)				x					x				
IT	Puglia Region	PRT (Transport regional plan)		x	x	x					x				
IT	Puglia Region	PFV (Faunistic hunting regional plan)													hunting season
IT	Puglia Region	PRAE (Mining regional plan)													productive activities
IT	Puglia Region	PRQA (Air quality regional plan)													Air improvment
IT	Puglia Region	PUTT (thematic territorial development plan)				x	x	x	x	x	x				
IT	Molise Region	Guidelines management plans of the network "Natura 2000"								x	x	x	x	x	
IT	Molise Region	Management Plan of SIC/ZPS "Occhito Lake"										x	x		
IT	Molise Region	Plan of Water Protection									x				

Provincial level – Sectoral Plans

no data

Local Level – Sectoral Plans

STATE	LEAD PLANNING AGENCY	PLAN TITLE	Themes Sectoral Plans												
			Energy	Land Transport	Sea Transport	Infrastructure	Port	Avifauna	Marine Protected Areas	Coastal Protected Areas (Natura 2000 sites)	Water/drainage basins - from Water Framework Directive 2000	Fishing	Aquaculture	Tourism	Other
IT (VENETO)	Lido Island _Municipality of Venice	Shoreline use and management plan for the Lido Island							x					x	
IT (VENETO)	Municipality of Caorle	Shoreline use and management plan							x					x	
IT (VENETO)	Municipality of Jesolo	Shoreline use and management plan							x					x	
IT (VENETO)	Municipality of Chioggia	Shoreline use and management plan							x					x	
IT (VENETO)	Municipality of Cavallino Treporti	Shoreline use and management plan							x					x	

3.4 General socio-economic profile

T. Papatheochari, S.Niavis

Already 40 per cent of the EU's GDP are produced in coastal communities. The maritime sector amounts already to almost €500bn euros and there is still huge potential for a further growth (Gesine Meissner, parliament's rapporteur on maritime spatial planning and integrated coastal management pers. Comm.).

The Adriatic and Ionian Seas link its coastal states, all members of the Council of Europe, into a distinct European region, bringing together EU and non-EU members.

In terms of demographic trends, an overall population growth has been observed, with most areas growing albeit by significantly different degrees. From an economic viewpoint the Adriatic countries are going through a difficult transition to a self-sustainable economy with the aim of reducing their dependence on international aid. Currently, there is already a high exchange of people, goods, capital, knowledge and technologies between the two banks of the Adriatic. It is based on a deep-rooted tradition of relations and a reasonably good infrastructure and transport organisation. Tourism, by virtue of the extraordinary local natural, artistic and cultural heritage both in the European and world market, is potentially one of the most important sectors within the area for the development of local economies and for employment.

The political situation in the region makes the need for co-operation beyond frontiers even more important, as transnational co-operation enriches culture and brings peace and stability.

While some of the Adriatic countries have well developed institutional systems and have put in place mechanisms to ensure sustainable development and management of Adriatic Sea relevant areas, others have experienced challenges in doing so due to instability, political isolation and lack of experience, technical capacity and financial resources.

The countries bordering with Adriatic-Ionian Sea are characterized by great differences according to the level of their economic development. This is depicted in Figure 3-8 where the average GDP per capita of countries' coastal regions (NUTS III) for the period 2007-2011 is presented. As can be seen from the Figure, regions' average GDP p.c. is around 18,000€. The highest GDP p.c. is observed at the coastal regions of Italy, as the average GDP p.c. at 22 Italian coast regions exceeded the 24.000€ in 2011. Significantly high is the GDP p.c. at the only Slovenian region bordering the Adriatic Sea, as this is similar to the average GDP p.c. of the region. The third country in terms of GDP p.c. is Greece, as the average GDP p.c. at its ten coastal regions was close to 15,000€. The aforementioned countries are followed by Croatia (9,743€), Montenegro (5,302€) and Albania (3,229€).

Additionally, countries present different growth patterns during the period 2007-2011. The only countries presenting a continuous GDP growth trend are Albania and Montenegro. Furthermore, Italian GDP p.c. after a short decline during the period 2007-2009 is steadily increasing through the last two years. Moreover, the trends of annual GDP p.c. for the countries of Slovenia and Croatia are relatively stable. Finally, Greece seems to have been seriously affected by the economic crisis, as the GDP p.c. at its coastal regions is presenting continuous declining trends.

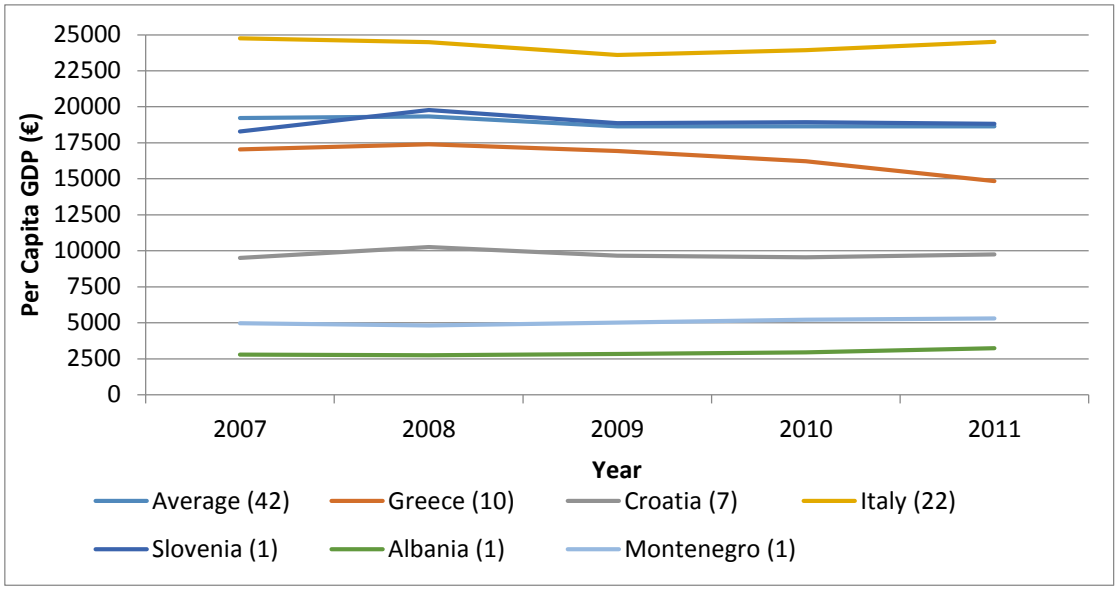


Figure 3-8 Adriatic-Ionian countries' NUTS III regions GDP per capita (2007-2011).*Numbers in parentheses denote the number of regions entered into estimations. Eurostat, 2014; Statistical Office of Montenegro, 2014; Albanian Institute of Statistics, 2014; Own elaboration

A more detailed picture about the structure of the Adriatic-Ionian regions' economy could be extracted from the data presented in Table 3-5 where three significant indicators quantifying the economic level of each NUTS III region is presented. More precisely, the first indicator refers to the relevant economic dynamic of each local economy taking into account the share of regional GDP against the total national GDP. As can be seen from the figures, the most significant local economies in terms of GDP contribution are found in Croatia and Slovenia. This fact is mainly explained from the relatively concentrated administrative structure of these countries which are divided in less number of regions than Greece and Italy. Moreover, differences are observed among the regional system of all the countries. In Greece the contribution of local economies to total GDP ranges from 0.17% (Lefkada) to 2.45% (Achaia). The same index for Croatia ranges from 0.93% (Licko-senjska) to 8.52% (Primorsko-goranska) and in Italy from 0.29% (Campobasso) to 1.60% (Venezia). Finally, the share of the Slovenian region Obalno-Kraska to total national GDP reaches 5.78%.

Additionally, the second indicator is a measure of the wealth status of each region measuring the total GDP per capita. The differences of regions in inter-national and intra-national level according to the values of the indicator are as significant as those observed by the measurements of the aforementioned indicator. The lowest GDP p.c. is found in Albania (3,229€ p.c.) and the richest in the Italian NUTS III region of Trieste (34,572€). Adriatic-Ionian Sea Greek regions' GDP ranges from 11,535€ (Arta) to 19,643€ (Zakynthos), while in Croatia GDP p.c. ranges from 7,972€ (Sibensko-kninska) to 12,777€ (Primorsko-goranska). In Italy, the gap between North and South is becoming evident from the fact that most of the northern regions have a GDP p.c. which hovers around 30,000€, while in most of the southern regions GDP p.c. does not exceed 20,000€.

Finally, the third indicator depicts the dynamics of the Adriatic-Ionian regions as these are revealed from the 2007-2011 period GDP change. The highest growth is observed in Albania (15.91%), while the highest decline is observed in Greek NUTS III region of Kefallonia (-21.60%). Almost all of the Greek regions present negative change, with the exception of Lefkada, in which a small positive change of 0.29% is observed. Croatian regions present different trends, as four of them increased their GDP in the period 2007-2011 and three of them faced a negative change. Nearly the same pattern is also observed in Italy, as 63% of its coastal regions present positive change in GDP and the rest of them negative. Finally, GDP of

the Slovenian coastal region and the country of Montenegro rose by 6.85% and 4.32%, respectively.

Country	**Region**	**Share of Total GDP**	**GDP P.C.**	**GDP 2007-2011 Change**
Greece	Arta	0.39%	11535	-3.76%
	Thesprotia	0.31%	13957	-6.82%
	Ioannina	1.10%	13023	-12.92%
	Preveza	0.36%	12450	-5.20%
	Zakynthos	0.40%	19643	-19.12%
	Kerkyra	0.87%	16888	-12.58%
	Kefallinia	0.35%	18325	-21.60%
	Lefkada	0.17%	14625	0.29%
	Aitoloakarnania	1.24%	11949	-9.11%
	Achaia	2.45%	16072	-14.42%
Croatia	Primorsko-goranska	8.52%	12777	8.71%
	Licko-senjska	0.93%	8059	0.24%
	Zadarska	3.20%	8347	0.35%
	Sibensko-kninska	1.96%	7972	-4.51%
	Splitsko-dalmatinska	8.30%	8119	-6.14%
	Istarska	6.11%	13048	0.59%
	Dubrovacko-neretvanska	2.72%	9885	-5.41%
Italy	Trieste	0.52%	34572	6.95%
	Ferrara	0.57%	24953	-6.86%
	Venezia	1.60%	29166	-0.06%
	Rovigo	0.41%	25843	1.02%
	Udine	0.95%	27572	-7.83%

	Gorizia	0.25%	28056	5.59%
	Ravenna	0.77%	30759	8.04%
	Forlì-Cesena	0.82%	32668	3.45%
	Rimini	0.63%	30311	6.93%
	Pesaro e Urbino	0.64%	27651	1.99%
	Ancona	0.88%	28863	1.02%
	Macerata	0.51%	24617	-1.67%
	Ascoli Piceno	0.30%	21995	-10.80%
	Teramo	0.44%	22371	6.01%
	Pescara	0.46%	22349	4.10%
	Chieti	0.58%	22967	7.94%
	Campobasso	0.29%	19758	-7.39%
	Foggia	0.59%	14659	-3.82%
	Bari	1.58%	19878	0.91%
	Taranto	0.65%	17769	3.40%
	Brindisi	0.43%	16707	4.19%
	Lecce	0.81%	15694	-3.78%
Slovenia	Obalno-kraska	5.78%	18829	6.85%
Montenegro	Whole Country		5303	4.32%
Albania	Whole Country		3229	15.91%

Table 3-5 Adriatic-Ionian Regional Economic Indicators. Eurostat, 2014; Statistical Office of Montenegro, 2014; Albanian Institute of Statistics, 2014; Own elaboration

Coastal and maritime activities play a significant role in the socio-economic trends of the Adriatic regions. The map below shows the GDP in comparison with the national average which is equal to 100 while Figure 3-9 shows the percentage of population impacted by maritime activities.

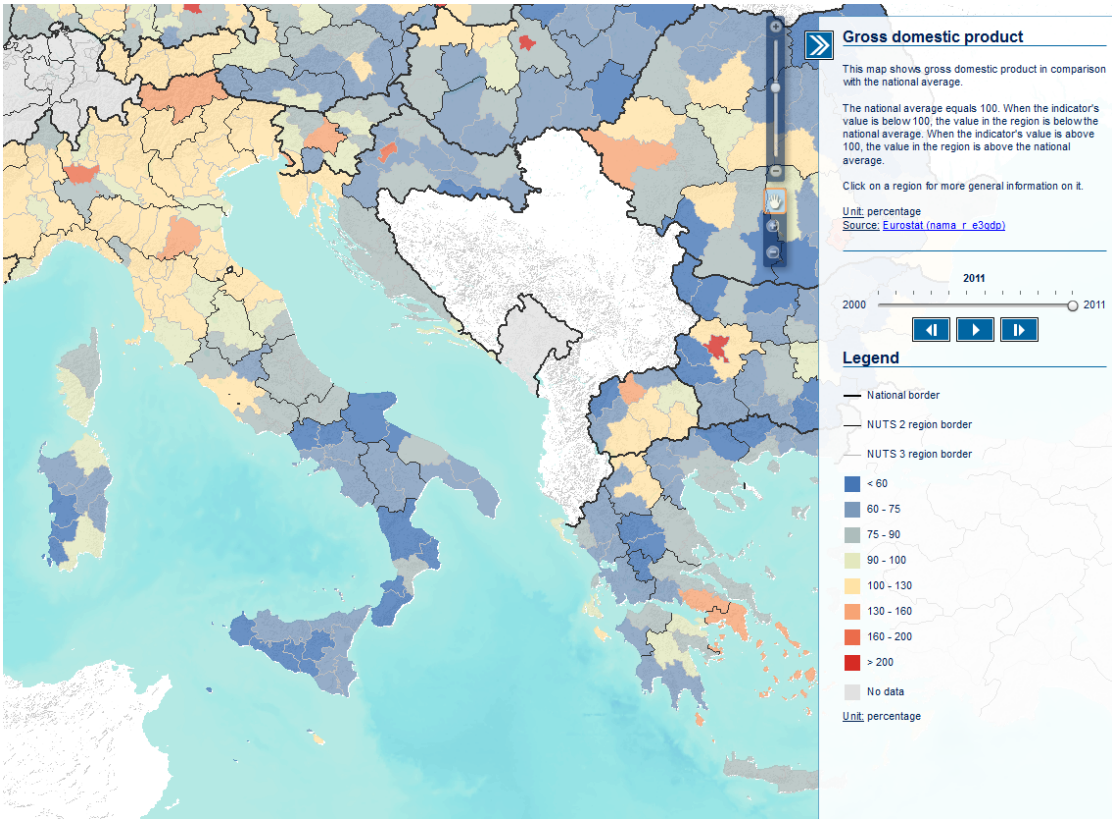


Figure 3-9 GDP (Italy, Greece). Eurostat, European Sea Atlas, 2011 on NUTS 3 2006 regions

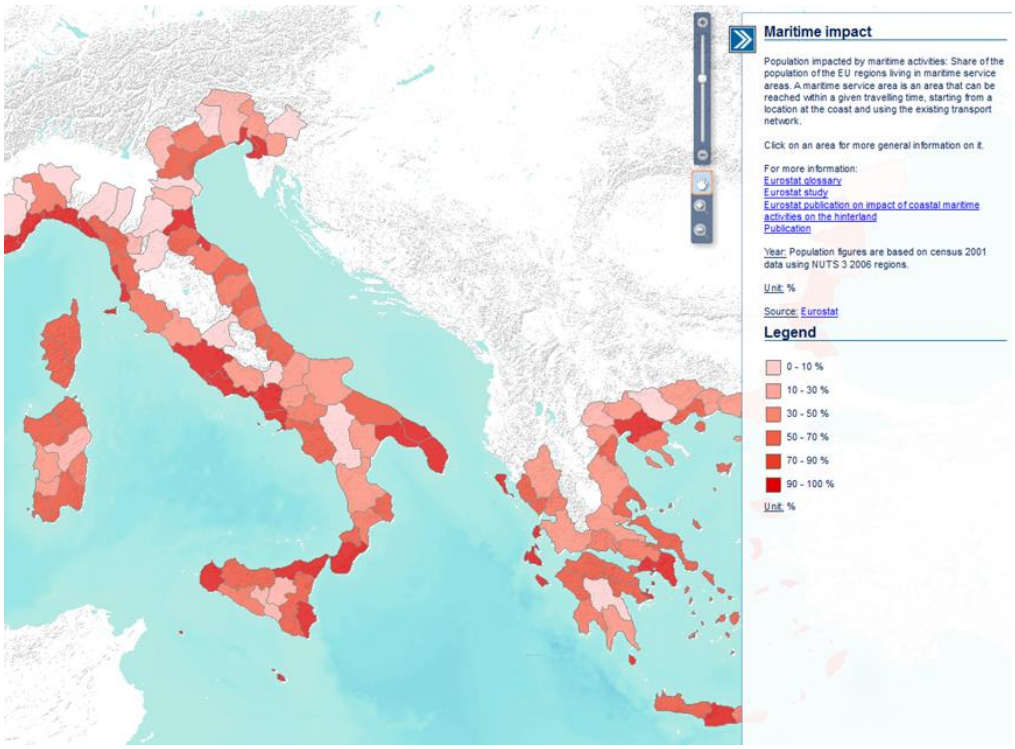


Figure 3-10 Population impacted by maritime activities (Italy, Greece) (source: Eurostat, European Sea Atlas, 2001 data using NUTS 3 2006 regions)

The share of the population living in maritime service areas, namely the areas that can be reached within a given travelling time, starting from a location at the coast and using the existing transport network is illustrated at Figure 3-10. The map shows an important share of

coastal population being impacted by maritime activities showing the direct interactions between land and sea.

The connection between people and sea in the region of Adriatic-Ionian Sea is reflected on the maritime activity in the whole region. Maritime transport of goods and people is a crucial sector for the economies of the region and the ports of Adriatic-Ionian Sea are among the most active ports of Europe. This is reflected by the share of regions' goods and passengers traffic to the total traffic of European ports which is presented in Table 3-6.

The figures of cargo traffic denote that the region is mostly specialized in dry bulk transport, since the relative volume against total European handling volumes is reaching 7.5%. The lowest performance is observed in the container handling sector as the percentage of the Adriatic-Ionian ports to the total European volumes is just exceeding 2%. This lack of competitiveness is mostly caused by the dominance of North European ports both in terms of infrastructure and in terms of hinterland connections' quality. Additionally, region has a high share of cruise traffic, as it attracts about the 14.5% of tourists cruising at Mediterranean. Finally, the region is amongst the most active European regions in international passenger traffic as the 8.$% of all ship passengers were travelling from Adriatic-Ionian ports.

Traffic Type	**Adriatic-Ionian / European Volumes**
Cargo	
Container	2.30%
Liquid Bulk	5.20%
Dry Bulk	7.50%
Ro-Ro	3.40%
Passenger	
International Passengers	8.40%
Cruise	14.50%

Table 3-6 The Relative Performance of the Adriatic-Ionian Ports (2011). SEETO, 2011; European Cruise Council, 2012; Eurostat, 2014; Port Authorities

Maritime transport significantly contributes to the establishment of enterprises and local employment. In Table 3-7 the number of local units which are directly or indirectly involved in sea transport services and their employees are presented for the Adriatic-Ionian regions. As can be seen from Table 3-7, the local units which operate at the water transport sector are 2193 and the employment at the sector exceeds the number of 10.000 employees. Additionally, the warehousing and other transport activities which at the coastal regions mainly concern combined transportation, logistics and shipping activities are also playing a significant role for the local economies since they provide employment to more than 100k people. At the spatial level the more active regions are these of North Italy, Ionian Islands and the coastal part of Croatia.

Country	**Spatial Unit**	Water Transport		Warehousing and support activities for transportation	
		Local Units	Employees	Local	Employees

				Units	
Greece	Ipiros	33	109	156	0
	Ionian Islands	281	791	118	271
	Western Greece	34	125	285	1029
Italy	Veneto	851	2688	2247	28753
	Friuli-Venezia Giulia	20	438	740	6788
	Emilia-Romagna	65	835	2032	37192
	Marche	8	685	547	4616
	Abruzzo	10	7	418	4269
	Molise	8	8	73	340
	Puglia	39	158	1424	10587
	Basilicata	0	0	177	990
Slovenia	Coastal	78	289	610	5588
Croatia	Coastal	689	4135	1093	23018
Montenegro	Total		187		3433
Total		**2116**	**10455**	**9920**	**126874**

Table 3-7 Local Units and Employment in the Water Transport Sector. Eurostat, 2014; Croatian Buraeu of Statistics, 2014; Statistical Office of Montenegro, 2014.

Fishing activities significantly contribute to the local and national economies of the region. Despite the fact that the percentage of fishing activities to the total national GDP is about 1% for the Adriatic-Ionian countries, the sector provides the processing enterprises with, highly exportable, valuable raw material and, additionally, generates a high number of jobs, especially in the coastal regions of the countries (Cataudella et al. 2005). The significance of fisheries sector is revealed by the data depicted in Figure 3-11, where the total share of exported fish products to the total exported agicultural products and merchadised products is presented. As can be seen from Figure 3-11 fish products exceed 10% of the total exported agricultural products with the exception of Montenegro and Slovenia. It should be noted that fish exports in Albania accounts of about one third of the total exported agricultural products. Additionally, fish products represent a significant share of total merchadised products exports in all of the countries, with Greece and Albania holding the largest share.

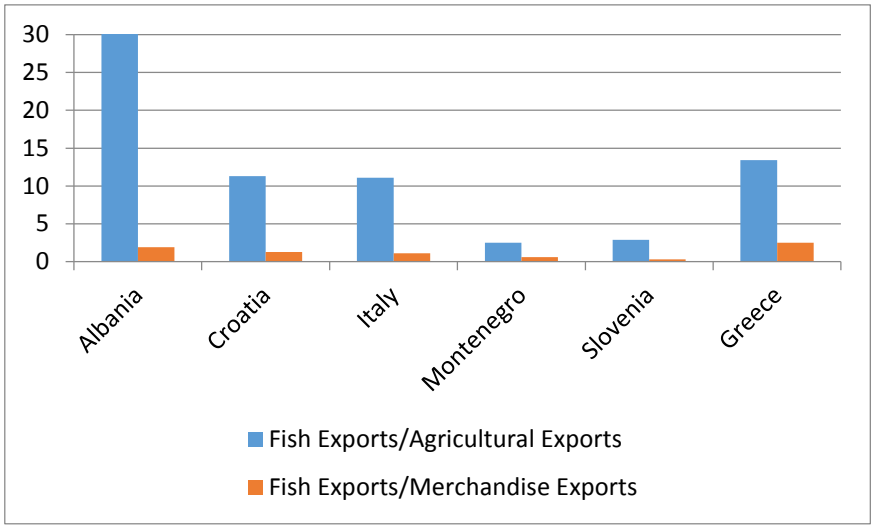


Figure 3-11 Contribution of Fishing Products to Exports (2011). FAO, 2014; Own Elaboration.

If tourism overall is an important economic activity in EU, it is even more true for coastal regions, being one of the main and fast-growing activities in AIM. World Tourism Organization (UNWTO) expects the number of tourist arrivals worldwide to increase by 3.3 % on average per year until 2030. (WWW.UNWTO.org). Accounting for over half of the international arrivals, Europe is the fastest growing region. Almost two out of three European tourists (63%) prefer coastal regions as their favorite holiday destination (Facts and figures on the European on holiday: 1997-98', Eurobarometer 48, Brussels, 1998).

The Blue Growth study on scenarios and drivers for sustainable growth from the oceans seas and coasts (Ecorys, 2012) points clearly to the importance of coastal tourism within the Blue Economy overall: a total of 2.75 mln people (including yachting and marinas as well as cruise tourism) are directly employed as a result of these economic activities – about half the employment of the Blue Economy as a whole (out of an estimated 5.4 mln). Maritime and coastal tourism is of huge importance to a large number of local economies. In light of the current economic, financial and public finance crisis it becomes the more important to address the challenges and opportunities of this sector.

In UE, Mediterrenean is the sea-basin with the highest GVA related to coastal and maritime tourism (Table 3-8).

	Mediterrenan Sea	**Black Sea**	**Baltic Sea**	**North Sea**	**Atlantic Oceean**	**Total**
Total GVA	**90.3**	1.3	18	31.1	34.5	**183**
Coastal tourism	**62.3**	1.3	11.7	20.8	26	**130**
Cruise tourism	**9.0**	0	1.7	1.9	1.8	**15**
Yachting and marina	**19.0**	0	4.6	8.4	6.7	**38**
Total	**1540.8**	26	306.2	564.3	594.5	**3182**

Employment						

Table 3-8 GVA and employment in maritime and coastal industry in 2011, per sea-basin (GVA in € bln, employment in 1000 jobs). Eocrys, 2013

Also, the importance of the Mediterranean Sea in the maritime and coastal tourism has increased during last years. In the AIM, the share of coastal tourism in total employment is about 2% in Italy, 0.8% in Slovenia and 3.7% in Greece (Policy Research Corporation (2008), Eurostat).

As far as nautical sector, AIM includes 3 out of 5 of the most developed Mediterrenean countries for maritime tourism (Table 3-9). Moreover, in some areas, e.g. in Montenegro, the demand for yacht mooring is much bigger than supply. On the other hand there is a growing demand for building new public bathing spots for tourists. Overall, the private versus public space arrangement on the limited ground is one of the major problems on the Adriatic coast (Plancoast, 2007).

Mediterrenean Countries	**Total pop. (Millions)**	**GNI per capita (€)**	**Number of categorized commercial marina**	**Number fo commercial moorings**	**Distance between marinas along the coast (Km)**
Spain	40	22.000	245	80.061	21,2
France	60	27.500	99	64.710	5,6
Italy	**60**	**26.800**	**478**	**167.875**	**17,8**
Greece	**11**	**19.900**	**63**	**12.797**	**217,1**
Croatia	**4,5**	**10.700**	**83**	**15.407**	**70,3**

Table 3-9 Development of top five Mediterranean countries in nautical tourism. Eocrys, 2013

Maritime and coastal tourism is essentially a cross-cutting theme and because the inclusion of tourism as EU competence is relatively recent, there is no specific regulatory framework for it.

Response capacity is limited by a fragmented and uncoordinated sector. A macro-regional approach to coastal and maritime tourism could be an incentive to strengthen governance, the key performance and overall competitiveness of the EU's maritime and coastal tourism sector and to mobilize participation of private actors and International Financial Institutions.

Considering the framework traced by Blue Growth strategy, including Integrated Maritime Policyand EUSAIR (pillar 4: Increasing regional attractiveness), the following needs and priorities can be addressed through MSP at macroregional scale:

- *Strenghten sustainability of coastal and maritime tourism*

One of the objective of MSP is to help to address policy options and regulatory framework limiting the main environmental impacts challenging the development of the touristic sector.

Measures to be proposed shall address to water and soil quality, water quantity (scarcity/competition with other industries particularly in southern Europe), soil sealing and related consequences, preservation of biodiversity and Natura sites, limitations of pressures coming from waste and indirect environmental impacts such as air (GHG) emissions. Habitat fragmentation, deterioration or destruction, competition for natural resources, import of invading species, trampling, stress in animals are other tourism-related impact to consider. Moreover, coastal and maritime tourism play a definite role in generating beach and marine

litter. Waste has the potential to become beach and marine litter if not handled (recycled or disposed) properly. According to UNEP (2009), 52% of marine litter in the Mediterranean originates from shoreline and recreational activities highly related to the tourism industry.

The cruise sector alone is showing a strong potential for growth. Over the past 10 years, the demand for cruising has roughly doubled worldwide. This is reflected in AIM, which is already seeing rapid growth. However, to locally capture the economic benefits and mitigate the possible negative effects of short and massive tourist arrivals, cruise sector should be better integrated in the tourist offer of the Adriatic-Ionian territories. A thorough waste management control for cruise ships is essential to prevent environmental disasters.

The European Commission – Enterprise and industry - has developed a European Tourism Indicators System (ETIS) for Sustainable Management at Destination Level. The first pilot phase, from 15 July 2013 to 15 April 2014, involved 100 tourism destinations across Europe which have expressed their strong interest to test the System in order to measure and to monitor their sustainable tourism management performances.

The results of this first phase will surely give additional useful information on the sustainability of coastal and maritime tourism in AIM.

- *Establish common strategies for addressing climate change*

Climate change is producing and will produce impacts on the tourism sector in many ways, with different effects on different types of holiday. One of the sectors most affected by climate change is the one of the outdoor activities (including beach tourism), especially in the coastal area. Climate change will have both direct and indirect impacts on the different types of tourism activities: direct, because the performance of the tourism activities requires favorable weather conditions; indirect, because the changing physical conditions of the destinations (mainly about coastal erosion) may indirectly decrease the attractiveness of tourism.

Italy, through the Ministry of Environment, is promoting a National Strategy for Adaptation to climate change, that include also planning, technical and non technical measures. MSP can help the development of the scheduled measures for maritime and coastal tourism, giving priority to conservation and reconstruction of dunes, natural restoration of rivers, conservation of Posidonia Oceanica, planning of beaches maintenance (Elements of a National Strategy for Adaptation to Climate Change - Document for public consultation, 12 September 2013).

- *Establish transnational cooperation to enhancing the value and appreciation of culture and natural heritage and avoid volatility of coastal and maritime tourism demand*

The business model of "sun-and-beach" mass-tourism appears to be increasingly problematic and less sustainable, as the EU's competitiveness in this segment is challenged: it creates volatility as the business model is constantly replicated in low-cost countries outside the EU.

On the other hand, cruise tourism follows a more successful trajectory in terms of economic performance and coastal regions (including cruise destinations themselves as well as their surrounding regions) struggle to create and capture economic benefits, whilst pressures to invest in port infrastructure go up.

Enhance competitiveness and strengthen response capacity can be done through policy actions supporting Mainstreaming and networking: includes more structural measures with an emphasis on trans-regional and trans-national cooperation and on the medium-term horizon.

A volatility of demand through years and seasons is constantly reported and the average expenditure by night has been decreasing over time, and so has been the average length of stay.

Moreover, cultural and archaeological heritage in the region represents a strong asset which should be duly exploited. Alternative or innovative and sustainable forms of tourism (e.g. sports, eco, cultural, nautical, thermal, rural, religion, scholastic, business, etc.) and their integration with festivals and creative industries have also interesting potential for development, establishing links of coastal and maritime tourism with other forms of regional economic development.

Trans-border co-operation within the strategy does also offer possibilities for developing the hinterland of coastal areas (e.g. by targeting rural areas, or through joint identification and promotion of transnational thematic tourist products and routes). Joint action in that area should be based on an analysis of large-scale spatial development tourism trends and its potential impact on the wider socio-economic development, as well as on systematic exchange of know-how. Improving coordinated governance in the tourism sector among private and public entities can lead to:

- Enhancing and improving safety and security of all tourism products, especially diving, sailing and adventure tourism type of products.

- Improving quality management and sustainability, e.g. through the European Tourism Quality label (ETQ) or other joint labels, as well as the promotion of service innovation (e.g. through the use of ICT).

- Promoting tourism activities and services based on local products (agro and sea foods), cultures and values, avoiding pressure on local communities and cultures: commercialization of local culture, cultural homogenization, too rigid adaptation to tourist demands, social tensions.

- *Improve transport for coastal and maritime tourism*

AIM presents the need of Improving connectivity, especially of islands, possibly establishing new ferry routes or extending the existing ones also for winter-autumn season.

The Adriatic Sea includes more than 1300 islands and islets, most along the Adriatic's eastern coast—especially in Croatia, with 1,246 counted, including the largest—Cres and Krk, each covering about the same area of 405.78 square kilometers. The Croatian islands include 48 permanently inhabited ones, the most populous among them being Krk and Korčula.

Another important need in the AIM is the improvement of intermodality of transportation (a need that is even more crucial for commercial transport) and of land-side accessibility.

- *Introduce common regulations for maritime tourism*

There is a wide disparity in Member States practice as regards licensing/qualifications for recreational boat operators. Also, there are about 4,500 marinas (recreational boat harbours) in Europe and these are not subject to either a common regulatory framework or even common technical standards for building and managing marina (eg. ISO or CEN).

A formal regulation for visiting yacht is not in place neither it seems there is a need for it, since the visiting yacht are only a small part of marina occupancy. While the case for the regulation of marinas does not appear to have been made out, a common certification system (compulsory licensing for sailing and motor boats) might be useful for the sector particularly as regards visiting yachts engaged in maritime and coastal tourism.

Considering the geomorphology of AIM and its central position in Europe, another key issue is its position as European energy crossroad. The port of Trieste is acting as the supplier of the crude oil *Transalpine Pipeline*. Moreover, several energy pipelines are planned to bypass the Adriatic-Ionian Sea, thus serving the East-West energy chain. The first planned pipeline is the *Pan-European Oil Pipeline* (PEOP) starting from Constanta and ending to Trieste in Italy. The second planned oil pipeline is the *AMBO pipeline* starting from the Bulgarian Black Sea port of Burgas and ending to the Albanian port of Vlorë. The existing and the planned oil pipelines of the region are depicted in Figure 3-12.

Figure 3-12 The Oil Pipelines of Europe . US Energy Information Administration (2013)

Additionally, the Adriatic-Ionian region is planned to be bypassed by the *Trans Adriatic Pipeline* (TAP). This project concerns the transportation of natural gas from Azerbaijan via Greece and Albania to Italy and further to Western Europe. Also, the The IGI project forms part of a larger project, named the ITGI (Interconnection Turkey – Greece – Italy) project with an offshore section (207 km) called the Poseidon Pipeline. The projects are depicted in Figure 3-13 and Figure 3-14.

The extremely complicated nature of the pipelines' projects and the number of actors involved strengthens the uncertainty about the successful completion of the projects. Nevertheless, the economic perspectives arising for the Adriatic-Ionian Sea countries, both during the construction and the operational phase of the projects, are notable.

Figure 3-13 The Route of Trans Adriatic Pipeline. Trans Adriatic Pipeline (2013)

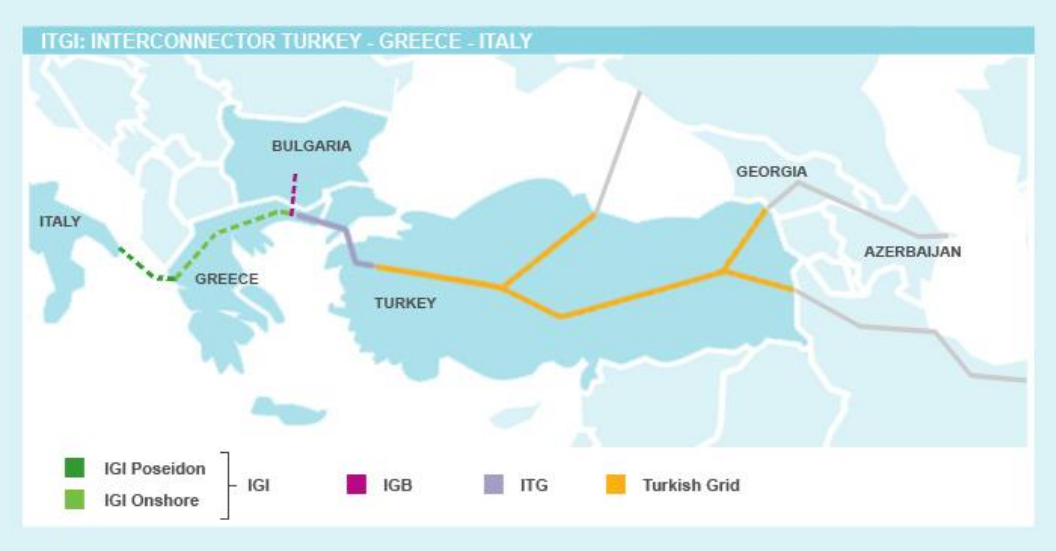


Figure 3-14 The ITGI- Interconnector Turkey-Greece-Italy. Edison Corporate

Some insights concerning energy production and consumption in the macroregion can be extracted from the ALTERENERGY project focusing on specific Adriatic regions as can be seen in Table 3-10. According to this table, the current energetic framework in the Adriatic Area is quite heterogeneous. The analysis conducted shows that Northern Italian regions are characterized by high Electrical Consumption per capita, and a small number of municipalities are involved in the Covenant of Mayor Initiative (CoM)[1]. In central and southern Italy, the electrical consumption is lower and in line with the countries of the eastern Adriatic shore. In central and southern Italy, a high number of municipalities in the last years joined the CoM Initiative. Finally, the energy production from renewable so[197]urces (RES) is higher in areas historically characterized by large hydroelectric plants (Montenegro, Split and Dalmatia, Serbia, Epirus, Abruzzo) and in some Regions that have, more recently, invested in wind energy, solar energy and electrical production from biomasses (Puglia, Molise and Emilia Romagna Regions).

Country	Territory	Municipal Cities involved in CoM	Total municipal Cities	Electrical Consumption (GWh)	Electrical Consumption / Population (MWh / person)	Renewable Energy Production (GWh)	RES Production/ Electrical Consumption %
Albania	District of Lushnja	na	na	181,37	1,27	0	0
	District of Lezha	na	na	164,3	0,76	0	0
Greece	Epirus Region	2	18	1296	3,85	632,08	49
Croatia	Istria County	7	31	1093	5,30	0,01	0

[197] The Covenant of Mayors is the mainstream European movement involving local and regional authorities, voluntarily committing to increasing energy efficiency and use of renewable energy sources on their territories. By their commitment, Covenant signatories aim to meet and exceed the European Union 20% CO2 reduction objective by 2020.

	Primorje-Gorski Kotar County	4	22	1382	4,67	275,49	20
	Split and Dalmatia County	na	55	1607,05	3,53	1245,08	78
Italy	Abruzzo Region	305	305	6344,7	4,73	2447	39
	Emilia Romagna Region	59	348	27310,9	6,21	2908	11
	Friuli Venezia Giulia Region	4	218	9720	7,87	2093	22
	Marche Region	27	239	7266,5	4,64	897	12
	Molise Region	83	136	1411,8	4,41	975,3	69
	Puglia Region	137	258	17520	4,28	3816	22
	Veneto Region	72	581	29747,2	6,02	5005,9	17
Montenegro	Whole country	5	21	3211	5,18	2762	86
Slovenia	Whole country	na	210	11966	5,89	3382	28

Table 3-10: Energy data overview in the ALTERENERGY area (data referred to 2010)
Source: ALTERENERGY project, 2012

4 Maritime uses

In the following sub-paragraphs a synthetic description of the marine/maritime uses is reported having in mind the main objective of the report which is the planning issue in the context of MSP. The analysis is reported for the AI macroregion and for each of the two Focus Areas. Whenever possible, depending on data availability, a time trend on a specific use is addressed. Being this document a work in progress, we shall identify in detail both in space and time conflict between uses accordingly to the maps and layers of uses that will be produced in the next phase.

4.1 Commercial transport

R. Mosetti, M. Lipizer, S. Fraschetti, G. Farella, F. De Leo, T. Papatheochari, S. Niavis, S. Mezek, S. Belošević

Deeply incised into the European mainland, the Adriatic Sea has long been an important transport route for its geographical, and indeed geopolitical, placement. On its coast highly industrially developed countries and less industrially developed mid-European countries (several of which are land-locked) gravitate naturally to the Adriatic Sea. Some of these are heavily dependent on that maritime route for their energy imports: as an example Austria receives 75 per cent of its oil imports through Adriatic ports, and Bavaria in Germany even more. Given their position both on the east-west and north-south axes of Europe, the Adriatic and Ionian Seas constitute an important maritime transport route. One of the key elements establishing the outward orientation of the Adriatic-Ionian countries' trade and strengthening their position regarding the global logistic chains is the port sector.

The main competitive advantage of Adriatic-Ionian ports is their proximity to a large market extending from the Balkan Peninsula to Central Europe. The main weakness of the ports, and especially for the northern ports of the region, is their relative long distance from the main Suez-Gibraltar sea-route and the relative lack of competitiveness against the ports of Northern Europe. Nevertheless, ports of AIM are considered as critical nodes of international trade networks and economic co-operation, bearing the largest share of the total imported and exported cargo volumes. AIM ports own significant infrastructure which provides them with the ability to adequately handle different kinds of cargo (Notteboom, 2009; South East Europe Transport Observatory – SEETO, 2011; Niavis and Tsekeris, 2012).

Several central European and landlocked countries depend heavily on the northern Adriatic ports for their imports. Five Northern Adriatic ports (Koper, Ravenna, Rijeka, Venezia, Trieste) have gathered considerable importance within the logistical platform of the North Adriatic Port Association (NAPA). NAPA was established in Trieste in March 2010 by the port authorities of Ravenna, Venice, Trieste and Luka Koper to start mutual cooperation to increase the potential, the quality and the efficiency of the Northern Adriatic ports, transport infrastructures and related services with the general goal to become a European multi-port gateway. Rijeka Port Authority joined the association in November of the same year, while port of Ravenna is no longer part of NAPA from 2012. The partners agreed in particular to establish a network of North Adriatic port community systems capable of integrating all the transport community members, to exchange data on the shipping lines and vessels operating between seaports and harbours in order to achieve coordination and integration and to promote the concept of "Single Window" with the aim of reducing transaction costs and operation turnaround time.

Considering all the above, AIM plays a key role in the development of intermodal maritime-based logistics chains in Europe, which should bring about a structural change in our transport organisation within the next years to come, with the group of EU project that are grouped in the "Motorways of the Seas" (MoS) concept.

In its Transport White Paper of September 2001, the European Commission proposed the development of "Motorways of the Sea" as a "real competitive alternative to land transport." These "motorways of the sea" should be part of the Trans-European network (TEN-T).The adoption of Article 12a of the TEN-T Guidelines of 29 April 2004 ("TEN-T" - Official Journal L 167, 30/04/2004 P.0001 - 0038, COM(2004)0884) by Council and European Parliament gives a

legal framework for funding the "motorways of the sea", giving three main objectives for the sea motorways projects:

(1) freight flow concentration on sea-based logistical routes;

(2) increasing cohesion;

(3) reducing road congestion through modal shift.

Considering the third point, an important issue is represented by intermodality and connections with the hinterland, especially related to the general lack of connection with the railways network. Being one of the most relevant issue for the development of maritime transport, this aspect will be addressed further.

AIM includes one of the four corridors designated by the European Commission: Motorway of the Sea of south-east Europe -connecting the Adriatic Sea to the Ionian Sea and the Eastern Mediterranean, including Cyprus (Figure 4-1).

Figure 4-1 Motorways of the Seas in the Mediterrenean. EC.

Two Actions have been developed on this corridor: Adriatic Motorways of the Sea (ADRIAMOS) and ITS Adriatic multi-port gateway (TEN-T, 2012).

ADRIAMOS aims to enhance a viable, regular and reliable sea-based transport service integrated in the logistisc chain along the Adriatic-Ionian transport corridor between the Port of Venice and the Ionian Sea/West Greece port cluster (Igoumenitsa and Patras), thereby contributing to the reduction of economic, social and environmental costs related to port and logistics activities. The beneficiaries and implementing Authorities were Venice and Igoumentisa Port Authorities.

ITS Adriatic multi-port gateway is promoted and coordinated by Venice Port Authority, where the consortium partnership includes partners of the NAPA and the Italian Ministry of Transport. In the framework of this action, NAPA ports agreed to focuson the deployment of ICT solutions enabling an efficient information exchange between the NAPA ports and all the actors involved in the intermodal transport processes.

As far as the routes, the geographic shape of Adriatic Sea is characterized from a long route from south to north where the larger ships as oil tankers are navigating from straight of Otranto toward north-Adriatic ports as Trieste or Koper (Figure 4-2). These ships routes are frequently crossed by other ships like ferries, yachts, oil tankers or other commercial ships navigating from East to West coast of Adriatic (Figure 4-3). This situation increases the risk for maritime incidents with great impact on sea-pollution: an important key issue related to

maritime transport in AIM is related to safety, respect to incidents that can have disastrous consequences for the environment and its biodiversity. Adriatic sea is one of the world's most sensitive areas being a sea almost "closed" basin including many MPA established in order to preserve the delicate balance of its ecosystems. Possible pollution by oil and other hazardous and noxious substances must be avoided, preserving and improving the overall safety of the sea. Over the past 15 years, in the Adriatic over 170 incidents took place. In order to provide a prompt and effective response, new early warning and predictive applications to monitor the risky factors caused by technological hazards in Adriatic are under development in the project HAZADR, in the framework of IPA Adriatic Cross-border Cooperation Programme, running from October 2012 to March 2015. The objective of the project is the establishment of a cross-border network for the prevention of risks and for the early management of emergencies, in order to reduce the risk of pollution and contamination of the Adriatic sea and its coasts. In fact, the basic problems in the cross-border area lie in the facts that the general and specific regulations are not harmonized and that response teams for contingencies at sea are not adequately trained nor prepared. Furthermore, only 4 out of 6 Adriatic states have adopted their own national contingency plans in event of accidental sea pollution by oil, hazardous & noxious substances, while regional contingency plans are practically non-existent (HAZADR, 2014).

According to the study of Det Norske Veritas (DNV), the Adriatic Sea has an accident frequency more than five times as high as the world average. The accident occurrence as related to the commercial traffic load was evaluated to be higher for the Adriatic Sea than for other highly dense shipping areas like the Mexican Gulf and the Barents Sea. Luckily until now there was not any serious maritime incident with potential impact on maritime environment but if it happens the separate operational response of regional countries to the incidents involving major spills it will take long time, enormous expenses and from some countries due to their lack of equipment it will be no response at all. Another important feature to maritime transport and shipping in general is the current levels of traffic in Adriatic Sea, apart from incident risks, raise serious concerns for the coastal states. That especially relates to operational oil discharges from large ships, mainly on international shipping routes that traverse the Adriatic. SHAPE (2014) includes maps of increased risk of sinking and collisions.

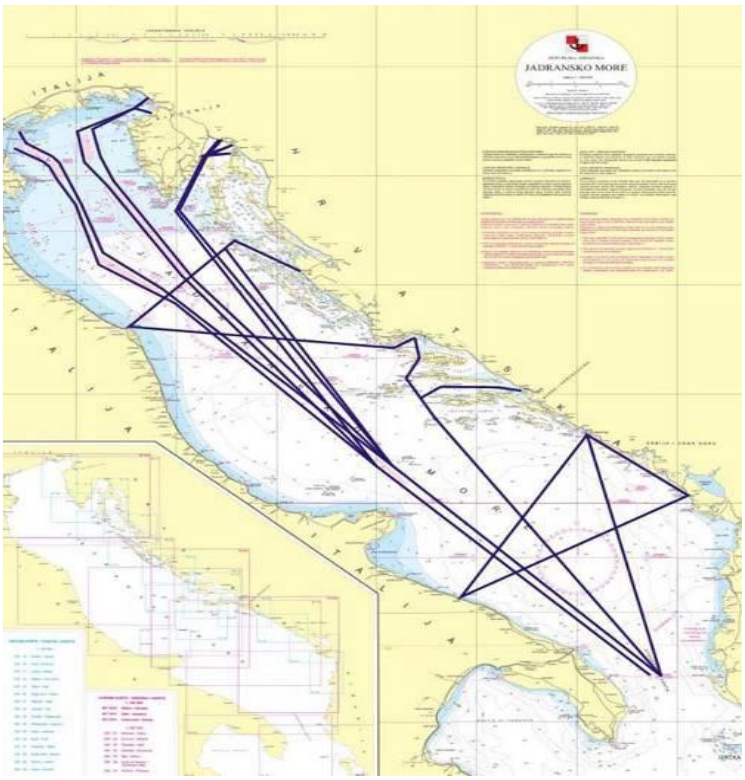


Figure 4-2 Traffic routes and maritime traffic intensity in the Adriatic Sea in 2008. Policy Research Corporation, 2011

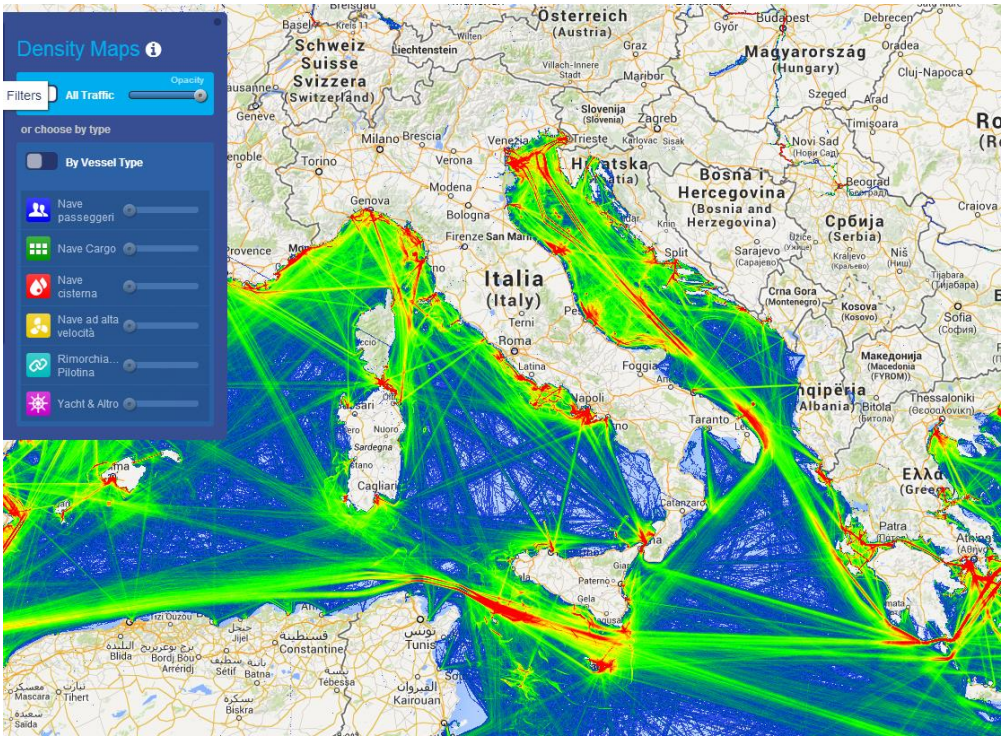


Figure 4-3 Marine traffic density. From http://www.marinetraffic.com/it/ais/home, last access 06.05.14

Container Ports

Undoubtedly, containerisation, as a global trend, has altered the way that seaborne trade is conducted in the Adriatic-Ionian Sea. Many port authorities have seized the opportunities arisen from container transport operations, because of the resulting high added value, and they have gradually carried out investment plans to facilitate container transfers (Niavis and Tsekeris, 2012). These investments increased the volume of container flows in many ports and brought about remarkable changes in the hierarchical position of ports, in terms of the volume of containers handled. In Figure 4-4 the annual container volumes transported through the main ports of the region are presented for the period 2005-2012.

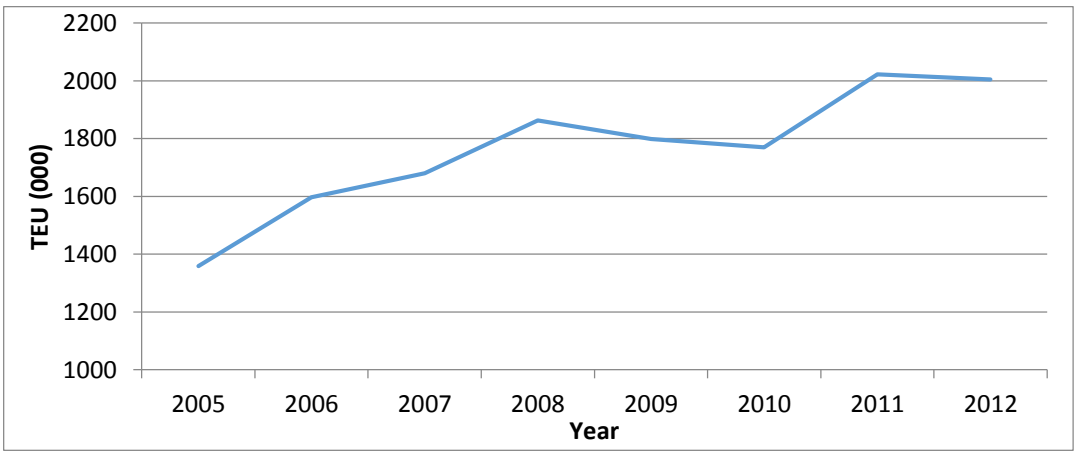


Figure 4-4 Annual Container Traffic in the Adriatic-Ionian Region (2005-2012). SEETO, 2011; Eurostat, 2014; Port Authorities

As can be seen from Figure 4-4, the annual container traffic in the region has grown significantly from 2005 to 2012. The annual transported containers in 2012 exceeded the number of 2 million TEU when in 2005 the annual transported TEU did not exceed 1.4 million. The economic recession of 2008 decelerated the continuous growth that was observed this year but, as figures show, the region is recovering after 2010. The services of the region can be classified into two basic categories. The first category of services is consisted by the Deep Sea shipping lines connecting Asia and Europe and the second category is consisted by the Intra-Mediterranean services. This category is formed by two types of services, feeder services connecting the ports of the Adriatic-Ionian region and services connecting the ports of Adriatic-Ionian region and the ports of East Mediterranean. The region is dominated by services of the second category. The main reason behind this dominance is the pattern of East-West connection that is adopted by the main shipping lines. More specifically, the vast majority of routes between Asia and Europe bypass Mediterranean through Souez-Gibraltar route and call at the ports of Northern Europe. While crossing the Mediterranean, ships call at specific transhipment ports which are situated close to the main route and containers reach the hinterland of Mediterranan countries through the hub and spoke system. Thus, Mediterranean ports mainly operate either as transhipment hubs or feeder ports and in a lesser extent as gateway ports. The main types of services of the adriatic ports are presented in Figure 4-5.

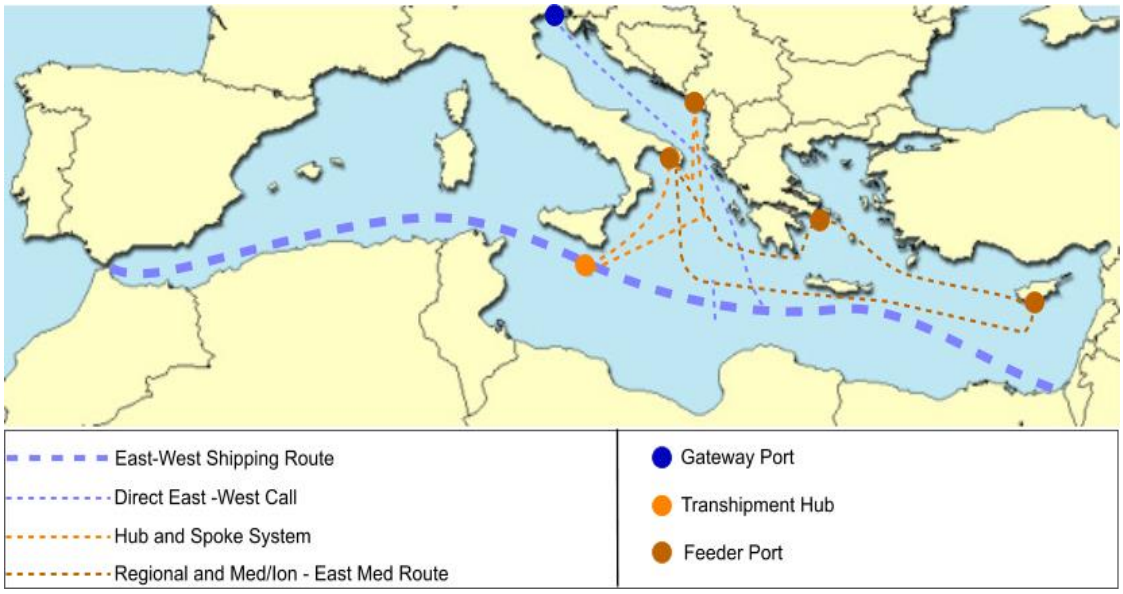


Figure 4-5 Container Shipping Patterns in Adriatic-Ionian Region. MDS Transmodal Limited, 2011; Own Elaboration

Service providers in the region are also classified according to the type of service that are providing. Thus, the region is served either from global carriers which present significant activity in the East-West routes and carriers which are specialised in local feeder services. Cooperation and joint operations are a common pattern in the services of the region, especially after the economic crisis of 2008 and are mainly forced by the effort of shipping lines to reduce costs and earn a largest share of the transported containers. In the deep sea routes two main joint operated services are observed. The first one refers to the service provided by CMA-CGM and MAERSK and the second to the service provided by the joint operation of Cosco, "K" Line, Yang Ming, Hanjin and Evergreen shipping lines. The first service employ vessels of about 5.000 TEU carrying capaciy and the second one vessels of capacity that ranges from 6.500 to 8.000 TEU. Both services are provided in a weekly basis (MDS Transmodal Limited, 2011; K Line, 2012; Luka Koper, 2014).

Additionally, in the intra mediterranean services the shipping lines operating in the region are far more in number than in the aforemntioned service. The main providers in the feeder and in the Adriatic - East Mediterranean routes are MSC, ZIM, Cosco, Evergreen, X-Press and Grimaldi. The carrying capacity of the vessels employed by the feeder services are significantly smaller than the capacity of the vessels of deep sea routes and ranges from 500 to 1750 TEU. The connections of each port through the shiiping lines and the types of the services that each port accommodates are presented analytically in Table 4-1.

	East-West	**Intra-Med**	**Shipping Companies**		
Ancona	0	8	Sermar	Evergreen	Cosco
			X-Press	Hapag Lloyd	MSC
			Adria Maritime	Italia Marittima	
Bar	0	2	Grimaldi	X-Press	
Bari	0	0			
Brindisi	0	1	MSC		
Durres	0	1	Zim		
Koper	2	12	CMA-CGM	Maersk	Cosco
			Yang Ming	K Line	Hanjin
			Evergreen	Hapag Lloyd	X-Press
			MSC	Grimaldi	Zim
			Sermar		
Ploce	0	1	X-Press		
Ravenna	0	13	Sermar	Evergreen	Alfa Levant
			X-Press	Hapag Lloyd	MSC
			Italia Marittima	Borchard	Grimaldi
			Zim		
Rijeka	2	4	CMA-CGM	Maersk	Cosco
			Yang Ming	K Line	Hanjin
			Evergreen	Hapag Lloyd	X-Press

Split	0	1	X-Press		
Taranto	1	1	X-Press	Cosco	Evergreen
			Yang Ming	K Line	Hanjin
Trieste	2	9	CMA-CGM	Evergreen	Cosco
			X-Press	Hapag Lloyd	MSC
			Adria Maritime	Italia Marittima	Zim
			Maersk	Yang Ming	K Line
			Hanjin		
Venice	0	14	Sermar	Evergreen	Alpha Levant
			X-Press	Hapag Lloyd	MSC
			Adria Maritime	Italia Marittima	Borchard
			Grimaldi	Zim	

Table 4-1 The Connections of Adriatic-Ionian Container Ports. MDS Transmodal Limited, 2011; K Line, 2012; Synthesis Project, 2012; Luka Koper, 2014, Port Authorities; Own Elaboration

As can be seen from Table 4-1, the ports of the region are intergrated in the shipping routes through diferrent ways. Most connections, despite the lack of deep sea calls, are observed at the port of Venice. The ports that are intergated directly in the East-West line are these of Koper, Rijeka, Trieste and Taranto. Finally, a relative lack of connections is observed at the ports of Bar, Brindisi, Durres, Ploce and Split which are only served by regional feeder services. The intergation pattern of each port at the global routes is directly reflected in the annual transported container volumes. This is becoming evident from the data presented in Figure 4-6, where the annual number of TEU transported by each port for the year 2012 is presented. The dominant port in container handling is the Slovenian port of Koper, in which the total annual transported containers exceed 550k TEU. Remarkable volumes are observed in the Italian ports of Trieste, Venice, Ravenna, Ancona and Taranto and in the Croatian port of Rijeka. The other ports of the region present container traffic which does not exceed 100 k TEU per annum.

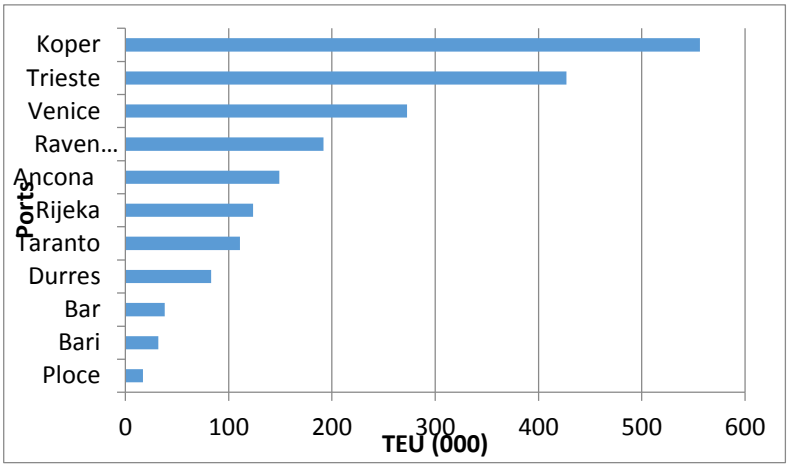


Figure 4-6 Container Traffic at the Main the Adriatic-Ionian Ports (2012). SEETO, 2011; Eurostat, 2014; Port Authorities

As can be seen from the figures, the ports with a high degree of connectivity and especially these that are connected directly to the main East-West maritime route, are the most favoured ones. The establishement of these types of connections guarantee a minimum volume of containers which acts as an advantage for attracting more cargo due to scale effects. The relatively high value of the Gini-Concetration Index which exceeds 0.55 during the period 2005-2012 testifies that the market structure of the region is quite concetrated. Furthermore, the advantage of the ports which serve as nodes of the East-west route is also depicted at the ports' Boston Consulting Group Matrix (BCGM) of Figure 4-7.

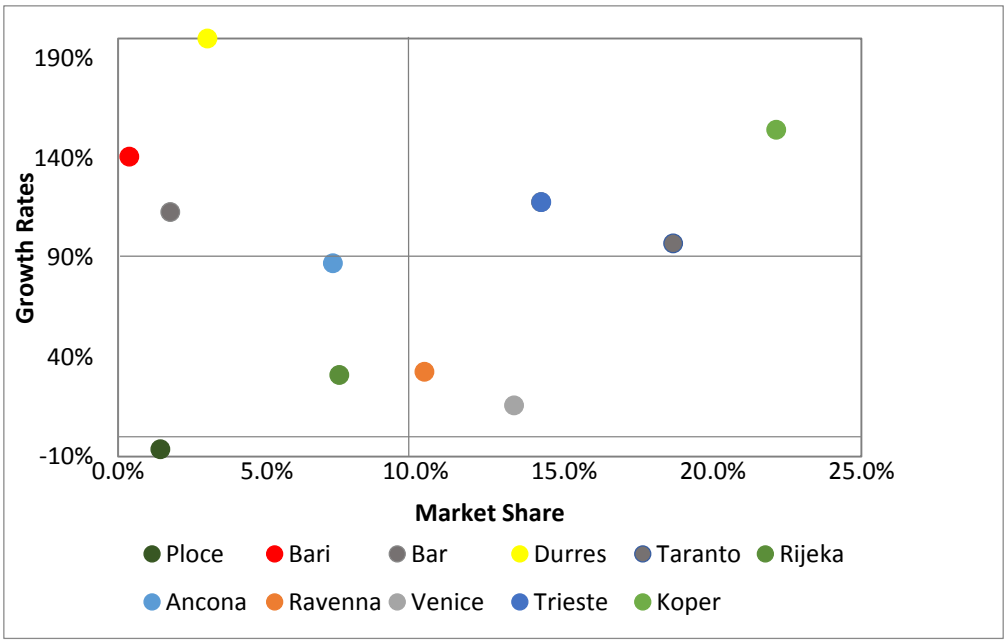


Figure 4-7. The Growth Rates and Market Share of Adriatic-Ionian Container Ports. SEETO, 2011; Eurostat, 2014; Port Authorities; Own Elaboration

BCGM Matrix is reflecting the relative position of each port against its main competitors. The Matrix takes into account the annual growth rates of ports and their average market share during the period 2005-2012. The diagram is being divided into four separate regions, according to a line vertical to the x-axis which denotes the average market share (9%) and a horizontal line representing the average growth rate of the Adriatic-Ionian ports (89%). The ports of the upper-right region can be characterised as leaders of the market because they present the higher market share and above the average growth rates. This category is formed

by the three ports (Koper, Trieste and Taranto) which are connected to the East-West route. Additionally, the upper left region is formed by the ports with relatively high growth rates and small market share (Bar, durres and Bari). The lowest right region contains the ports that own a significant market share and quite stable growth rates (Ravenna, Venice). Finally, the ports of the lowest left category are not presenting high developmental prospects and especially the port of Ploce.

Liquid Bulk Ports

Besides container handling, the ports of the region also specialize in the transportation of other types of cargo, such us liquid bulk and dry bulk. The total volume of liquid bulk cargo in the Adriatic-Ionian region for the period 2005-2011 is presented in Figure 4-8. As can be seen from the figure, the annual transportation of liquid bulk cargo steadily exceeds 70k tones. As in the containers sector, the recession of 2008 affected in a negative way the liquid bulk volumes, but the years after 2008 the situation seem to positively alter the prospects for ports in the sector of liquid bulk.

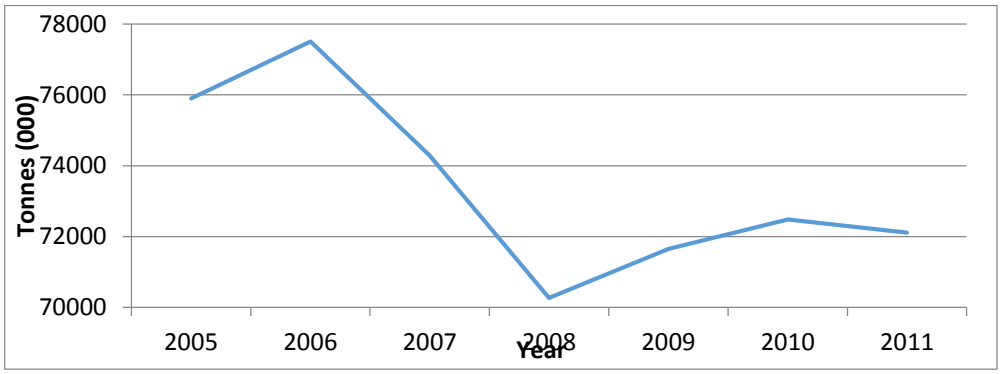


Figure 4-8 Annual Liquid Bulk Cargo Traffic in the Adriatic-Ionian Region (2005-2011). Eurostat, 2014; Port Authorities

The annual volume of transported cargoes of the main ports of the region for the year 2011 is presented in Figure 4-9. As can be seen from this figure, liquid bulk cargo transportation is mainly conducted by the ports of Italy. Nevertheless, many other ports of the region, namely Rijeka and Koper, show significant developmental prospects in the sector of liquid bulk transportation. The market structure of the liquid bulk sector is less concentrated than the containers sector as for the period 2005-2012 Gini coefficient ranges from 0.48 to 0.51 prices. The dominant port in liquid bulk cargo is the port of Trieste. The port serves as the starting point for the crude oil Transalpine Pipeline which supplies with oil the countries of Italy, Germany and Austria *(Transalpine Pipeline, 2013)***.** A number of ports own adequate infrastructure which enables them to specialize in transporting different liquid products. Thus, the region can accommodate cargoes such as crude oil, chemicals and Liquified Petroleum Gas (LPG) through ports like Trieste, Venice, Taranto and Ravenna. Finally, it should be noted that since 2009 a Liquified Natural Gas terminal is in use in the Italian port of Porto Levante (Lušić et al. 2008; Synthesis Project, 2012).

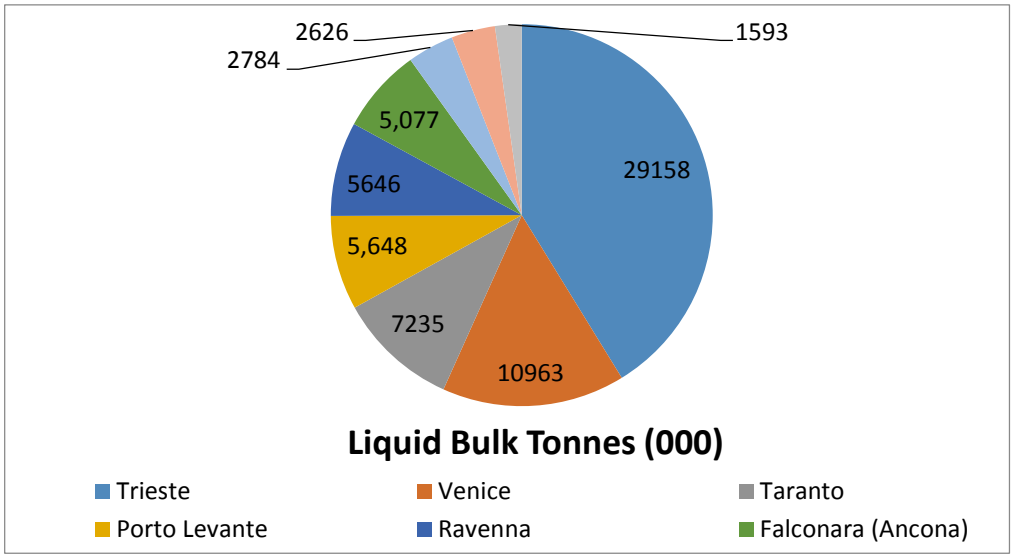


Figure 4-9 Liquid Bulk Volume at the Main the Adriatic-Ionian Ports (2011). Eurostat, 2014; Port Authorities

Dry Bulk Ports

Additionally to the liquid bulk, many ports of the region are also specialized in the transportation of dry bulk cargoes. The region's activity in the dry bulk sector is significant, presenting a high potential for further growth. This is testified by the data presented in Figure 4-10 in which the total dry bulk volume transported by the main ports of the region is presented. The annual volume for all the period exceeds 50k tonnes, while in the period 2006-2008 the annual transferred volume exceeded 80k tonnes. After a decline for the period 2009-2010 which was mainly caused by the financial recession, the market seems to recover.

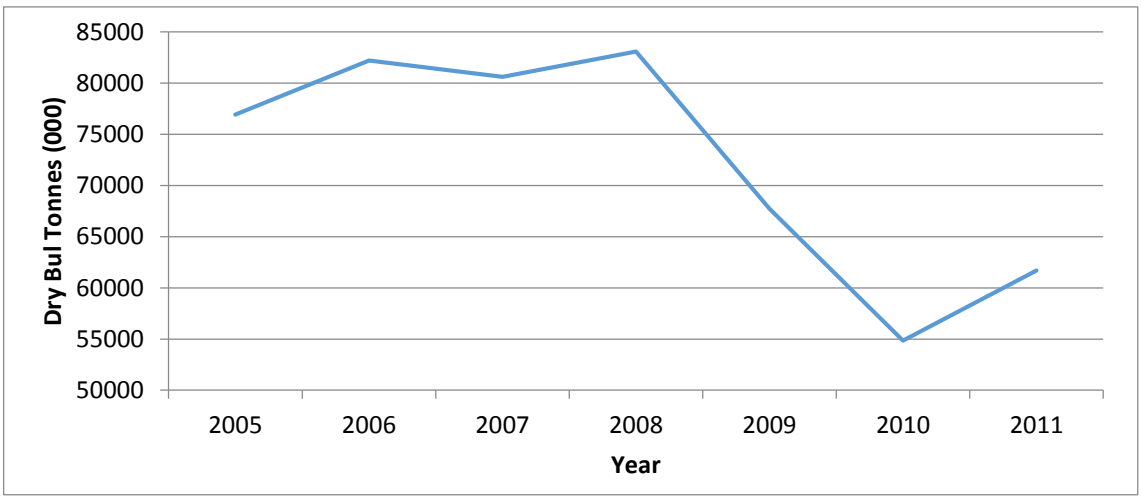


Figure 4-10 Annual Dry Bulk Cargo Traffic in the Adriatic-Ionian Region (2005-2011). Eurostat, 2014; Port Authorities

The analytical figures per port for the year 2012 are presented in Figure 4-11. Taranto is the port in which the largest volumes of dry bulk cargoes are observed. Among the other most active ports in dry bulk market we can observe other Italian ports, such as Ravenna and Venice and also ports of other countries, such as the Slovenian port of Koper and the Croatian ports of Ploce and Bari. The market structure in the period 2005-2012 follows a deconcetration trend, since Gini coefficient value dropped from 0.59 in 2005 to 0.51 in 2012. This finding provides hints that the smaller ports of the region are gradually becoming more active in the

transportation of dry bulk cargo. Finally, it should be noted that the main types of dry bulk cargoes are the iron and steel products, grain and chemicals.

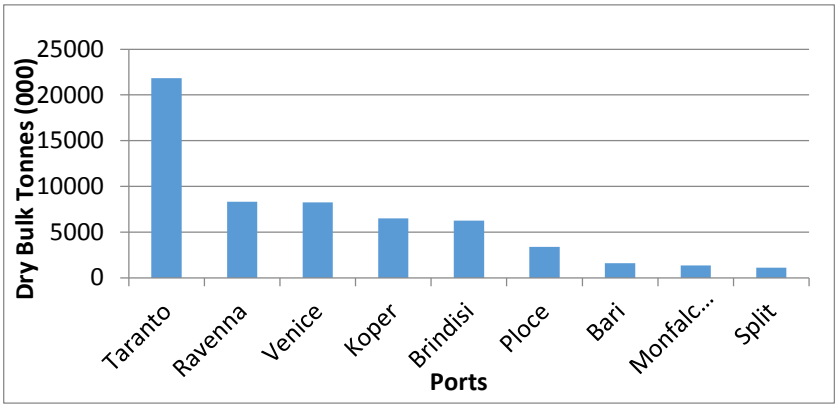


Figure 4-11 Dry Bulk Volume at the Main the Adriatic-Ionian Ports (2011). SEETO, 2011; Eurostat, 2014; Port Authorities

Ro-Ro Ports

Finally, the Adriatic-Ionian ports also show a great activity in the Ro-Ro sector. The domestic lines and the Short Sea Shipping connections strengthen this type of transport which does not demand specialized infrastructure for its successful operation. The annual volume of Ro-Ro traffic for the period 2005-2011 is presented in Figure 4-12. As can be seen from the data in this figure, the annual activity of Ro-Ro transportation is presenting significantly different trends from those of the sectors analysed above. This kind of transportation presented a stable trend between 2005-2007 periods and a declining trend in the period 2007-2009. Nevertheless, through the years after 2009, a sharp increase is observed which is mainly caused from the new Ro-Ro line established in 2009 between Trieste and Turkey.

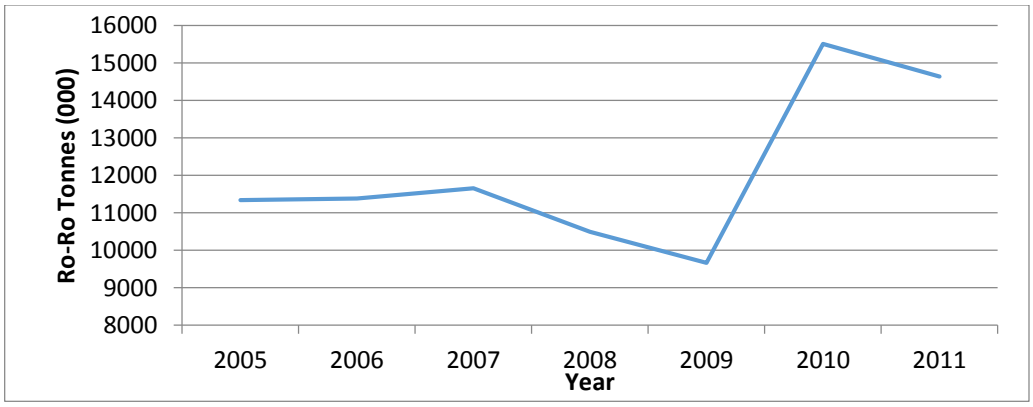


Figure 4-12 Annual Ro-Ro Traffic in the Adriatic-Ionian Region (2005-2011). Eurostat, 2014; Port Authorities

The Ro-Ro traffic in the major ports of the region for the year 2011 is presented in Figure 4-13. There are only five ports in the region with an annual transportation that exceeds 1 m. t. The dominant port in Ro-Ro traffic is the port of Trieste. Also, remarkable figures are observed for the Greek ports of Igoumenitsa and Patra which strongly specialize in Ro-Ro traffic. The list of the busiest ports of Ro-Ro cargoes contains also the two Italian ports of Ancona and Bari. The dominance of the aforementioned ports in the Ro-Ro traffic is mainly explained by the network strategy of shipping lines in the Adriatic Sea and the ports that they are using as routes for their sea connections. Thus, the established lines which are extensively presented in the section of passenger traffic that follows, seems to significantly favour the specific ports of Italy and Greece.

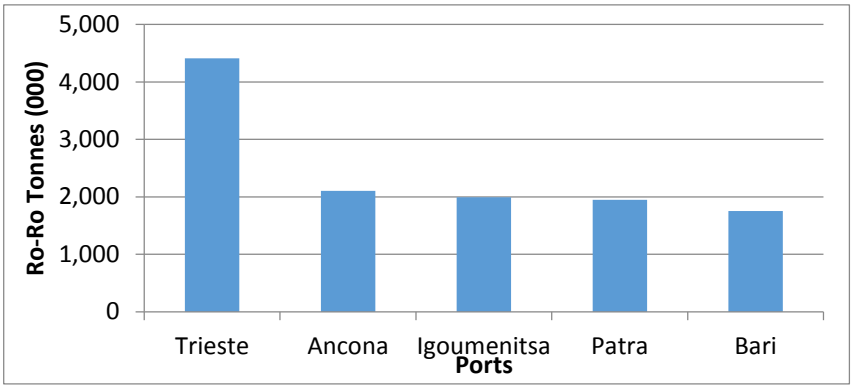


Figure 4-13 Ro-Ro Traffic at the Main the Adriatic-Ionian Ports 2011. Eurostat, 2014; Port Authorities

4.1.1 Focus Area 1

FA1 is one of the areas in which the average traffic density among the highest in all Mediterrenean (Figure 4-3 and Figure 4-14).

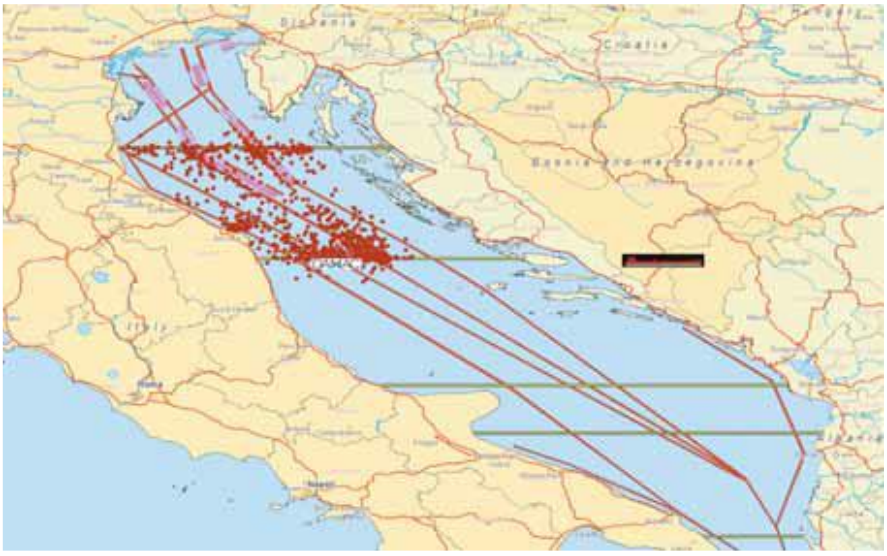


Figure 4-14 Shipping intensity in the Northern Adriatic in 2005. DAMAC project, 2007

The share of imported goods at northern Adriatic ports is at least twice as large as the share of exported goods. In the port of Trieste this share is approximately even ten to one. The major reason can be found in their role of a gateway to countries of Central Europe, especially for goods coming from the Far East. Ports of Koper and Rijeka have quite resembling throughput, with 15 million in Koper and 12 million in Rijeka in 2006. Their annual maritime throughput growth reaches from 680.000 to 1.200.000 tons in average. The port of Trieste has much 13 greater throughput capacity with 45 million tons in 2006, but comparing Koper and Rijeka it has a lower annual growth of approximately 330.000 tons in average. The main reason for Trieste's greater throughput is its greater capacity. During the period 2005-10 the NAPA ports enjoyed container traffic growth of 62% (measured in terms of TEU), to reach a combined throughput of 1.47 million TEU in 2010. After a slump in throughput volumes in 2009 of 10% due to the world economic crisis, the ports' total traffic increased by 13% in 2010 to marginally exceed pre-recession levels. The port of Trieste is the first Italian port for what is concerned the crude oil traffic in Italy and it is the 10th port in Europe.

TEU movements in the principal ports of the NA are reported in Table 4-2.

Port	TEU 2010	TEU 2012	Variation 2010-2012	Variation 2011-2012
Ancona	110.395	N.A.	N.A.	N.A.
Ravenna	183.577	207.500	1,3%	-3,64%
Trieste	281.643	408.023	-44.87%	3,77%
Venice	393.913	429.893	9,1%	-6,21%
Koper	476.731	572.263	20,03%	-2,89%
Rijeka	137.048	178.837	30,49%	18,69%

Table 4-2 TEU movements in the principal ports of the NA (personal elaboration).

The results from a scenario analysis made by NAPA on the future container market (Table 4-3) show that the major economic drivers of demand and market share through the NAPA ports are the introduction of ships of about 8,000TEU making direct calls in the North Adriatic from 2020 (and their cost structures determining the market price charged to freight forwarders and shippers), and about 11,000 TEU from 2030, allied to efficient rail freight services for inland distribution (particularly being able to operate 750 metre long trains). In these circumstances the NAPA ports become more competitive and secure significant additional market share.

	2010	2015	2020	2030	Change 2010-30
NAPA	4.3	4.4	9.4	11.3	+6.9
Northern Range	66	66.1	60	58.3	-7.7
Tyrrhenian	11.6	11.2	11.4	11.3	-0.3
Black Sea	1.1	1.1	1.1	1.3	+0.2
Other	17	17.2	18	17.8	+0.8

Table 4-3 Modelled container traffic market shares for NAPA & other port groupings, 2010-30. MDS Transmodal Limited for NAPA –draft report

Commercial port at Koper (Port of Koper)

Over the past two decades, the port has developed into the most modern port in the Northern Adriatic, which is one of the most important economic actors and generators of economic activities in the region. The port has 12 technologically specialized terminals for handling of a wide variety of product groups. Since 2005, passenger transport has also been present in the port.

In the past decade, the total shipping has been constantly increasing (with the exception of 2009 due to the global crisis), but already in 2011 and 2012 it again achieved record total transhipped volumes, approaching 18 million tons of goods. In recent years, the Port of Koper is among the first ones in the Mediterranean in terms of cars throughput and among the first in the Adriatic in container traffic.

	2007	2008	2009	2010	2011	2012	2013
Total cargo	15,362	16,050	13,143	15,372	17,051	17,880	17,999

Table 4-4 Information about the cargo throughput by year (millon t)Source: http://www.luka-kp.si/slo/terminali-in-tovor)

General cargo	1,438,883	1,659,405
Containers	5,292,047	5,849,694
Vehicles	674,692	662,169
Granular and dry bulk cargoes	7,280,490	6,987,806
Liquid cargo	3,194,636	2,840,588
Total	**17,880,697**	**17,999,662**

LOADED	**2012**	**2013**
General cargo	1,082,481	1,275,590
Containers	2,678,077	2,989,749
Vehicles	379,358	389,838
Granular and dry bulk cargoes	1,472,037	1,296,892
Liquid cargo	300,551	18,651
Total	**5,930,504**	**5,970,719**

UNLOADED	**2012**	**2013**
General cargo	356,351	383,814
Containers	2,613,970	2,859,946
Vehicles	277,334	272,331
Granular and dry bulk cargoes	5,808,453	5,690,916
Liquid cargo	2,894,085	2,821.937

Total	**11,950,193**	**12,028,943**

Table 4-5 Cargo throughput in 2012 and 2013 (tonnes)

Croatian ports, besides cruise transport, also have purposes as a commercial shipping, ferry transport and recreational boating. The whole Adriatic Sea includes 138.595 km2 and the Croatian part of Adriatic Sea includes 56.964 km2. The length of the Croatian coast in total is 6.278 km with 1.242 islands. Of the approximately 350 ports and harbours on the coast and islands of seven (Pula, Rijeka, Zadar, Sibenik, Split, Ploce and Dubrovnik) can accept large ocean-going ships, all of them located on the mainland coast. The bulk of port traffic Croatian seaports refers to the port of Rijeka, which typically achieves over 50% of the total turnover of all Croatian ports. The development plan of Croatian sea ports by 2010. were Planned large investments in the modernization of the port, which is the foundation for higher traffic and development of ports and granting concessions to domestic and foreign investors.

The shape of the Croatian with the territory on the eastern coast of the Adriatic Sea clearly indicates the vital importance of transport infrastructure and sea ports as well as the need for land and sea links the countries of Southeast Europe and Central Europe over the Croatian areas. Selection of multimodal Corridor through Croatian territory indicating that a Croatian territorial position is not only her advantage, but also the obligations under the European Community. The Republic of Croatia with its geographical position is a very important ground for linking Western Europe and the Balkans, and the compound of Central Europe and the Adriatic, or the Mediterranean Sea. An important transport route for Croatia is also the Adriatic-Ionian route, which has not yet been Transeuropean corridor. Its length in the Republic of Croatia is 545 kilometers. Sea ports, as part of the overall transport system of the Republic, reflect the economic activity of the Republic of Croatia and the areas that gravitate to these ports. Major infrastructural projects on the construction of roads, which connect the Croatian port with adequate roads in Slovenia, Austria and Hungary, have made the Croatian port more attractive. That especially relates on the port of Rijeka Gateway Project and the perspective of the port of Ploce, after the construction of adequate transport infrastructure and port terminals for transshipment of containers and bulk cargo.

Container ports

Container traffic has a dominant role in the transport of general cargo, because it integrates different ways of transport into a unique transport chain. The reason is that it is easier to handle cargo and the turn – around time is reduced, thus decreasing the costs of transhipment and reducing freight rates, attracting more users. Due to all these factors, container transport is considered to be the most perspective way of transporting of cargo. The Mediterranean Sea is of extreme importance for container transport, because it is one of three most important routes on relation East-West i.e. that one connecting Europe with Near East, Middle East, Far East. Taking into consideration the fact that in liner marine service there’s a trend of rationalization of the number of ports of call because of the reduction of costs, the Mediterranean ports in the vicinity of main fairway between Suez Channel and Gibraltar took the function of main transhipment container ports. The distribution of containers from those ports towards distant ports of the Mediterranean basin is done by regular feeder lines Container traffic in the Adriatic appeared in the end of 1970. and it is of the greatest intensity in the North Adriatic ports, because they have the best traffic connections with gravitational hinterland, i.e. the States of Central Europe.

In the eastern part of the northern Adriatic sea transport is dominated by three ports: Trieste, Koper and Rijeka. At the direction of the North Adriatic, maritime transport is growing at an average annual rate of 2.8%. By the 1990th year share of Rijeka in a crowded cargo north Adriatic ports amounted to about 35%, and in times of crisis to the 1990s, this proportion dropped to 12%. Recovery of this port, begun with modernizing its infrastructure and creating a more favourable operating conditions, has led to a gradual rise in its share, and the 2006th year reached 18.5%. Port of Rijeka is an a International port and it is the most important port in Croatia. It is intended primarily cargo transport in the structure which important role is played by container traffic. There is a constant growth of container traffic in the overall traffic port of Rijeka. Since 2000th years there has been a steady growth in container traffic at the terminal Brajdica, as a result of investment in reloading equipment and improvement of port services, and in the 2007th year amounted to 145,040 TEUs. The plan is to expand the storage container, extend the operational coast at the terminal Brajdica and Zagreb shore and deepen the port in order to fit the largest container ships. After the planned works, container transport capacity could be increased to 200,000 TEUs.

Port of Ploce is primarily a transit port for Bosnia and Herzegovina, and to a smaller extent serves to Serbia, and the far south of the Croatian. In 2007th in Ploce was transhipped more than 30,000 TEU, which was 65% higher than a year ago, thereby the port was the second most container traffic in Croatia, after Rijeka which was in the 2007th year used for transhipment 145,040 TEUs. Due to the intense growth of container traffic at this port in the past decade, the ongoing construction of a modern container terminal, which will lead to changes in the structure of transport and in particular the strengthening of the container traffic in the Adriatic. Given the state of the global and European container market and the role of the Adriatic ports in these developments, it is assumed that the new container terminal in Ploce will be connected to a feeder-service and that his annual sales will be between 80,000 and 100,000 containers.

Ro-Ro Ports

Bakar Bay belongs to the region of Kvarner aquatorium and retracted part of the Rijeka Bay. Bakar Bay is a natural harbour elliptical shape, length 4600 m. Maximum width is 1,100 m and the narrowest navigable width with depths greater than 20 m, 350 m. Bakar port basin became an important port operations in the terminal for bulk cargo and Ro-Ro terminal for handling general cargo. Bulk cargo terminal is located on the north shore of the Gulf (location Podbok). He was released on the market in 1967. Year. The sea depth along Podbok of 18 m allows ships up to 150,000 DWT. Ro-Ro terminal for general cargo on shore Goranin, on the western shore of the bay, is intended to transshipped cargo stored in warehouses in the background ŠkrIjevo Free Zone - Kukuljanovo with whom creates a unique technological unit.

Specific information:

- Container and Ro-Ro terminal (Brajdica) - The sea depth - 11-12 m
- South Coast - 300 m - 2 STS container cranes, the construction of an additional 300 m of coast with associated infrastructure and superstructure (estimated total capacity of 500,000 TEU terminal)
- West Coast - 164 m - 2 STS container cranes
- The bulk cargo terminal (Bakar-Podbok) - The sea depth - 18 m storage Capacity - To 130,000 t (coal) or 400,000 t (Ore)

Ro-Ro terminal Bakar (Goranin) at the site of the former coke plant in Bakar in the plan is the construction of the car terminal. Planned capacity amounted to approximately 50,000 cars per year, in the form of an exclusive port for a specific vehicle type or open mixed terminals with various kinds of vehicles, depending on the needs of the market. The planned area is 60,000 m² plateau former coke plant.

DESCRIPTION	2002	2009	2010	INDEX 3:2	INDEX 3:1
GENERAL CARGO	791.239	2.112.870	2.317.423	109	293
BULK CARGO	1.733.067	2.873.487	2.050.334	71	118
WOOD	201.706	220.975	243.950	110	121
TOTAL	**2.726.012**	**5.207.332**	**4.611.707**	**88**	**169**
Container traffic in TEU	14.695	130.740	137.048	105	933

Table 4-6 Total traffic of Port of Rijeka. Source: **Port of Rijeka, Statistical data for 2010**.

With an area of approximately 20,000 m2 container terminal in the port of Split has an annual capacity of approx. 30,000 TEU and daily storage capacity of 2,000 TEU containers. Across Malta, Taranto and Gioia Tauro container terminal in the Mediterranean is well connected with a number of major world container ports, while road and rail connected to all of Europe. Terminal cover three forklifts one of which is capacity 22t and 10t two and two container handlers capacity 44t. It is equipped workshop for repairing container terminals for containers fridge container and other necessary equipment. The area accommodation container is under 24-hour video surveillance and supervision of staff and security. RO-RO ramp (berth no. 5), maximum draft 7.5m, meets all international regulations. Ramp offers the possibility of loading empty containers aboard ships shore crane 5t, while the container terminal is located in close proximity (20m). Between the terminal and the ramp are two railway tracks and roads for the trucks that bring containers to the ship.

Port of Šibenik is often associated with other coastal areas, inland highway with Croatian and Europe, and train with the hinterland. The port consists of the following terminals:

- Terminal (Vrulje)
- Terminal for transhipment phosphate (Dobrika)
- Terminal for bulk and general cargo (Rogač)
- Terminal for timber

PURPOSE

- Transhipment of general and bulk cargo
- Length shore Rogač and 10 m
- Depth coast Rogač II 7-8 m
- Depth coast Rogač III 5-6 m

- Number of berths - 3

STORAGE CAPACITY

- the size of the open warehouse with a concrete surface 20 000 m2
- Capacity loading / unloading - three gantry cranes (5 tons) and two gantry cranes (7 tons)
- ability to work or grab crane hook

REFERENCE CHARGES

- Clay, AL-blocks, aggregate, building materials, wood

TRACKS

- Used tracks R1 and R2, each with a length of 400 m on the coast Rogač

The Port of Rijeka is favourably positioned at the beginning of PAN European transport corridors. Rijeka has developed multimodal transport infrastructure. It is the shortest way to overseas markets to European countries in the hinterland and has regular shipping lines for the Mediterranean, Middle East and Far East – Asia. The total traffic of Luka Rijeka dd and Adriatic Gate Container Terminal (AGCT) was the 2012th year of 4.511 million tons of cargo. Traffic Luka Rijeka dd the part of general, bulk cargo and timber amounted to 3.235 million tonnes of cargo and it is at the level of 2011. Looking at the types of cargo, general cargo traffic rose by 2%, timber traffic by 39% and the turnover of bulk cargo to 6% lower. AGCT turnover amounted in 2012. 128,680 TEUs and is lower by 3% compared to the 2011th year. Port system operates within the Kvarner Bay at the following locations:

- Rijeka - conventional general cargo terminal for grains and phosphates, terminal for fruit
- Sušak - container terminal, conventional general cargo, timber
- Bakar - terminal for bulk cargo, Ro-Ro terminal
- Raša - Bršica livestock terminal, timber terminal and warehouse background Štalije
- Omišalj - oil terminal

Port of Rijeka already has several projects financed from the EU funds. Project „Eco.Port - Noise characterization of ports: System for the control and monitoring of noise pollution in ports‟ is a project co-financed by the programme 2005: Adriatic cross-border cooperation between Croatia and Italy, the PHARE CBC / INTERREG IIIA – a new programme of Adriatic cross-border cooperation. In the framework of the project, carried out in the area of the Port of Rijeka Authority, a series of acoustic measurements were carried out as well as the strategic noise chart for the Port of Rijeka Authority. Project „Border control of nuclear and other radioactive materials with stationary portal monitors‟ is a programme financed from the national PHARE 2006 programmer. The project was carried out in cooperation with the National Institute for Radiation Protection and the Customs Administration to strengthen the border controls of nuclear and other radioactive materials with the help of stationary portal monitors. „Study on the port’s waste reception devices‟ is another project from the PHARE 2006 programme implemented in cooperation with the Ministry of the Sea, Transport and Infrastructure, which will enable the establishment of an integral waste disposal system in the harbours of the Republic of Croatia. From project ADRIPLAN (ADRiatic Ionian maritime spatial PLANning) funded by the European Commission – DG Maritime Affairs and Fisheries (DG MARE) under the theme "Maritime Spatial Planning (MSP) in the Mediterranean sea and/or the Black sea" is expected to operate complementary to other modes of transport enhancing intraregional and interregional coherence.

Estimates of future traffic flows indicate the expectation of an increase in maritime traffic especially on the north Adriatic transport route, primarily as a result of overcapacity northern European ports. Passenger shipping in the immediate function of the tourism economy and interconnection Croatian islands and the mainland with the islands, and given the fact that there is a realistic assessment of the further increase in tourist traffic in Croatia, and the imminent completion of the modern highway that will bring to harbour and ferry ports a larger number of tourists, it is necessary to continue to modernize passenger fleet and invest in adaptation of existing ports and ferry docks, new boats and demands greater passenger traffic. Passenger and vehicle transport is presented in the tables below.

DESCRIPTION	**2002**	**2009**	**2010**	**INDEX 3:2**	**INDEX 3:1**
General cargo	791.239	2.112.870	2.317.423	109	293
Bulk	1.733.067	2.873.487	2.050.334	71	118
Timber	201.706	220.975	243.950	110	121
TOTAL	**2.726.012**	**5.207.332**	**4.611.707**	**88**	**169**
Container traffic in TEU	14.695	130.740	137.048	105	933

Table 4-7 Traffic in the port of Rijeka 2010. Source: Port of Rijeka d.d., Statistic results for 2010.

Ferry lines	**Passengers**			**Vehicles**		
	2011	**2012**	**INDEX 2012/2011**	**2011**	**2012**	**INDEX 2012/2011**
Rijeka – Split - Stari Grad – Korčula - Dubrovnik	45.323	41.350	**91,2**	7.934	7.044	**88,8**
Zadar – Ošljak - Preko	1.617.167	1.606.123	**99,3**	247.624	244.473	**98,7**
Split - Supetar	1.538.513	1.534.340	**99,7**	316.024	314.198	**99,4**
Ploče - Trpanj	182.871	189.194	**103,5**	68.239	70.540	**103,4**
Split – Stari Grad	593.634	601.445	**101,3**	141.292	138.678	**98,1**
Dubrovnik – Suđurađ - Lopud	10.955	14.293	**130,5**	4.144	4.746	**114,5**

Table 4-8 Ferry traffic 2011/2012. Source: Agency for Coastal Shipping, TRANSPORT OF PASSENGERS AND VEHICLES comparison 2011/2012

Lines	Passengers 2011	Passengers 2012	INDEX 2012/2011
Sali – Zaglav - Zadar	27.705	28.717	**103,7**
Brodarica - Krapanj	81.200	99.440	**122,5**
Trogir – Slatine - Split	65.678	80.211	**122,1**
Šipan – Lopud – Koločep - Dubrovnik	213.149	215.260	**101,0**

Table 4-9 Shipping lines 2011-2012. Source: Agency for Coastal Shipping, TRANSPORT OF PASSENGERS AND VEHICLES comparison 2011/2012

4.1.2 Focus Area 2

Greece has the largest merchant fleet in the EU and one of the largest merchant fleets in the world. The country is surrounded by a rather large number of important shipping lanes and has 20 ports with more than one million tonnes of cargo per year, out of which the port of Piraeus is the most important one (DG-MARE, 2011) (Figure 4-15)

One of the most important Greek ports is the port of Igoumenitsa (Table 4-10). According to the reviewed Regional Framework for Spatial Planning and Sustainable Development of the Region of Epirus, the port of Igoumenitsa, originally designed to be a hub of combined transportation (acting as a starting point for Egnatia road connecting it directly with northern and central Greece), has failed to promote its role as an international western gateway of the country. More south than Igoumenitsa, the port of Preveza has a commercial character but not a steady traffic. Its recent upgrading and the upcoming connection to Italy are expected to contribute to the enhancement of its role in a national and Adriatic level and the tourism development in the wider area. Other smaller ports located at the Region Epirus are the tourist ports of Parga and Sivota. In the southern part of the Adriatic-Ionian macroregion, the port of Patra has been an important gateway for western Greece. However, based on the table below, it is obvious that, although in 2000 the ports of Parta and Igoumenitsa were equal in terms of passenger service, over the decade, the port of Patra has lost a significant number of passengers, however without the parallel increase of passengers in the port of Igoumenitsa with the exception of truck movement. Also an important role for commercial transport plays the Port of Platigialo, able to serve a range of activities (e.g. Ro - Ro, car terminal, general cargo, bulk cargo etc) attracting a large number of users.

	Passengers		Trucks		Vehicles	
Year	**Patra**	**Igoumenitsa**	**Patra**	**Igoumenitsa**	**Patra**	**Igoumenitsa**
2000	1.275.986	1.230.706	292.660	129.263	237.116	327.564
2001	1.339.004	1.193.148	279.026	134.254	239.025	344.028
2002	1.383.428	1.153.078	295.630	146.126	261.293	287.136
2003	1.263.124	1.087.142	304.979	154.589	249.345	274.787
2004	1.125.159	895.452	298.833	162.047	222.486	213.197
2005	1.247.991	938.086	283.778	158.255	226.269	243.743

2006	1.264.274	972.391	295.206	161.904	216.186	252.594
2007	1.130.880	1.005.171	296.900	179.543	194.805	254.461
2008	1.094.450	1.038.408	312.459	181.890	158.243	260.854
2009	1.000.184	1.088.603	212.549	164.288	170.528	282.732
2010	879.314	1.176.246	171.045	163.405	151.223	305.900
2011	748.029	1.107.570	145.843	149.151	135.925	287.951

Table 4-10 Comparative annual movement in ports of Patra& Igoumenitsa (connections with Italy). Hellenic Statistical Authority

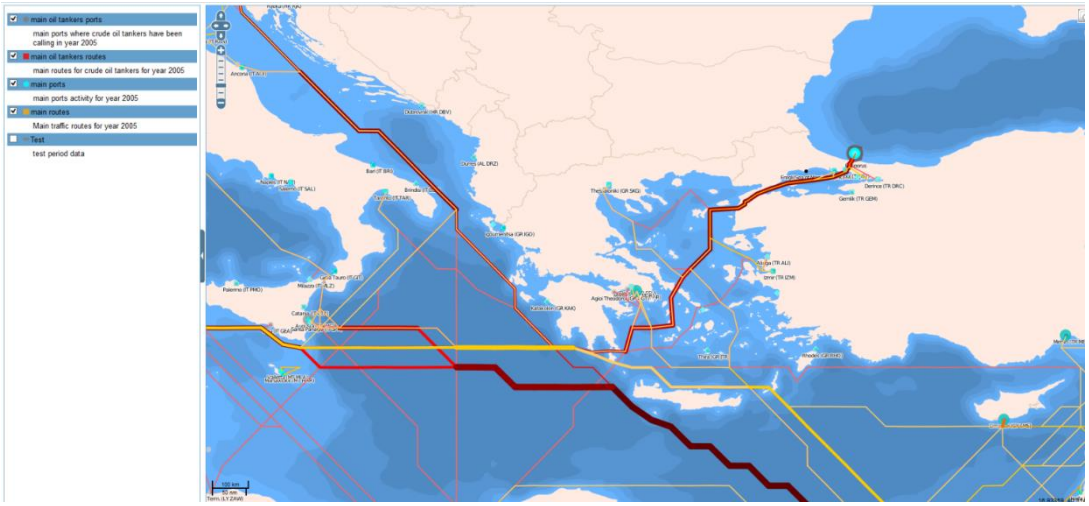


Figure 4-15 Major ports and routes in Greece. Source: SafeMed Project

In the Ionian Islands Region (IIR) there are totally 95 ports of which 20 serve only fishing vessels, 18 serve only tourist boats (marinas and recreational boating), 10 are passenger ports serving coastal connections, while the remaining 41 ports have a mixed use. The 41 of these ports are located at the Regional Unit (RU) of Corfu, 18 at the RU of Lefkada, 21 at the RU of Kefalonia, 6 at the RU of Ithaki and 9 at the RU of Zakynthos.

Regarding small islands there are 25 ports of which 3 are purely for fishing vessels, 7 for tourist boats, one for passengers (Pisaetos, Ithaki) while the rest have a mixed use. More specifically, the Regional Unit of Corfu has:

- the port of Kerkyra that provides the basic connection to Igoumenitsa and Italy
- the port of Lefkimi connecting Southern Corfu to mainland Greece via Igoumenitsa
- the port of Cassiopeia in the north which is expected to operate as cross-border link to Albania
- small ports on the neighboring islands and the island of Paxos ensuring local transportation and the needs of the fishing and tourist boats
- a marina for 800 boats at the center of the eastern coast of Corfu, in Gouvia
- 64 fishing fishing shelters for professional and amateur fishing vessels

At the Regional unit of Lefkada there is a marina in the city of Lefkada with 620 berths for yachting. There is a ferry connection operating from the marina to Meganissi, via a speedboat that serves only passengers. Also the port of Nidri serves mainly regular local lines to Meganissi and during the summer it is hosting an important load mostly transferred by small ship, while the port of Vassiliki performs seasonal routes to Kefalonia and Ithaki. The small islands of Kalamos and Kastos have port infrastructure serving the connection with Mitika in Aetoloakarnania. Lefkada has also 14 fishing shelters for professional and amateur fishing vessels while a lot of the area's small islands lack an operator for their management.

The main ports of the Regional Unit of Kefalonia are Argostoli, Poros, Sami and Lixouri. Poros and Sami are the most important ports of the island ensuring the connection to the mainland through Kyllini and Patra. The port of Argostoli is still a freight and passenger port which recently made an expansion projects to accommodate cruise ships. Indicatively, in 2011 60 cruise ships arrived at the port and, in 2012, 120 cruise ships (twice as many). The ports of Argostoli and Lixouri are seasonally connected with Kyllini. According to the Master Plan of the Port of Argostoli which has a time horizon for completion in 2025, the basic needs for port infrastructure are designed to serve the following needs:

- The ferry connection to the mainland ports namely the Port of Kyllini
- The ferry connection to Lixouri

- The movement of freight by general ships or bulk cargo. Here it is notable that the port of Argostoli is the only one in the island that can accommodate general cargo handling
- The traffic of cruise and tourist yachts

In addition, the ports of Pessada and Fiskardo are serving intraregional connections with the port of AgiosNikolaos and the port of Vassiliki (Lefkada) respectively. Finally, the island of Kefalonia has 17 fishing shelters for professional and amateur fishing vessels.

In Ithaki, the main ports are Vathi and Pisaetos on the west side of the island which is under a construction expansion project funded by NSRF 2007-2013. Due to the large increase of the fuel price, the shipping company serving the Patra - Kefalonia – Ithaki connection, requested the use of Pisaetos as an alternative port being closer to Vathi port (only 5km away) consuming this way less fuel by avoiding to go round the island.

Also, in the northeast of the island there is the port of Frikes serving connections with Fiscardo in Kefalonia and Vassiliki in Lefkada. The port of Frikes is the only port of Ithaki lacking some institution responsible for its maintenance. The island of Ithaki has also 8 fishing shelters for professional and amateur fishing vessels.

The Regional unit of Zakynthos has a basic port serving all passenger and freight traffic with Kyllini handling significant loads. Recently the port's Master Plan has been commissioned. There is also the port of Agios Nikolaos, which during the summer months serves the ferry link between Zakynthos and Kefalonia (Pessada). The remaining ports of Zakynthos involve 9 fishing shelters (Port of Zakynthos, AgiaTriada, Planos, Tsilivi, Kavos, Alykanas, Keri, Agios Sostis and Alikes).

The ports with the best quality and more port infrastructure seem to be located at Corfu. The marina of Gouvia singles out both in capacity (800 boats) and developed infrastructure. It should also be noted that the marinas of Gouvia and Lefkada had a Blue Flag for 2011. Of great importance also is the interconnection of large and small islands with the mainland and flying fast - hydrofoils which is currently limited in linking Corfu and Paxos.

One of the most important Greek ports of FA2 is the port of Igoumenitsa (Fig 4-15). According to the reviewed Regional Framework for Spatial Planning and Sustainable Development of the Region of Epirus, the port of Igoumenitsa, originally designed to be a hub of combined transportation (acting as a starting point for Egnatia road connecting it directly with northern and central Greece), has failed to promote its role as an international western gateway of the country. The planning development of the port, as expressed through the master Plan of the Port Authority of Igoumenitsa, has differentiated from the original objectives. It is now mainly focused on serving unaccompanied cargo (Ro-Ro), cruise infrastructure, the fueling of ships. The aim is on the one hand to exploit the already built infrastructure and on the other to take advantage of the opportunities and address risks that emerge from the shrinkage of the initially planned transport infrastructure. Possible developments in the near future (mainly the possibility of recovery hydrocarbon deposits, but also with the possibility of upgrading role of the port of Durres) will require a new revision of planning functions of the port. The port is connected with the Ionian ports (Corfu - Paxos - Patras) through the old port and with Italy (Ancona, Venice, Bari, and Brindisi) through the new port.

In the core region on the part of Greece for FA 2, and out of the total 95 ports located in the Greek Ionian Sea, 41 are located at the Regional unit (RU) of Corfu. More specifically, the Regional Unit of Corfu has:

- the port of Corfu that provides the basic connection to Igoumenitsa and Italy
- the port of Lefkimi connecting Southern Corfu to mainland Greece via Igoumenitsa
- the port of Cassiopeia in the north which is expected to operate as cross-border link to Albania

• small ports on the neighboring islands and the island of Paxos ensuring local transportation and the needs of the fishing and tourist boats

• a marina for 800 boats at the center of the eastern coast of Corfu, in Gouvia

• 64 fishing fishing shelters for professional and amateur fishing vessels.

In Corfu most ports are not subject to any operator. More specifically, the only ports belonging to the juridiction of the Port Authority of Corfu are the port of Corfu and the ports of the small islands of Erikousa, Avlaki Othonon and the three ports of Paxos (Gaios , Lakka and Longos). All the other ports of Corfu (Lefkimmi, Paleokastritsa, Kassiopi, Agios Stefanos, Astrakeris etc) do not operate under the jurisdiction of any operator. According to the Port Authority of Corfu there is a number of projects (planned or under construction) for the improvement of the port. In addition, the authority is aiming at receiving a certificate for the Port's environmental management (EMAS) in order to be characterised as a "Green Port", while the strategic goal for the future is to attract more cruise liners and make Corfu a cruise port (home port).

Corfu Island seems to have the ports with the best quality and more port infrastructure. The marina of Gouvia singles out both in capacity (800 boats) and developed infrastructure. It should also be noted that the marina of Gouvia had a Blue Flag for 2011.Of great importance also is the interconnection of large and small islands with the mainland and flying fast - hydrofoils which is currently limited in linking Corfu and Paxos.

Apulian area hosts large/medium shipping harbours (Taranto, Bari, Brindisi, Monopoli, Barletta, Manfredonia and Gallipoli) and several fishing ports, touristic marinas and small docks.

The port of Bari is currently among the most important for communication with Eastern Europe and Greece. Bari is a multipurpose harbour able to meet all operational requirements, from cruise transport to shipping. Among the largest of the Adriatic Sea, the port of Bari in 2012 handled 2.0 million passengers, of which approximately 650000 cruise passengers. Even in Brindisi port traffic is substantial, and there are several lines that connect not only Greece but also Turkey. Its commercial traffic, however, concerns coal, fuel oil, natural gas, chemicals. The outer habour has, in fact, mainly industrial uses, with facilities for goods shipping for the local chemical factories. Overall, the port of Brindisi has 21 commercial docks for a linear development of over 3700 m.

The port of Taranto, one of the first in Italy for goods shipping, is located on the northern coast of the Gulf of Taranto (Ionian Sea) and plays an important, both strategic and commercial, role. The latest installation is the container terminal, a modern building complete with computerized systems and control tower, with a capacity of cargo handling and storage of approximately 2,000,000 TEU / year. There are, also, a facility for the transport of crude oil and several piers serving the local steel factory.

The ports of Manfredonia, Monopoli, Barletta (Adriatic) and Gallipoli (Ionian) are smaller in size but are, like the others, dedicated to the transport of goods (expecially for local factories) and passengers (Table 4-11).

	A Liquid bulks (x1000 tons)	B Solid bulks (x1000 tons)	C Total goods (x 1000 tons)	A+B+C	Total TEU'S
Taranto	5252,783	20531,731	9157,838	34942,352	263461
Brindisi	2547,279	6542,818	1018,223	10108,32	13507
Bari	0	1236,338	3264,353	4500,691	29398
Barletta	248,159	608,328	33,379	889,866	0
Monopoli	96,978	143,687	0	240,655	0

Table 4-11 Goods shipped by Apulian ports in 2012. Assoporti.it

The recreational boating in Apulia consists in 64 marinas and docks and about 10 thousand berths, resulting to be a major economic resource for Apulia (Figure 4-16).

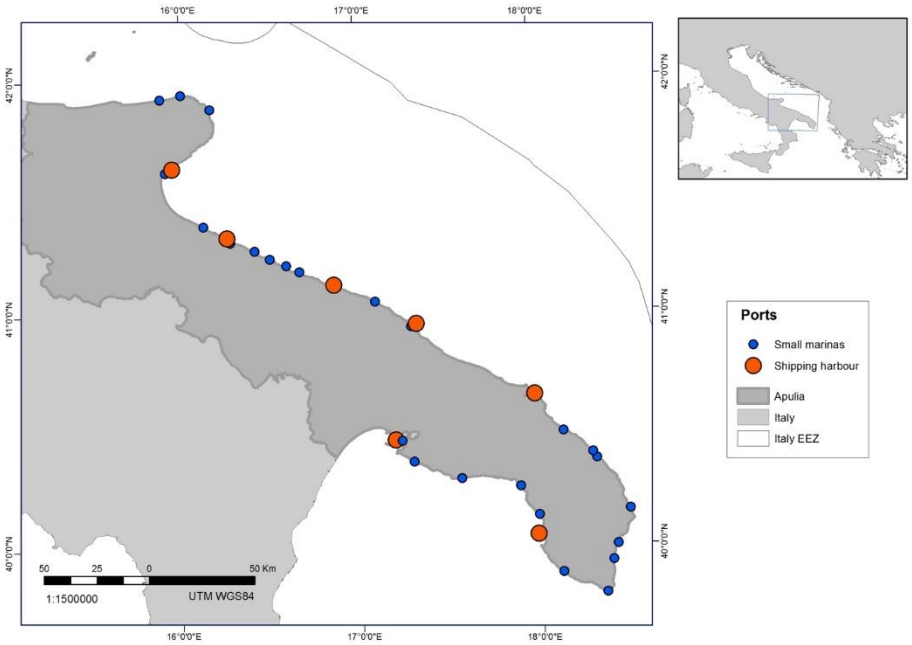


Figure 4-16 Marinas and shipping Harbour of Apulian coast

4.2 Passenger and cruise transport

R. Mosetti, S. Fraschetti, G. Farella, F. De Leo, T. Papatheochari, S. Niavis, A. Kokkali, P. Drakopoulou, V. Vassilopoulou

Cruise tourism is one of the most promising activities in Adriatic and Ionian countries and MSP can be a key tool in promoting its sustainable development.

According to the study carried out by Risposte Turismo in 2013, in Adriatic cruise ports about 5 million passengers were moved in 2012 (+0.9% more than 2011) and 3,550 calls were made (-1.3% fewer than 2011). Although contained, the growth rate of passenger movements in the area appears to be significant, in a year in which the sector, on a worldwide level, suffered stagnation in line with the general trend of the economy. On the level of individual ports, Venice occupies the first place and closed 2012 with more than 1.7 million passengers (equal to 35.6% for the total area), followed by Dubrovnik with 975,000 and Corfu with about 655,000. The first forecasts for 2013 elaborated by "Risposte Turismo" for 12 ports (Venice, Dubrovnik, Corfu, Bari, Split, Ancona, Ravenna, Trieste, Sibenik, Brindisi, Igumenitsa and Rijeka), which represent 80.1% of passenger traffic movements in 2012 and about 79% of ship calls egistered last year, show decided growth estimated in the order of +9.3% for passenger movements and +1.9% for ship calls. Moving on to the ferry sector, the report documents passenger movements and ship calls for more than 30 of the main Adriatic ports. In 2012 passenger movements in these ports were 16,325,000, a decided decline with respect to the previous year (-9.3%). While ship calls in these ports were about 80,000, a reduction of -1.9% with respect to 2011. Taking into consideration ten of the most important ports for ferry traffic in the Adriatic (Split, Zadar, Igumenitsa, Corfu, Ancona, Bari, Durres, Brindisi, Dubrovnik and Venice), the analysis of the historic series of data relative to the decade 2003–2012 highlighted that, in terms of passenger movements, there has been a return to the starting point with the total for 2012 (about 14.2 million, only slightly better than the value registered in 2003 (about 13.2 million).

Cruise Ports

On the other side, the cruise sector and its benefits regarding local development seem to have an even greater impact on the port industry of the region. A lot of local ports have entered in the Mediterranean cruise networks and started or planned large development plans in order to adequately accommodate the new mega cruise ships. In Table 4-12 the infrastructure of the main cruise ports is presented in comparison with the mean infrastructure capacity of Mediterranean ports in order for the differences to be highlighted. As can be seen, the Adriatic-Ionian ports outweigh the average of Mediterranean ports in terms of the number of terminals dedicated to cruise traffic. The other indicators of infrastructure's capacity highlight the relative lack of adequate infrastructure of the Adriatic-Ionian port cruise sector. More precisely, only 36% of the region's ports can accommodate cruise ships with draught over 11 m. and less than 30% can accommodate ships with length over 350 m. It should be noted, that the last generation of cruise ships are exceeding 11m draught and 300 m. length. Finally, only 36% of the ports own a passenger terminal which is a prerequisite for the efficient and pleasant service provided to passengers.

	Adriatic-Ionian	**Mediterranean**
Percentage of ports with >1 cruise terminal	86%	82,9%
Percentage of ports with depth >11 m.	36%	51,3%
Percentage of ports with length of berth >350 μ.	29%	44,7%
Percentage of ports with passenger stations	36%	76,3%
Percentage of ports in <60km distance from airport	71%	78,9%
Number of ports	**14**	**76**

Table 4-12 Infrastructure Capacity of the Adriatic-Ionian Cruise Ports (2012). Greekcruise, 2013; Medcruise, 2011; 2012a; 2012b; Port Authorities; Own Elaboration

Despite the relative lack of adequate infrastructure, cruise passenger flows are steadily increasing in the last decade and many ports can accomodate ships with high carrying capacity. Additionally, port authorities strengthen their networks among shipping lines and thus, tend to attract significant traffic. Table 4-13 presents the average carrying capacity of ships and the number of cruise lines calling at each port. As can be seen Bari and Venice are the two ports that acommodate cruise ships with average capacity exceeding 3000 passengers.Additionally, concerning the connectivity of each port, Dubrovnik, Corfu and Venice seem to have established an extended lines' network as the lines calling at the ports exceed 20.

Port	Pax/Call	Shipping Lines
Bari	3537	5
Venice	3314	20
Trieste	2195	3
Corfu	1551	21
Dubrovnik	1348	23
Ravenna	1311	6
Koper	1212	11
Split	840	16
Kotor	821	19
Zadar	501	6
Sibenik	298	3

Table 4-13 Shipping Companies and Size of Ships Calling at Adriatic Ionian Ports (2014). MedCruise, 2014; Port Authorities; Own Elaboration

The annual traffic of cruise passengers in each port is presented in Figure 4-17. Venice is the dominant port of the region. Apart from the transit passenger flows, Venice acommodates remarkable homeport traffic. Significant volumes of cruise traffic are also observed at the ports of Dubrovnik, Corfu and Bari, since the annual passengers in these ports exceed 600k. As can be seen from the figures, the ports which can accomodate the larger cruise ships and have estabished a cruise network are presenting the most significant growth prospects.

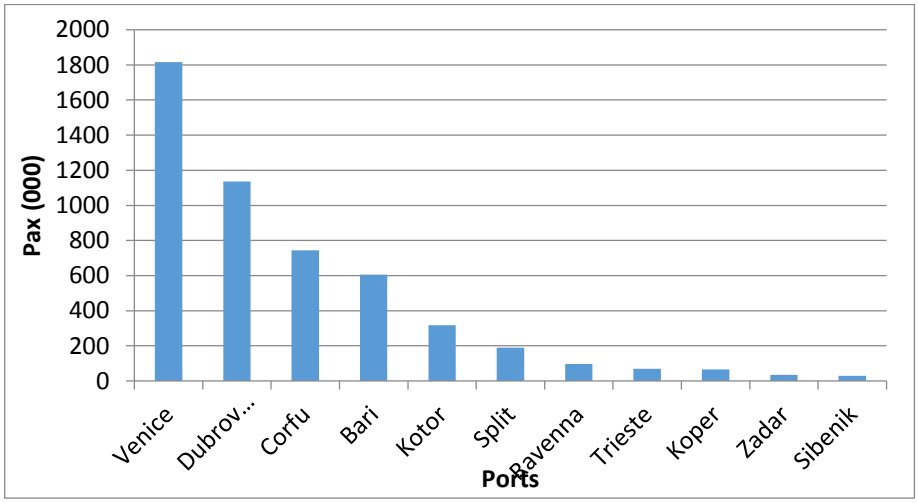


Figure 4-17 Total Cruise Passengers at the Main the Adriatic-Ionian Ports (2013). Medcruise, 2014; Port Authorities; Own Elaboration

Undoubtedly, the competitive dynamics of the Adriatic-Ionian cruise ports, affect the annual traffic achieved by each port differently. Figure 4-18 presents the results of Shift-Share analysis, which estimates the gains and losses of the main ports of the region in the period

2009-2013, in terms of total passenger arrivals. Share Effect depicts the expected traffic growth of a port, under the condition of keeping its market share and maintain the same growth rates as those exhibited by the port system as a whole. The Shift Effect calculates the amount of traffic a port has lost or won from competitors taking into account the growth rates of ports and the growth rate of the system as a whole (De Lombaerde and Verbeke, 1989). As can be seen from the figure, most of the ports present a positive value in the shift component and only three ports negative. The greater gains are observed at the ports of Kotor and Ravenna and the greater losses at the ports of Venice and Bari. This finding reveals the great potential of even the smaller ports to attract significant cruise passengers' volumes.

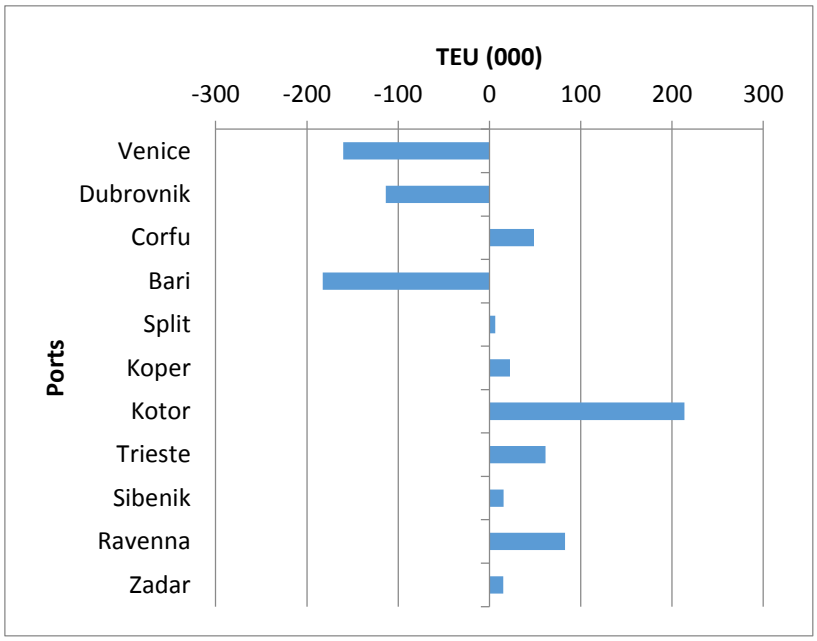


Figure 4-18 Results of Shift-Share Analysis. Greekcruise, 2013; Medcruise, 2011; 2012a; 2012b; 2014; Port Authorities; Own Elaboration

The intense competition among ports that was testified by the aforementioned results directly affects the local economies of ports since the prospects of cruise tourism for the development of their hinterlands are remarkable. It is estimated that the average passenger spends at the port of embarkation around 74 €. If the air transport costs to the port of cruise embarkation is also considered, then the average cost per passenger reaches 290 €. Similarly, it is estimated that the average cost per passenger at cruise itineraries is 62 €. Taking this into account the total estimated spendings of cruise tourists at the ports of the region are presented in Figure 4-19. The type of traffic (transit or base) is taken into account during the process of estimation. As can be seen, the total estimated spending at Venice exceeds 100m €. This remarkable finding is the result of the high base traffic that the port of Venice attracts every year. Therefore, attracting homeport traffic is a crucial task for port authorities (European Cruise Council, 2012).

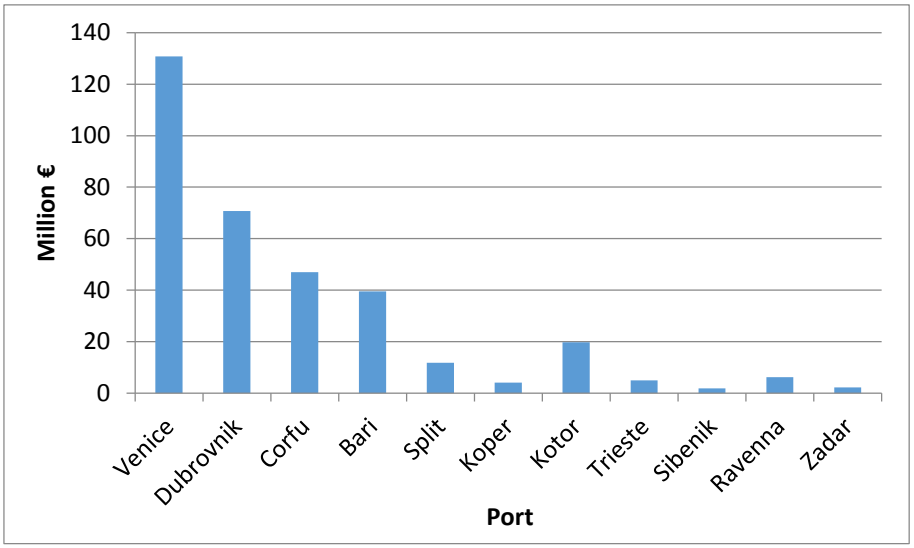


Figure 4-19 Tourists' Total Estimated Spendings At Adriatic-Ionian Cruise Ports (2013). Medcruise, 2014; European Cruise Council, 2012; Own Elaboration

Passenger Ports

AIM ports serve as critical nodes for the transportation of passengers, either for their own countries or for different countries of the region.

Short Sea Shipping routes of the region present remarkable volumes, thus attracting the interest of a significant number of shipping lines. Moreover, the ports accommodate a large number of cruise passengers each year which enables them to further strengthen their advantage against their global competitors.

Local and international passenger services are provided from many shipping companies through a large number of ports. The active connection of the 2014 are presented in Figure 4-20. As can be seen from Figure 4-20, the Adriatic-Ionian region is well served by shipping companies and the main international lines concern the connection of the Balkan coastline to the Italian ports. Thus, the ports of the Balkan Peninsula such as Patra, Igoumenitsa, Durres and Bar are favored due to their established connections with the Italian ports of Bari, Brindisi, Ancona and Venezia (Synthesis Project, 2012).

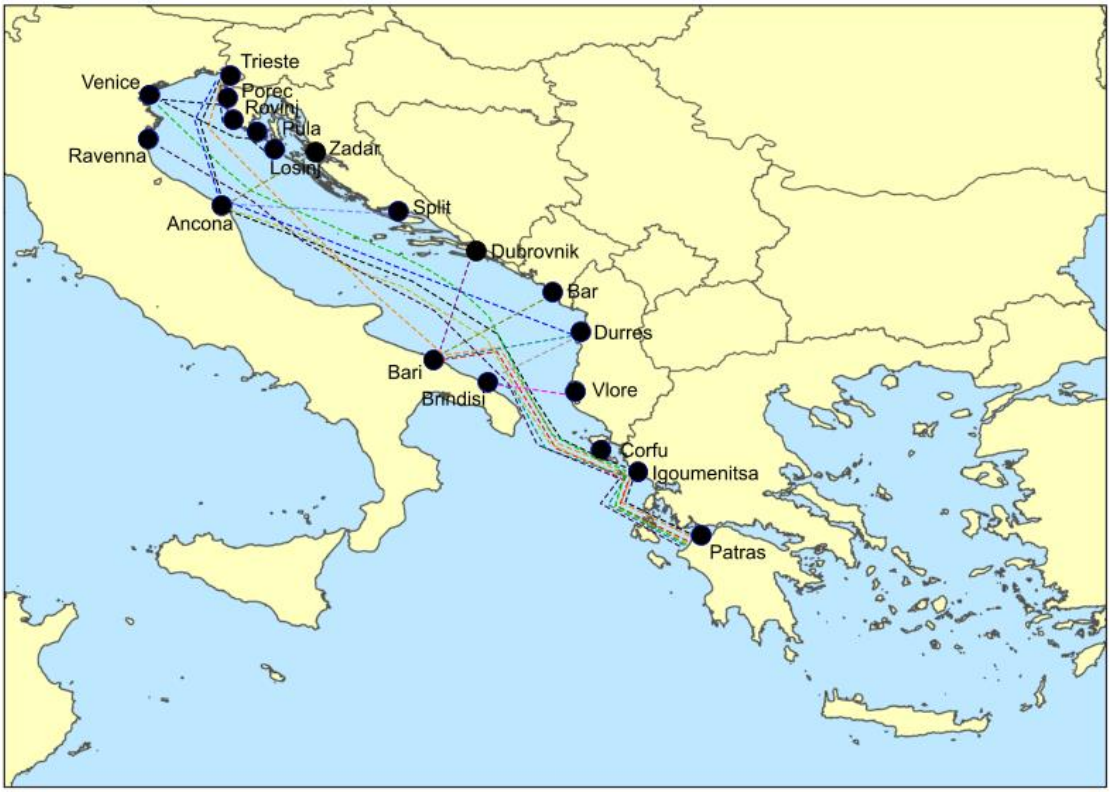


Figure 4-20 Ro/Ro PAX Connections in the Adriatic-Ionian Region (2014). Directferries, 2014; Shipping Companies; Own elaboration

Connections are more intensive during the summer period beacuse of the high tourist demand in the region. Nevertheless, many lines remain also active during the winter period, especially in the routes between Greece and Italy. In order to overcome the seasonability problem, shipping lines operating in the region employ cooperation strategies through joint maritime services. These strategies have resulted to the exit of many companies which were active in the past and thus has given a more concetrated structure in the shipping market of Adriatic-Ionian region. Despite the exit of many shipping lines, the competition in the region remains strong and its main characteristic is the effort of the companies to reduce their costs. Bearing in mind the active lines presented in Figure 4-20, it is interesting to analyse the position of each port in such a competitive environment. This is achieved by examining the data included in Table 4-14 where the shipping lines calling at each port, the intensity of calls and the average capacity of the ships calling at the ports are presented (Dealnews, 2013; Naftemporiki, 2013).

Port	**Connections**		**Shipping Lines**		**Calls / Week**	**Pax. / Call**
Patra	Igoumenitsa	Ancona	Superfast Ferries	ANEK Lines	35	1456
	Corfu	Ravenna				
	Bari	Trieste	Grimaldi	Minoan Lines		
	Brindisi	Venice				
Igoumenitsa	Patra	Ancona	Superfast Ferries	ANEK Lines	38	1379
	Corfu	Ravenna				

	Bari	Trieste	Grimaldi	Minoan Lines		
	Brindisi	Venice				
Corfu	*Ancona*	*Patra*	*Superfast Ferries*	*ANEK Lines*	5	1460
	Igoumenitsa	*Bari*				
Ancona	Igoumenitsa	Patra	Superfast Ferries	ANEK Lines	41	1500
	Corfu	Durres	Grimaldi	Minoan Lines		
	Trieste	Split	Adria Ferries	*SNAV*		
	Zadar		Jadrolinija	*Blue Line*		
Bari	Patra	Igoumenitsa	Superfast Ferries	Adria Ferries	37	1150
	Corfu	Durres	Ventouris Ferries	Jadrolinija		
	Dubrovnik	Bar	Montenegro Lines			
Brindisi	Patra	Igoumenitsa	Grimaldi	Red Star Ferries	25	940
	Durres	Vlora	European Ferries			
Venice	Patra	Igoumenitsa	ANEK Lines	Venezia Lines	21	458
	Porec	*Rovinj*				
	Pula	*Losinj*				
Ravenna	Patra	Igoumenitsa	Grimaldi	Minoan Lines	1	600
	Trieste					
Trieste	Patra	Igoumenitsa	Grimaldi	Minoan Lines	5	1704
	Ancona	Ravenna	Adria Ferries			
Durres	Ancona	Trieste	Adria Ferries	Ventouris Ferries	31	1077
	Bari	Brindisi	Red Star			

			Ferries			
Vlore	Brindisi		Red Star Ferries	European Ferries	9	1272
Bar	Bari		Montenegro Lines		4	920
Split	Ancona		*SNAV*	Jadrolinija	17	1290
			Blue Line			
Zadar	*Ancona*		*Jadrolinija*		5	1053
Porec	Venice		Venezia Lines		7	330
Rovinj	Venice		Venezia Lines		7	330
Pula	Venice		Venezia Lines		2	330
Losinj	Venice		Venezia Lines		1	330
Dubrovnik	Bari		*Jadrolinija*		4	1030

Table 4-14 Intensity of Maritime Connections at Adriatic-Ionian Ports (2014). Directferries, 2014; Shipping Companies; Own elaboration

As can be seen from the data of Table 4-14 the busiest ports are those of Ancona, Patras, Igoumenitsa, Bari and Durres. These ports are well connected with a significant number of destinations and are called by more than 30 ships per week whose average capacity exceeds 1k passengers. High levels of connectivity are also observed at the ports of Brindisi, Split and Venice. Nevertheless, most lines of Split and Venice are characterised by seasonality and are not in operation during the winter period. The importance of ports' connectivity and calls' intensity is reflected in the total passenger traffic for the year 2011 which is presented in Figure 4-21. The figures testify that the ports with the larger traffic are those that have managed to attract the larger number of shipping lines.

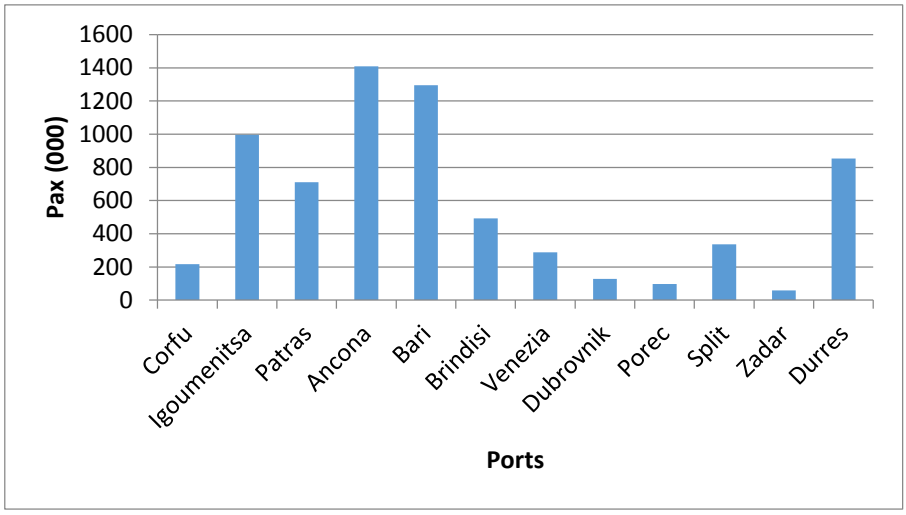


Figure 4-21 International Passenger Traffic at the Main the Adriatic-Ionian Ports (2011). SEETO, 2011; Eurostat, 2014; Port Authorities

4.2.1 Focus Area 1

The Port of Venice is the leading Mediterranean homeport for cruise ships. Cruise ships account for a large share of transiting passengers. In 2012 1.998.960 passengers (1.739.501 on cruise ships) transited by Venice, confirming its position as one of the Mediterranean's chief homeport. Issues related to cruise transport in FA1 are being deepened (and will be included at a later stage) since, being one of the most promising economic sector, it will be an important component for MSP.

Shipping links, aimed mostly for tourists, have been activated by the town of Trieste for years, with links along the Istrian coasts, to the towns of Pula, the island of Brioni, the towns of Rovinj, Portorož, Piran, etc..and in the past were made with the motorboat "Marconi", recently replaced with a less prestigious drive. During the summer season in all the major centres of the coastal regions of Friuli-Venezia Giulia (Grado, Lignano, Bibione) and Veneto (Caorle, Jesolo, etc..), daily cruises are active to the city of Venice and to the Istria in coastal Towns. The well known catamaran "Prince of Venice", of the Company Kompas, runs summer cruises from the Istrian towns on the Slovenian and Croatian coasts to Venice. Maritime links between the Italian coasts and the Slovenian and Croatian are held over distances that vary between 15 and 50 miles (for example between Grado and Portorož and Portorož and Venice). If the paths are made in the Gulf of Trieste, the maximum water depth is about 25 m. If the connection involves the city of Venice, the maximum height of the bottom can reach 25 m – 30 m. The deepest waters are found along the coasts of Slovenia and Croatia where, already a few miles from the coast the height of the sea reaches 25 m to 30 m and more. Along the Italian coasts the sea depth is more limited and reaches 6 m to 10 m at 5 – 10 miles offshore. The presence of shallow water will greatly influence the hydrodynamic behaviour of fast hulls, whose wave generation and the propulsive power require to reduce the speed. The use of fast vessels cover not only emissions and discharges into the sea, but also the generation of anomalous waves by the ship, which proceeds at high speed in shallow water. These waves are spread and discharged into the environment and along the coasts and damage the environment itself. This phenomenon , called "Wake Wash", is very well known and is particularly acute along the coasts of Veneto region and in the lagoon of Venice, for its harmful effects.

Ferry routes between Italy and Croatia in North Adriatic are reported in Figure 4-22.

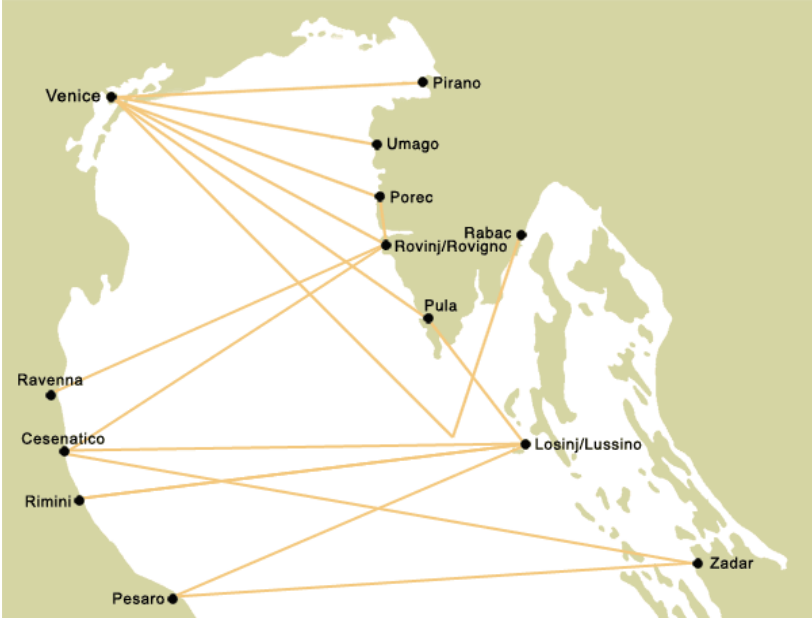


Figure 4-22 Ferry routes between Italy and Croatia in North Adriatic - Istria and Kvarner (http://www.find-croatia.com/ferries-croatia/ferry-map-north-adriatic.html, last access 06.05.2014)

	2011	2012	INDEX
Dubrovnik port	705.292	743.087	105,4

Table 4-15 Number of cruise passengers in Dubrovnik port (2011-2012). Source: Agency for Coastal Shipping, Traffic in state ports 2011/2012

The passenger terminal in Koper operates from 2005. It allows mooring of large tourist ships (cruising tourist excursions). In the market of maritime passenger transport, it has been recognised as a new, attractive and undiscovered destination for cruise ships sailing in the Mediterranean.

Year	Ship arrivals	Number of passengers
2005	18	1,100
2006	18	1,614
2007	54	25,580
2008	44	15,246
2009	53	31,021
2010	54	37,264
2011	78	108,729
2012	46	64,455
2013	54	65,434

Table 4-16 Number of passengers and cruise ships in the Port of Koper, 2005-2013Source: http://www.luka-kp.si/slo/terminali-in-tovor/potniski-terminal

The Port of Koper is a member of the Association of Mediterranean Cruise Ports (MedCruise), which provides greater visibility and additional promotion for the Passenger Port of Koper. The following associations and institutions are actively involved in the development of passenger traffic at Koper: **Slovenia's Consortium for the Development** and **Promotion** of **Cruise**, Municipality of Koper, Postojna Caves, Lipica, Portorož Tourist Association and the Slovenian Tourist Board.

4.2.2 Focus Area 2

Greece is an attractive destination for cruise passengers. Given Greece's unique geographical features and in particular its extensive insular territory, the country's territorial and social cohesion depends directly on the existence of frequent and reliable coastal shipping services (serving 94 islands, 144 ports and around 36 million passengers per year) (DG-MARE, 2011).

The situation in most ports in the Ionian Sea has improved in terms of port infrastructure with the implementation of numerous projects through the last decade. Also, ferry connections have been strengthened significantly both in terms of intraregional connections between the islands, and with ports between the islands and the mainland and with Italy.

Cruise industry is a major sector of maritime transport in the area, which has been developed in Corfu and Argostoli where the relevant infrastructure has been constructed. According to the statistics of the cruise traffic in Corfu and Argostoli there is a steadily increasing traffic both in ships and passengers even during the current economic crisis (2009 to present), which shows that the international nature of the cruise industry makes it less vulnerable to the negative effects of the economic crisis.

The Ionian islands are connected with Italy, Albania and the mainland of Greece and specifically with the major Italian ports of Venice, Ancona, Bari and Brindisi and Sarande (Albania) either directly by ferry boat from Corfu, or by ships from Igoumenitsa or Patra which have intermediate stops in Corfu and –according to the season- in Zakynthos and Sami (Kefalonia). Connections to Italy, the mainland of Greece as well as intraregional connections are formed depending on the season and conditions. Passenger transport is presented in the following Tables.

Ferry lines	**Passengers**			**Vehicles**		
	2004	**2007**	**2004 - 2007**	**2004**	**2007**	**2004 - 2007**
Corfu-Igoumenitsa	1.174.000	1.445.000	23,1%	369.000	456.000	23,6%
Argostoli-Liksouri	491.000	583.000	18,7%	135.000	182.000	34,8%
Kyllini-Poros	333.000	496.000	48,9%	117.000	190.000	62,4%
Zakynthos-Kyllini	1.043.000	1.152.000	10,5%	311.000	352.000	13,2%

Table 4-17 Ferry traffic 2004 – 2007. Hellenic Statistical Authority, MEECC (under review-a)

Ferry lines	Passengers			Change %		Vehicles			Change %	
	2΄ Trim 2011	2΄ Trim 2012	2΄ Trim 2013	2012 /2011	2013 /2012	2΄ Trim 2011	2΄ Trim 2012	2΄ Trim 2013	2012 /2011	2013 /2012
Argostoli - Liksouri	114.076	106.032	106.635	-7,1	0,6	32.200	30.399	28.912	-5,6	-4,9
Zakynthos – Kyllini	228.881	196.226	199.498	-14,3	1,7	58.396	48.371	54.773	-17,2	13,2
Corfu - Igoumenitsa	353.257	327.121	370.864	-7,4	13,4	104.409	92.649	102.225	-11,3	10,3
Kyllini-PorosKefalonia	90.765	72.647	88.775	-20,0	22,2	32.024	24.590	27.056	-23,2	10,0

Table 4-18 Passenger traffic and vehicles in in ferry lines (second trimester of 2011-2012-2013). Hellenic Statistical Authority

Lines	Passengers			Change %	
	B΄ Trimester 2011	B΄ Trimester 2012	B΄ Trimester 2013	2012 /2011	2013 /2012
Patra-Akarnania-Ionian Islands	83.616	112.280	115.231	34,3	2,6

Table 4-19 Passenger traffic in line Patra-Akarnania-Ionian Islands (second trimester of 2011-2012-2013). Hellenic Statistical Authority

Ports	Arriving passengers			Change %		Departing passengers			Change %	
	B΄ Trimester 2011	B΄ Trimester 2012	B΄ Trimester 2013	2012 /2011	2013 /2012	B΄ Trimester 2011	B΄ Trimester 2012	B΄ Trimester 2013	2012 /2011	2013 /2012
Igoumenitsa	118.964	95.837	76.307	-19,4	-20,4	88.376	72.458	56.125	-18,0	-22,5
Corfu	23.851	9.865	7.488	-58,6	-24,1	19.338	10.098	7.526	-47,8	-25,5
Patra	99.176	64.864	72.857	-34,6	12,3	79.635	53.877	55.943	-32,3	3,8

Table 4-20 Passenger traffic in the most important ports of the area (second trimester of 2011-2012-2013). Hellenic Statistical Authority

Ports	Passengers arriving		Passengers departing	
	2010	2001	2010	2001
Corfu	-	34.875	-	31.721
Lefkada	43.508	69.335	45.249	73.824
Meganisi	75.532	-	74.335	-
Nidri	-	-	61.701	-
Sami	171.796	174.990	179.060	186.191
Fiskardo	31.040	-	29.765	-
Ithaki	42.192	42.803	50.917	45.915
Pisaetos (Ithaki)	29.697	-	20.037	-
Frikes (Ithaki)	514	3.914	493	-

Table 4-21 Passenger traffic (2001-2010). Hellenic Statistical Authority, MEECC (under review-a)

Also cruise ship traffic in the port of Argostoli is presenting an upward path. The cruise ship arrivals increased about 52% between 2009 and 2012 and passenger arrivals have increased about 29% (Table 4-22).

Year	Number of cruise	Number of

	ships	**passengers**
2009	62	90.808
2010	64	82.812
2011	56	87.171
2012	94	116.783

Table 4-22 Number of cruise ships and passengers in Argostoli port (2009-2012). MEECC (under review–a)

During 2005-2009 a private Canadian company launched seaplanes in the Ionian Islands, linking them with each other and with Patra, Ioannina, Volos and Brindisi in Italy. Today under the IPA project "Creation of a Network of Sea Planes in the Adriatic Basin (ADRI -SEAPLANES)" the revival of seaplanes lines is attempted by the Region of Ionian Islands to strengthen the connection among the islands and with the mainland but also with the countries of the Adriatic. A part of this project is pilot seaplanes flights to all areas of the project partners. The launch of seaplanes is now considered essential to enhance the spatial coherence and openness of the region. The upcoming Law 4146/2013 concerning waterways of the sea could help towards this direction. Seaplanes are expected to operate complementary to other modes of transport enhancing intraregional and interregional coherence.

The Ionian Islands, and Corfu in particular, is a favorable destination, both for domestic and international visitors, hence there exist a good maritime traffic in the area (Figure 4-23). Cruise industry is a major sector of maritime transport in the area, with cruise traffic in Corfu steadily increasing, both in terms of ships and passengers even during the current economic crisis (2009 to present), which shows that the international nature of the cruise industry makes it less vulnerable to the negative effects of the economic crisis. According to data presented in Table 4-23, the traffic of cruise ships in the port of Corfu had a continuous annual increase from 2003 to 2011 while the number of passengers in the same period increased by 124.35%, whereas more than 1.5 million passengers have been recorded embarking, and an equal number of passengers disembarking, from all four major ports in the Greek part of the FA2 (Table 4-24).

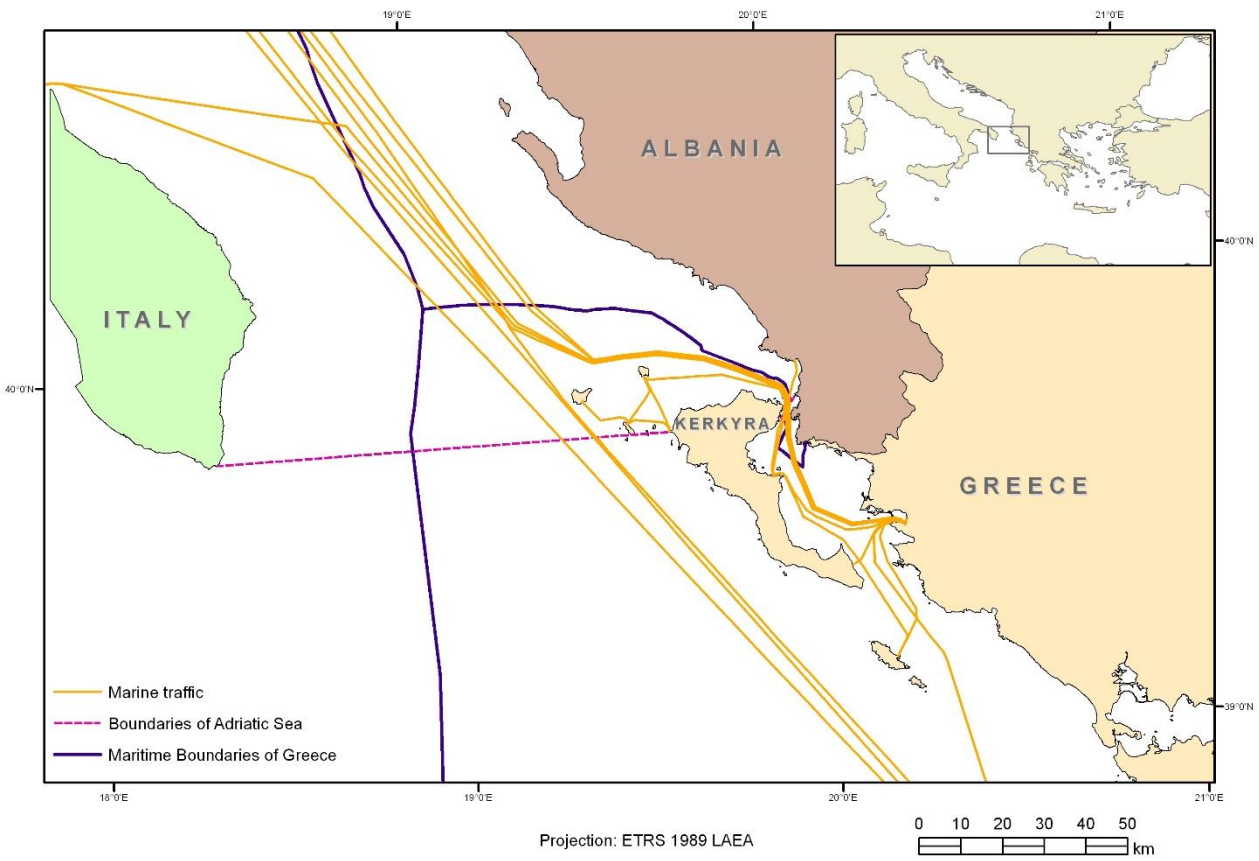


Figure 4-23 Major marine traffic routes of passenger traffic in the Greek part of FA2. Hellenic Statistical Authority; data from CoCoNET project.

Year	Number of cruise ships	Number of passengers
2003	308	264.871
2004	309	260.279
2005	328	276.050
2006	342	311.445
2007	369	384.553
2008	410	441.600
2009	375	500.400
2010	429	549.025
2011	464	594.228

Table 4-23 Number of cruise ships and passengers in Corfu port (2003-2011). MEECC-a

Port	Passengers Dissembarked per year			Passengers Embarked per year		
	2009	**2010**	**2011**	**2009**	**2010**	**2011**
Diapontia Isls.	4236	3585	3941	3733	3733	3737
Lefkimi (Corfu)	81709	77660	78163	88873	80669	80992
Igoumenitsa	865312	827192	787282	850905	821789	774774
Corfu	775313	748930	695541	779973	748218	701740

Table 4-24 Domestic passenger traffic in the ports of the FA2 (2009-2011). Hellenic Statistical Authority; data from CoCoNET project.

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Bari	277979	303338	351897	465739	567885	507712	586848	618882	604781
Brindisi	10642	2492	10303	2004	1745	28489	5226	13507	4628

Table 4-25 Number of cruise ships and passengers in Apulian ports (2005-2013)

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Bari	1454000	1575000	1780000	1846000	1961000	1903000	1951000
Brindisi	562000	457000	422000	504000	524000	520000	527000

Table 4-26 Total number of passengers in Apulian ports (2005-2011)

Also in Apulia this traffic is increasing especially in the Bari port. In Brindisi, the variable numbers observed can be possibly due to the management politics of the touristic ports. The number of passengers is rather stable in time in both ports.

4.3 Coastal and maritime tourism

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Tourism has traditionally been one of the most active and developed sectors of the economy in AIM. The extended coastline of the Adriatic-Ionian countries and the large number of islands have rendered the region to a popular tourist destination. The performance of tourism in the macroregion is extremely uneven but overall the region has developed a large range of tourist infrastructures and most of the coastal space is filled with accommodation infrastructure such as hotels and marinas. The bed capacity and the total tourist arrivals of the coastal regions of the Adriatic-Ionian Sea for the year 2012 are presented in Table 4-27. Regions' capacity for tourist accommodation exceeds 3 M. beds.

	Number of Beds	**Tourist Arrivals**
Greece	274,382	3,921,186
Italy	1,902,269	34,729,989
Croatia	769,204	10,277,159
Montenegro	149,348	1,439,500
Albania	15,901	250,000
Slovenia	24,560	656,823
Total Adriatic-Ionian	3,135,664	51,274,657
Total Europe	28,390,959	492,515,102
Adriatic-Ionian / Europe	11%	10%

Table 4-27 Annual Capacity and Occupancy in Tourists' Accommodation Infrastructure (2012). Eurostat, 2014; Statistical Office of the Republic of Slovenia, 2014; Albanian Institute of Statistics, 2014; Own Elaboration

The highest number of accommodation infrastructure is found in Italy, where nearly 2 M. beds are available. The poorest numbers of accommodation infrastructure is found in Albania. Additionally, the tourist arrivals in 2012 exceeded 50 M. tourists. Italy is the dominant host country, while Croatia, Greece and Montenegro also present significant achievements in tourism sector. The tourism sector of the region is amongst the more active sectors of Europe as it has the 11% of the total available beds and attracts 10% of the total tourists visiting a european destination (Figure 4-24).

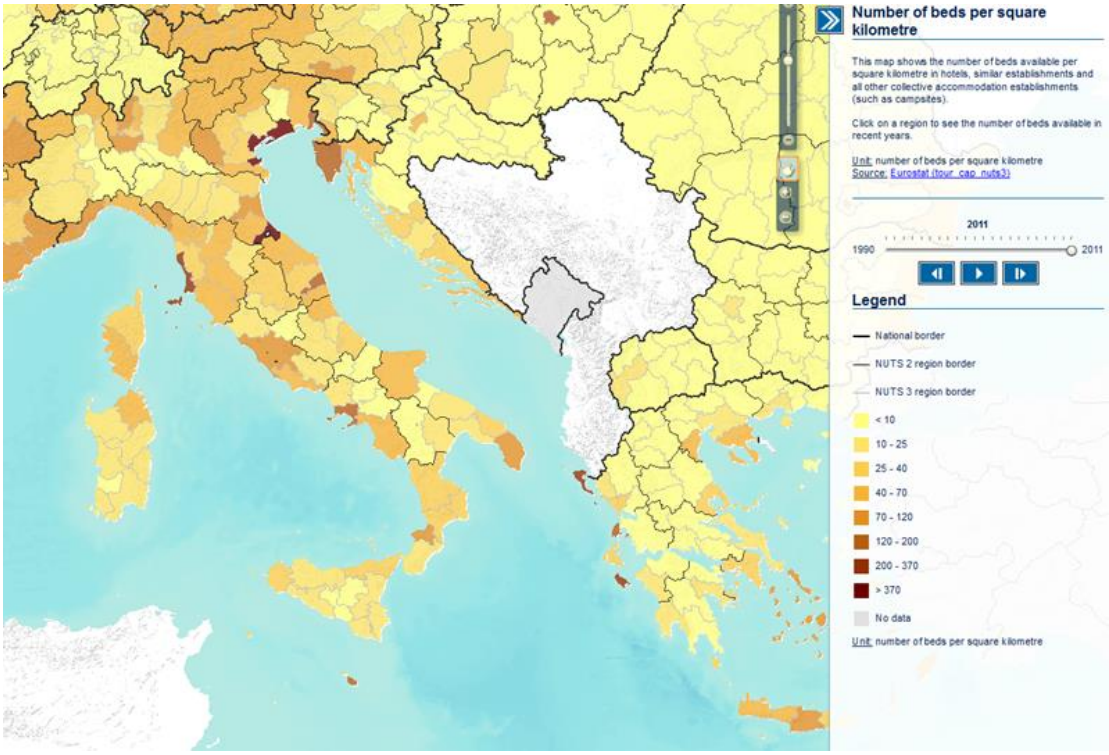

Figure 4-24 Number of bed per square kilometre (NUTS 3 regions). Eurostat, European Atlas of the Seas, 2011

The tourist accommodation establishments' capacity of Adriatic-Ionian NUTS III regions is presented in Table 4-28. As can be seen, the average capacity of Italian regions is the highest of the Adriatic-Ionian Region, as in 2011 in each of the Italian NUTS III regions, over 2,300 accommodation establishments could be found. Nevertheless, it should be noted, that this estimation is strongly and positively influenced by the high capacity of Venezia prefecture which accounts of over the 50% of total coastal Italian establishments. Thus, the average capacity of Italian NUTS III, with Venezia left out of estimations, ranges in about 1150 establishments. Greek NUTS III regions' average capacity in 2011 exceeds 765 establishments. The higher capacity is observed in Corfu and the lower capacity in Arta. Croatian coastal regions have in average of 260 accommodation establishments. The lower capacity is observed in Licko-senjska region and the higher capacity in Primorsko-goranska. As for the other countries, Montenegro presents the higher capacity with 300 establishments, followed by Albania and Slovenia whose establishments are 205 and 105, respectively.

Country	**NUTS III**	**Total tourist accommodation establishments**		**2010-2011 Change**
		2010	2011	
Greece	Arta	28	28	0.00%
	Thesprotia	253	275	8.70%
	Ioannina	383	386	0.78%
	Preveza	530	543	2.45%
	Zakynthos	1,004	890	-11.35%

	Corfu	4,033	4,010	-0.57%
	Kefallinia	150	153	2.00%
	Lefkada	950	1,007	6.00%
	Aitoloakarnania	133	126	-5.26%
	Achaia	185	173	-6.49%
	Average	**765**	**769**	**-0.37%**
Croatia	Primorsko-goranska zupanija	440	432	-1.82%
	Licko-senjska zupanija	69	76	10.14%
	Zadarska zupanija	250	272	8.80%
	Sibensko-kninska zupanija	133	134	0.75%
	Splitsko-dalmatinska zupanija	341	373	9.38%
	Istarska zupanija	280	303	8.21%
	Dubrovacko-neretvanska zupanija	229	232	1.31%
	Average	**249**	**260**	**5.26%**
Italy	Trieste	263	285	8.37%
	Ferrara	404	421	4.21%
	Venezia	28,643	29,367	2.53%
	Rovigo	2,269	2,513	10.75%
	Udine	7,652	3,747	-51.03%
	Gorizia	440	462	5.00%
	Ravenna	1,082	1,087	0.46%
	Forlì-Cesena	1,002	1,016	1.40%
	Rimini	2,644	2,673	1.10%
	Pesaro e Urbino	973	1,025	5.34%
	Ancona	806	833	3.35%
	Macerata	746	795	6.57%

	Ascoli Piceno	701	711	1.43%
	Teramo	699	699	0.00%
	Pescara	385	413	7.27%
	Chieti	564	600	6.38%
	Campobasso	304	325	6.91%
	Taranto	316	357	12.97%
	Brindisi	418	507	21.29%
	Lecce	1,629	1,888	15.90%
	Foggia	928	987	6.36%
	Bari	608	724	19.08%
	Average	**2,431**	**2,338**	**4.35%**
Slovenia	Obalno-kraska	101	105	3.96%
Montenegro	Whole Country	300	-	-
Albania	Whole Country	269	205	-24%
Adriatic-Ionian Average		**1505**	**1491**	**2.65%**

Table 4-28 Total tourist accommodation capacity in NUTS III regions of Adriatic-Ionian Sea (2010-2011). Eurostat, 2014; Statistical Office of Montenegro, 2014; Albanian Institute of Statistics, 2014; Own elaboration

The capacity of accommodation establishments follows different trends across the Adriatic-Ionian NUTS III regions during the period of 2010-2011. Despite the fact that the average number of establishment per region has fallen from 2010 to 2011 in absolute terms, the average change for regions is positive. This is explained by the strong growth patterns that emerge in the smaller regions against the mainly negative or less significantly positive patterns that are observed in the more congested areas. The highest capacity losses are observed in Italian region Udine and the Greek region Zakynthos and the highest growth at the South-Eastern Italian regions of Brindisi, Bari and Lecce.

Tourism sector brings remarkable economic results and significant prospects for regional development. This is becoming evident from the data of Table 4-29 where the total local units operating at each region and the total number of employees of tourism related enterprises are presented. As can be seen from the data more than 600k people are employed in the tourism sector in which more than 150k of local units are active. Ionian Islands, coastal Croatia and the northern regions of Italy present the higher activity among the regions of Adriatic-Ionian space.

Country	Spatial Unit	Accomodation		Food and Beverage Service Activities		Travel Agencies	
		Local Units	Employees	Local Units	Employees	Local Units	Employees
Greece	Ipiros	754	1271	3508	6299	115	229
	Ionia Islands	3680	8164	4332	8248	271	1054
	Western Greece	459	1726	5386	10690	50	188
Italy	Veneto	3840	29950	22844	94473	1578	4158
	Friuli Venezia	704	4327	6529	23212	210	685
	Emilia Romagna	5192	28232	21089	96494	915	3286
	Marche	1443	6259	7041	26210	459	1367
	Abruzzo	1434	6443	6779	22332	253	659
	Molise	181	844	1652	4279	33	93
	Puglia	2051	11289	16357	51780	674	1650
	Basilicata	369	1578	2304	6954	119	315
Slovenia	Coastal	637	5352	3571	12156	409	1075
Croatia	Coastal	2631	32421	16838	61105	1911	6167
Montenegro	Total		5803		6626		969
Total		**23375**	**143659**	**118230**	**430858**	**6997**	**21895**

Table 4-29 Local Units and Employment in Tourism Related Activities (2010). Eurostat, 2014; Croatian Buraeu of Statistics, 2014; Statistical Office of Montenegro, 2014

The accommodation and services demands on AIM coasts are associated to coastal and maritime tourism, that can be defined in the following way (Study in support of policy measures for maritime and coastal tourism at EU level - Ecorys, September 2013):

• **Coastal tourism** covers beach-based recreation and tourism (e.g. swimming, surfing, sun bathing), and non-beach related land-based tourism in the coastal area (all other tourism and recreation activities that take place in the coastal area for which the proximity of the sea is a condition), as well as the supplies and manufacturing industries associated to these activities.

• **Maritime tourism** covers tourism that is largely water-based rather than land-based (e.g. boating, yachting, cruising, nautical sports), but includes the operation of landside facilities, manufacturing of equipment, and services necessary for this segment of tourism.

AIM includes different model of tourism development: from low profile to niche tourism and from mass tourism to high profile tourism. We refer to mass tourism where locations or services offered tend to target or attract high volumes of visitors with a relative low average spending potential. These location are generally not fixed, but dynamic and changing over time, nevertheless, in Italy there are some "traditional" locations for mass tourism (e.g. Romagna coast). The main features of this kind of tourism are the seasonality, the variability of demand due to lack of fidelisation and the risk of environmental externalities due to its impacts. In Italy but also in general, in recent years we see a saturation of the traditional model of "sun & beach" mass tourism, and in some cases the touristic offer started to differentiate and give space to low profile tourism (nature camping, scouting and youth camps, small-scale boating and recreational fishing, etc.) or niche tourism (specific added-value services or locations attracting a potential lower volume of visitors, but which may value quality of services better than cost-effectiveness, due to higher spending willingness).

According to Ecorys (2013), maritime and coastal tourism actors shall review their business models and to make the necessary efforts to consider moving to 'higher value' models – which respect natural resources as well as social values. One strategy is to upgrade 'low-profile' tourism to 'niche' tourism. Another strategy is to upgrade specific 'mass tourism' destinations, and make better use of the (cultural and natural) values available.

As far as the oriental side of the AIM basin, despite a wide range of possibilities in Croatia, tourism is mainly concentrated in summer seaside tourism and, in the last few years, in sailing tourism. In Montenegro the accommodation offer is very limited and tourism industry is not well organised in terms of offer. Nevertheless, tourism is gradually growing in the summer seaside in Montenegro, which is one of the eastern Adriatic regions with the most attractions which are also ecologically preserved. Current tourist attendance in Albania is, on the other hand, quite occasional: foreign tourism is not promoted very much, however there are many Albanian emigrants coming back for holidays on the coast during the summer (IPA, 2013).

Adriplan partners found difficulties in acquiring data specifically related to coastal tourism, particularly related to Greek coasts. The main problem is related to distinguish activities related to the coast from those inland based. Data related on marinas (position, number and type of boats), that can be tracked down easier, will be included in the further revision of the document.

Coastal and maritime tourism in Adriatic-Ionian Italian coast

The demand for costal tourism affects 31.8% of arrivals in Italy 1 (37.9% of those from Italy and 23.8% from abroad), positioning in the first place for the number of stays among the different type of tourism (Unioncamere 2009).

From statistical data on coastal touristic presence, it can be seen that for both presence and arrival a positive trend came from the 90's and then the negative trend started from 2001 (Table 4-30).

More recent statistic data can be found in ISPRA reporting for MSFD (2013): between 2007 and 2010 coastal tourism presence passed from 119.6 million to 116.2 million, with a decrease of 3%. Arrival trend has been the same, even though not so marked: from 21.6 million in 2007 to 21.4 million in 2010. Coastal and maritime tourism hospitality is made up of more than 51.000 facilities (including bathing facilities), for a total of more than 1.650.000 beds, correspondent to 36% of the entire national bed availability.

Adriatic-Ionian regions have a considerable share on national coastal tourism: they account for almost 60% of the total presences (Figure 4-25).

	Coastal tourism		Total tourism	
	Arrivals	**Presences**	**Arrivals**	**Presences**
1997	16.769.507	97.572.908	70.622.726	292.208.275
1998	17.743.946	102.338.155	72.313.561	299.508.387
1999	18.578.495	10.633.255	74.320.938	308.314.729
2000	19.668.928	115.364.410	80.031.637	338.885.143
2001	19.992.104	118.062.780	81.773.368	350.323.133
2002	19.818.944	117.113.539	82.030.312	345.247.050
2003	19.966.081	116.222.159	82.724.652	344.413.317
2004	20.029.941	112.915.810	85.925.672	345.315.658
2005	20.182.546	112.201.943	88.338.564	355.255.172

Table 4-30 Costal tourism presences and arrivals 1997-2005. Mercury srl 2007 from ISTAT data.

More recent statistic data can be found in ISPRA reporting for MSFD (2013): between 2007 and 2010 coastal tourism presence passed from 119.6 million to 116.2 million, with a decrease of 3%. Arrival trend has been the same, even though not so marked: from 21.6 million in 2007 to 21.4 million in 2010. Coastal and maritime tourism hospitality is made up of more than 51.000 facilities (including bathing facilities), for a total of more than 1.650.000 beds, correspondent to 36% of the entire national bed availability.

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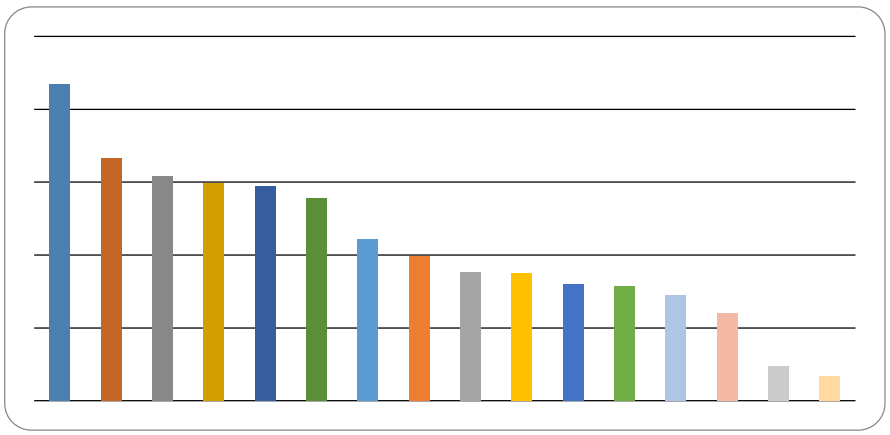


Figure 4-25 Percentage of presences for coastal tourism respect to total touristic presence in each Region. Mercury srl, 2007.

In Adriatic-Ionian Regions, a generally high share of touristic presence is related to coastal tourism and the cluster of northern Adriatic Italian Regions (Friuli Venezia Giulia, Veneto, Emilia Romagna) represent the most important pole of attraction for coastal touristic presence in Italy, especially for foreign visitors (Figure 4-26).

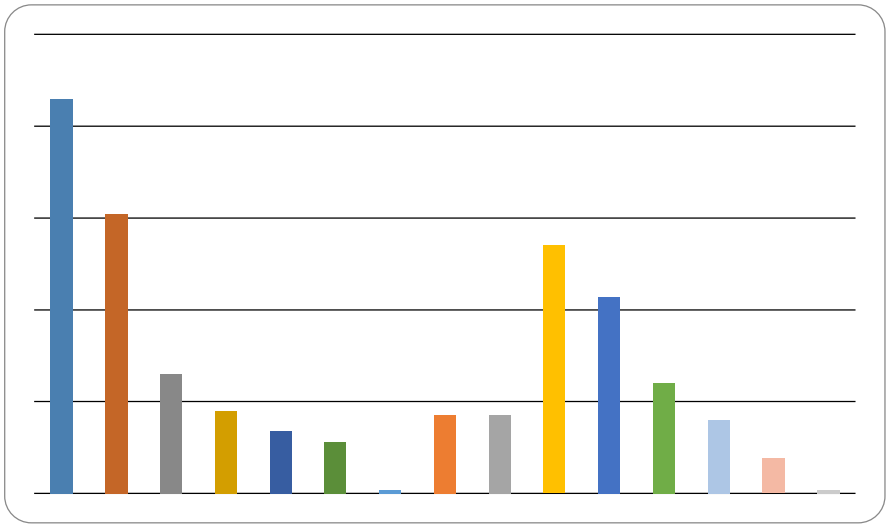


Figure 4-26 Percentage of national coastal tourism presences for each Region. Mercury srl, 2007.

The first four Italian regions for the highest tourist density respect to their coastal length are Emilia Romagna, Veneto, Friuli Venezia-Giulia and Marche, that is to say all the Italian region included in FA1 (Table 4-31). These data highlights the presence of mass tourism and also the priority of addressing the environmental footprint of coastal tourism that can be created by such an high population density in Northern Adriatic.

Region (Italy)	**Lenght of bathing coast (Km)**	**N. Presence/Km bathing coast**	**Private concessions for beaches**	
			n.	**surface (mq)**
Emilia Romagna	100	1.593	1.010	2.050.695
Veneto	99	1.151	438	3.307.594
Friuli Venezia Giulia	62	522	209	659.327
Marche	151	316	1.056	1.544.927
Abruzzo	113	224	723	2.111.730
Molise	33	34	87	226.779
Calabria	616	50	1.421	2.012.334
Puglia	699	29	1.233	2.415.880
Basilicata	59	21	-	-
Lazio	266	51	793	1.574.390
Campania	356	123	275	331.941
Sardegna	852	35	508	334.634

Toscana	390	253	1.279	3.307.594
Sicilia	940	34	-	-
Liguria	282	278	1.751	1.901.200

Table 4-31 Summer presences per Km of bathing coasts (last column).Number and surface for concession of state owned property to private subjects. Mercury srl, 2007 from ISTAT and Ministry of health data.

An insight on the type of tourism in the Italian coast can be given by the split among cost items for people using the services related to coastal and maritime tourism (Figure 4-27).

In Italy, very few tourist allocate budget for boat mooring or rental, while a relevant part of the costs for coastal tourism is related to bathing facilities ("stabilimenti balneari"): 31.2% of Italian tourist and 26.9% for foreigners allocate part of their budget for it. The services associated generally includes an entrance fee, renting of umbrellas, deck chairs, use of showers and changing/locker rooms, etc.). That is the most peculiar feature of Italian coastal and maritime tourism: a widespread diffusion of bathing facilities wherever attractive sandy coasts are located.

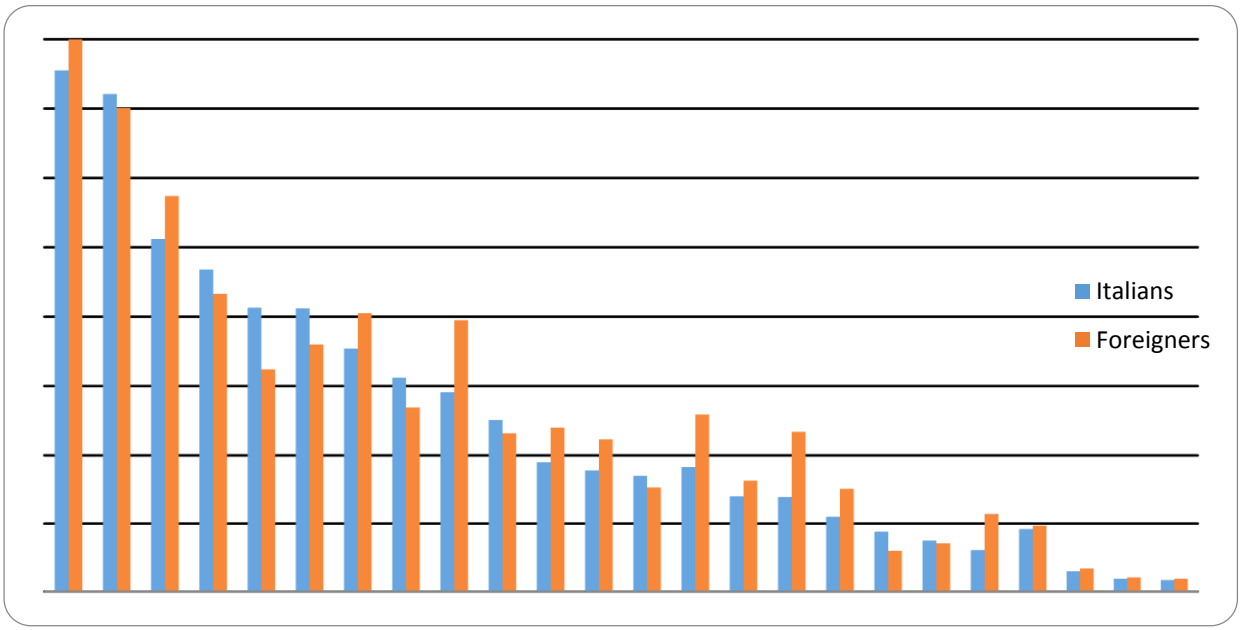


Figure 4-27 Percentage of Italian and foreign tourist that allocate a budget for each cost item for Italy. Unioncamere 2009

North-eastern Italian coasts has been historically the birthplace of the tourism connected to bathing facilities. The first bathing facility in the Adriatic was built in Rimini in 1843, 14 years before of Lido of Venice and 39 before Cervia (Ravenna). Since then, tourism resorts have undergone a gradual metamorphosis that transformed them from expression of exclusive tourism (with the emergence of specialized tourist areas) to a mass phenomenon.

Two main features highlighted at AIM scale are particularly evident for coastal and maritime tourism on the Italian coasts: seasonality and environmental footprint.

Italian coastal and maritime tourism facilities close in winter, with the result that from October to March about half the number of beds are available.

Coastal destinations typically experience a steep growth in visits in peak seasons (from few hundred inhabitants in the low season up to several thousand during peak periods), where in other tourism destinations (e.g. cities) the ratio of visitors over inhabitants are not that disproportionate and the consequent impact is reduced.

The environmental footprint is determined by the impacts induced by the increase of population (Figure 4-28) and by the infrastructures necessary for coastal and maritime tourism development. Throughout the years, the growing of coastal tourism contributed to the environmental re-shaping of part of the Italian coast: of the 700,000 hectares of marshes and coastal lagoons found in Italy in the early 20th century, in 1972 only 192,000 remained and less than 100,000 in1994, while 75% of dune systems have disappeared since 1960 (Plancoast, 2007).

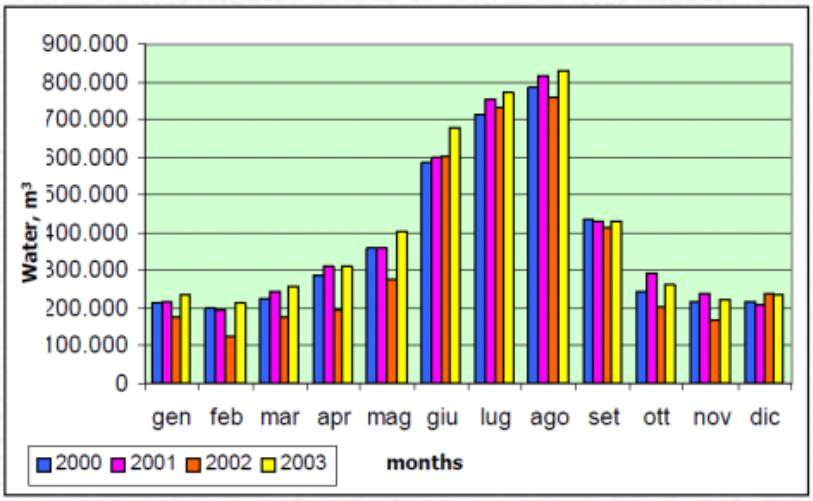


Figure 4-28 Environmental consequences of high seasonality of tourism in Emilia Romagna – water consumption. SHAPE, 2014.

The combination of high anthropogenic pressure, several naturalistic protected areas, high density of resident population and positive sensitivity of citizens and administration to environmental issues can lead local municipalities to adopt an Environmental Management System (EMS) as a tool to move from the mass tourism model to a sustainable tourism development model. E.g: the city of Cervia got the EMS certification in 2007, after a site-specific study confirming the intricate relationship between the primary economic resources (tourism), and its resources (water, waste) and its particular environment rich on natural and protected areas (salt-pans, Park Po River, ancient pinewood) (Bruzzi, 2007).

The data on the permits on state-owned coastal land (that are mainly granted for recreational purposes for the establishment of bathing facilities) are included in the *Sistema Informativo Demanio marittimo (S.I.D.)* of the Ministry of Infrastructures and Trasport.

Data included in the projections made by the Ministry on initial estimates are included in Table 4-31. The classification is not homogeneous: for example in Veneto only 166 units are detected, corresponding to 2, 1% of the national total, because the bathing facilities management activity in many cases is associated with or included in hotel management and not is not even classified as a subsidiary activity. However, it is estimated that the total number of bathing facilities in Italy exceed 15.000 units (Mercury srl 2007) but he data needs to be updated and homogenized. Locations of registered enterprises in the field of bathing tourism are reported in Figure 4-29.

Figure 4-29 Distribution of bathing facilities registered enterprises in 2008. Italian Ministry of Agriculture, Food and Forestry, 2010.

4.3.1 Focus Area 1

Among the Italian FA1 Region, Veneto Region received 14.1 million arrivals in 2008 with 60.6 million overnight stays. Seaside tourism accounted for 3.7 million arrivals (25.8 million overnight stays) in 2007. The arrival per different types of tourism according to the location are reported in Figure 4-131, from which we can see that seaside tourism is the most relevant in summer. Also for the average overnight stays seaside tourism has the first position (Figure 4-31) and from 2000 to 2012 there has been a fall of Italian tourists overnight stays and a small increase of foreign toruirits overnight stays. To this an economic impact analysis should be added, in terms of added value, employment and imports produced by the entire tourism expenditure in Veneto in 2011, the last year for which it was possible to process direct, indirect and induced effects. According to these estimates, tourism in Veneto generated nearly 11 billion in added value and 370,000 work units, respectively equal to 8.2% and 15.9 % of the corresponding regional totals. About 34 % of the added value effects were generated by foreign tourist spending.

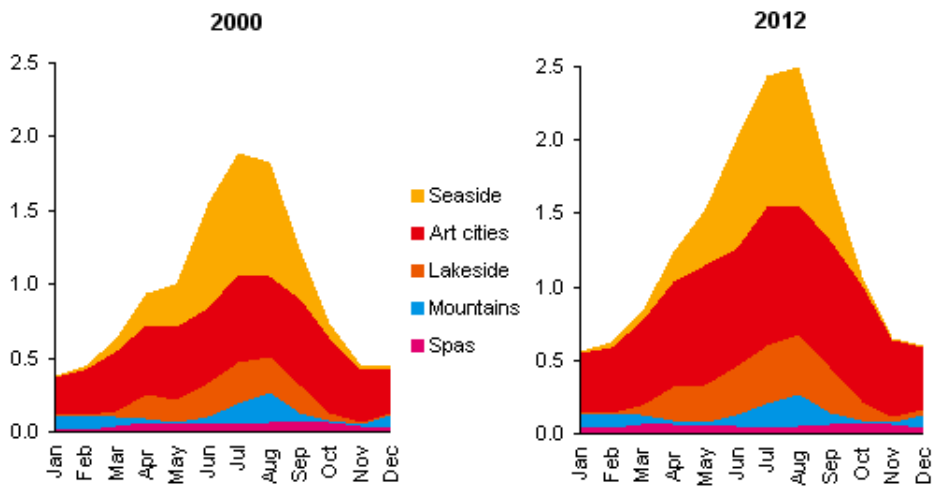


Figure 4-30 Tourist arrivals by month and district (millions) for Veneto Region. Years 2000 and 2012. Veneto Region on Istat and regional data.

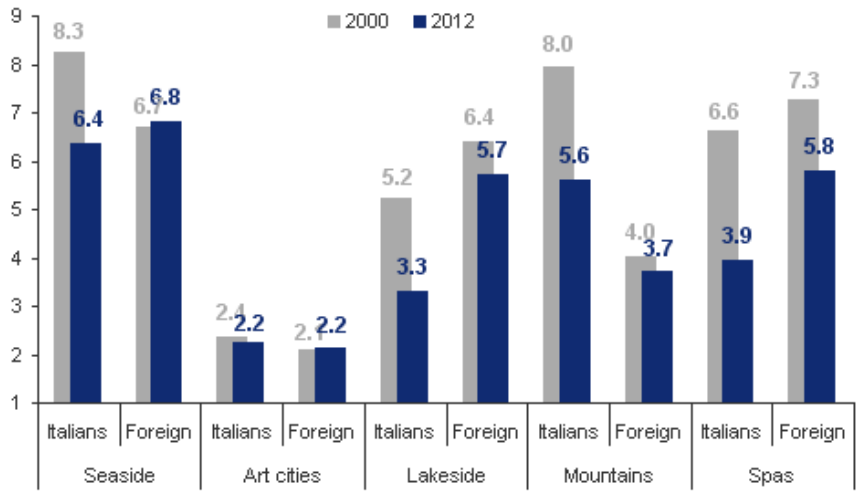


Figure 4-31 Average overnight stays (attendante/arrivals) for Veneto Region. Years 2000 and 2012. Veneto Region on Istat and regional data.

A common feature of Italian Adriatic coast is the establishment of seaside resorts for beach tourism. The first were established in the middle of the nineteenth century. From then on the very fine sand, the calm sea, the excellent climate, and the sincere, creative conviviality of the people have been the distinguishing features attracting tourists. The Adriatic has a long tradition of welcoming visitors and especially appeals to families. Beautiful beaches are equipped with all facilities including baby parks and keep fit sessions on the sand. Adriatic Italian coasts also appeals to young people offering them a variety of night life entertainment (particularly on the Romagna Riviera which is unrivalled in its discos and night spots and has no seasonal limits). The Adriatic coast passes through seven Italian regions, from the border with Slovenia down to the farthest point of Apulia.

Italian northern coasts

Northern part includes the seaside resorts of the Friuli and Veneto regions. In the gulf of Trieste, it is dominated by rocks looking down over the sea, with delightful stretches of sand at their bases. The Friuli Adriatic offers not only beaches equipped for those holiday-makers who

love to have all possible comforts available to them (Sistiana and Ginestre), but also more secluded beaches for those who seek greater tranquillity. The generally less well-known resorts (Costa dei Barbari, Duino) usually have little eating-places with simple cuisine, and are certain to offer good fish dishes. There are a ways sports facilities for tennis, horse-riding, football and, of course, sailing. A holiday here also gives you the chance to get into the sport of potholing - a sport which started up in the Carso area over a hundred years ago and offers a way to explore thousands of underground caves, or else rock climbing, for example, on the natural rock - face for training climbers in the Rosandra valley, just a short distance from Trieste. The oldest and best-known seaside resorts are Grado (there are some remarkable architectural and artistic treasures in the old town-centre), Marano, and the more recently established Lignano Sabbiadoro all on the edges of beautiful lagoons. Going southwards, 117 kilometers of broad, sandy beaches form the dividing line between the sea and the land of the Veneto region. There are countless places worthy of note: Bibione, beautifully situated like an island between the sea and a set of canals, which separate it from the mainland, has highly modem tourist facilities, set in natural surroundings of great beauty; Caorle, with its ancient dwellings; Lido di Jesolo has facilities that can easily accommodate the many thousands of visitors, and Sottomarina, with wide, welcoming beaches just a short distance from Chioggia, a very old fishing town.

The regions of the Upper Adriatic offer many interesting aspects for the environmental context analysis. There are various landscapes and ecosystems that characterize the area just mentioned and each of these is like a treasure chest containing a wide range of species, often including important endemic species. In the area under consideration, , we find plains like the Pianura Padana where the river Po flows through and projects at last into the Adriatic Sea forming one of the most important and beautiful Italian wetlands, the Po Delta, where many sedentary and migratory birds find refuge, we also find a wide lagoon area characterized by shapes such as barene, velme, canals and mouths, and the Karst, a unique landscape characterized by caves, sinkholes, limestone pavements shaped by the dissolution of carbonate rock with acidified rain. The biodiversity found in these landscapes and ecosystems is then often being preserved and protected in many parks, reserves and other types of protected areas that are scattered all over the territory: the Parco Delta del Po in Emilia Romagna and in Veneto, are only a few examples.

The *Riserva naturale regionale della Foce dell'Isonzo* offers the possibility to observe a wide range of animal species of particular interest, sometimes elsewhere rare or unusual species. After the institution of the natural protected area, the most conspicuous effects on the increase in biodiversity, have been in favour of birds which are constantly kept under control: so far, more than 300 species of birds have been counted. Among these, some are migratory and choose the area to stop and feed themselves during their long flight, others choose the area to winter, still others to spend the summer season.

The *Riserva naturale regionale delle Foci del Fiume Stella* is wholly included in the municipality of Marano Lagunare and is part, together with the *riserva della valle Canal Novo*, of a wider environmental system: the lagoon of Grado and Marano. As for the fauna, it was reported the presence of the loggerhead sea turtle, a kind of sea turtle that is being protected, which is to be however considered accidental. The lagoons of Grado and Marano are home to many fishes such as the flathead mullet, the gilt-head bream, the European sea bass, the European eel, the European flounder, species of fish in the *Atherindae* family and many others, that spend their trophic phase in the area and that reproduce in the sea. Among the few species that reproduce in the lagoon: the threespined stickleback, the Canestrini's goby, the Mediterranean killifish, the Panizza's goby, which is an endemic species of the Upper Adriatic.

A critical area for possible use conflicts with touristic activities is the Grado and Marano lagoon in the Friuli Venezia Giulia Region. Nowadays, the main contention is about the intrusiveness of tourism activities in the lagoon, more precisely the impact in terms of saltmarshes' erosion of the waves generated by the large number of nautical boats and vessels moored in the marinas and little ports of the Lagoon and the related disturbance to fauna. The local environmental and planning authority (Friuli Venezia Giulia Regional Government) wonders on the best way to preserve the Lagoon habitat from artificial erosion, calculating a Tourism Carrying Capacity

(TCC) and imposing a regulation to vessels allowed to moor and transit in the Lagoon. The Lagoon of Marano and Grado plots down the coastal profile of Friuli-Venezia Giulia. Delimitated by rivers Isonzo and Tagliamento, the whole area is a Natura 2000 SAC/SPA given by the two watershelds of Marano Lagoon and Grado Lagoon. The total surface area is 160 squared km along a coast of 32 km around; the middle distance between the coastal line and the barrier islands is around five km. The complex hydrodynamics of the lagoon is subject to continuous human pressures. After a bulk of activities that produced meaningful changes in lagoon waters circulation, because of pollution in 1998 has been implemented a law that stopped the dredging of the channels, reducing the average deep of the channel network. The sea-water affluence comes through six tidal inlets (Lignano, Sant'Andrea, Buso, Morgo, La Fosa of Grado and Primero), that lead to many basins (Marano, Sant'Andrea, Buso, Morgo, Grado and Primero). In the lagoon there are many saltmarshes, which are typical structures in the upper coastal intertidal zone between land and open salt water, regularly flooded by the tides. They have a fundamental role in the lagoon ecosystem. From a morphological point of view, they catch suspended sediments and the relative sea loss; from the natural istic one, they are a place of ecological excellence for the roosting and growth of many kinds of birds. Moreover, widest saltmarshes host some "casoni", the typical wood and rush huts that sheltered local fishermen in pre-industrial fish times, nowadays abandoned or recovered as tourism chalet (both low and high cost). In last years, the development of the harbor tourism and increase in motor boats traffic had a negative impact on the lagoon's environment and local habitats, mostly because of increase in the wave motion by vessels passage and of the related erosion generated in saltmarshes (Figure 4-32). In most serious cases, saltmarshes vanished or are next to vanish. The most relevant source of pressure for the internal habitat of the lagoon is the boats and vessels transit. There are 10,537 mooring places across the Marano and Grado watershield, a figure arising from official harbour plans, field enquires and aerial photo analysis. More specifically, 6,000 posts are provided by the local 17 Marinas, while the others are located in official city-harbours and authorized landfalls (Silvestri, 2013).

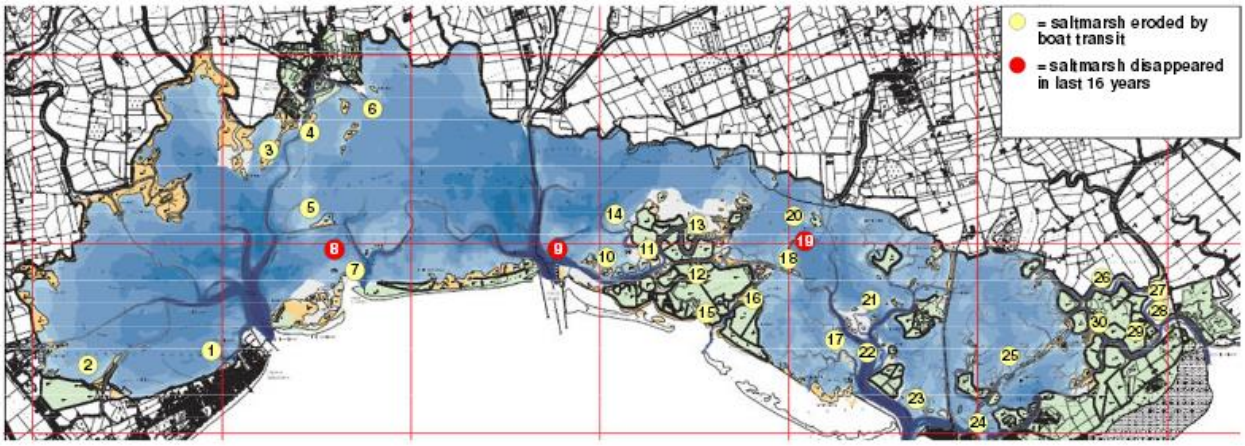


Figure 4-32. Saltmarshes and vessel generated erosion. Sinergheia and eco&eco (2012) on Triches et al (2011)

The line separating the lands of the Veneto and those of the Emilia Romagna region is the wide delta of the Po River - the longest river in Italy. South of the delta, recent, impressive urbanization work in the Comacchio area has created the so-called Sette Lidi, or Seven Lidos (Lido di Volano, Lido delle Nazioni, Lido di Pomposa, Lido degli Scacchi, Lido degli Estensi, Lido di Spina and Porto Garibaldi), which are today host to a firmly-established seaside tourism, with holiday homes and residences.

Romagna riviera

The Romagna Riviera is proverbially famous for its highly-organized beaches, enabling a huge seaside village to spring up in a continuous line along the coast - a holiday city where people meet each other, make new friends, listen to music and dance, have fun by day and by night,

and throw themselves into sporting activities. From the Po estuary, to the Gabicce promontory, there are 110 kilometers of gentle coastline linking the Comacchio lidos to Cattolica, including Marina di Ravenna, Milano Marittima, Cervia, Cesenatico, Gatteo, San Mauro, Bellaria, Igea Marina, Viserba and Rimini, Riccione and Misano. The shoreline is on averageonehundred meters wide, and the sand is extremely fine and golden.The Emilia Romagna Riviera appeals to visitors from all over the world and is popular because of its large beaches, the quality of its services and its safety: there are over 1400 bathing beaches equipped with facilities, 337 rescue look-out points - one every three hundred meters -800 lifeguards, and 45 first aid centers with ambulances. The Gabicce headland forms the boundary of the Romagna region, and we then come to Le Marche - a coastline stretching for a good 180 kilometers as far as the mouth of the Tronto. The sea shore of Le Marche, with its beautiful beaches alternating with pebbles, rocks and sand, has everything holidaymakers could want. In the northern part of the region, known as the "Riviera of the hills", long, slender beaches are interrupted here and there by headlands, small coves or the mouths of mountain streams. The resorts of Gabicce Mare, Pesaro and Fano offer a quiet seaside holiday even for inexpert swimmers and children. A little further south, Senigallia, the ancient capital of the Senones Gauls, is famous today throughout Europe for its very fine, white, velvety beach. In the distance, you can see the Conero, a headland of extraordinary beauty thrusting out into the blue of the sea just behind Ancona. Here, the most unusual stretch of Le Marche coastline starts: the Conero Riviera, with splendid white bays, sometimes accessible only by boat or along paths cutting through the Mediterranean maquis. Going southwards from Ancona, you come to a succession of charming tourist sites: Portonovo, Sirolo and Numana, with its practical and efficient tourist harbor, and Marcelli the most modern, with tourist villages, residences and many facilities for accommodating visitors. Further along the coast, there are wide, flat beaches, as far as the green surroundings of the pine woods at Porto Recanati, Porto Potenza Picena and Civitanova Marche (with two ports, one for tourism and one for fishing). To complete the panorama of Le Marche coastline, we cannot fail to mention the green Ascoli Piceno Riviera, stretching between Porto Sant'Elpidio, Lido di Fermo, Porto San Giorgio and Pedaso and the so-called Riviera of the Palms, between Cupra Marittima, Grottammare and San Benedetto del Tronto.

Slovenian coasts

Slovenian coast includes part of the North-East of the Adriatic from the state border with the Republic of Italy in Lazaret to the state border of the Republic of Croatia at the mouth of the river Dragonja. The Slovene coast of the Karst Region measures 46.6 kilometres.

The number of accommodations in the Coastal-Carst region is reported in Table 4-32. The number of bed available in 2011 and 2012 accounts for about the 22% of total bed in Slovenia.

		2008		**2009**		**2010**		**2011**		**2012**	
		Number of rooms	**Total of bed capacities**	**Number of rooms**	**Total of bed capacities**	**Number of rooms**	**Total of bed capacities**	**Number of rooms**	**Total of bed capacities**	**Number of rooms**	**Total of bed capacities**
Total	Izola/ Isola	1698	5194	1700	5201	1470	4562	1460	4351	1537	4622
	Koper/ Capodistria	1534	4788	1535	4744	1476	4478	1617	4927	1465	5253
	Piran/ Pirano	5896	14930	6078	15541	5875	15040	5866	15253	5659	14685

	Divača	26	78	30	88	119	276	102	338	84	246
	Hrpelje - Kozina	163	398	126	285	143	311	140	310	143	328
	Komen	46	149	49	158	49	165	48	167	54	175
	Sežana	411	881	417	890	389	831	397	848	321	725
SKUPAJ		**9774**	**26418**	**9935**	**26907**	**9521**	**25663**	**9630**	**26194**	**9263**	**26034**

Table 4-32 Number of accommodation in the Coastal-Carst region. SURS

In 2011, the region recorded 658,851 tourists (58.7 % of foreign tourists) who have created 2,191,924 overnight stays (55% foreign). This region present is 23.3% of the total number of the overnight stays in Slovenia in 2011. In the first 7 months of 2013 the region generated 1,182,526 overnight stays, which is 2.7% less than in the same period last year.

In 2012 foreign overnight stays accounted for almost two-thirds of the total, mostly Italians (23%), Austrian (20%) and German (15%). Economic developments and socio-political situation in Slovenia affected by the number of domestic tourists whose arrivals decreased by 8.5% in 2012 respect to 2008. In the ssame period overnight stays decreased of 13%. The average length of stay in 2012 was 3.3 days.

Most overnight stays were generated in the municipality of Piran, followed by the municipality of Koper, Izola, Sezana, Hrpelje-Kozina and Komen (Table 4-32).

	2008		**2009**		**2010**		**2011**		**2012**	
	Tourist arrivals	**Overnight stays**	**Tourist arrivals**	**Overnight stays**	**Tourist arrivals**	**Overnight stays**	**Tourist arrivals**	**Overnight stays**	**Tourist arrivals**	**Overnight stays**
TOTAL	282010	1054754	296430	1124561	266362	989025	271938	985879	257888	917113

Table 4-33 Tourist arrivals and overnight tourists (domestic and foreign) in the Coastal-Karst region for reflections from 2008 to 2012. SURS

The Slovene coastal line, as the entire coast of the Gulf of Trieste, is urbanized to a great extent. The percentage of the more or less preserved natural coast is small, for it is estimated at only about 18%, but it is made of important spots of environmental and ecological value for wildlife watching, which are described below.

Nature Reserve Škocjan Inlet

Nature Reserve Škocjan Inlet is 122 hectares of Mediterranean wetlands and largest (brackish) marshes in Slovenia, which is important due to its rich fauna and flora. The Škocjan Inlet Nature Reserve consists of two parts, Bertoška bonifika as the freshwater part of the Reserve, and the brackish lagoon with its shallows and mudflats. It is a large unfrozen water area for wintering of waterfowl and it remains of great ecological importance throughout the year. In terms of biodiversity, the area provides habitats for 41% of all Slovene amphibian species, 41% of all Slovene reptile species, 55% of all species of birds observed in Slovenia, and 36% of all mammal species living in Slovenia. This diversity of animal and plant species is facilitated by different depths of the lagoon, and high diversity of habitats such as marshy meadows,

shoals, pools, rivers etc. The Škocjan Inlet is important on the international level as a European rest-stop for migrating birds and as a suitable location for wintering, feeding, breeding or moulting. In 1999, a five year (1999 - 2003) action plan titled the Programme for the protection and development of the Škocjan Inlet nature reserve was approved by the Slovenian government, while in 2002 the same institution issued the regulation plan for rehabilitation and restoration of the natural reservation Škocjan Inlet. In April 2004, the Slovenian government adopted international act of Special Protection Areas – Natura 2000, which includes also the Natural reserve Škocjan Inlet. This way Slovenia adopted all the necessary legislation for the conservation and restoration of the Škocjan Inlet.

Sečovlje Salina Nature Park

Sečovlje Salina Nature Park covers about 650 ha along the Slovene-Croatian boundary. Its northern part, where active salt-making is still taking place, is called Lera. From the Park's southern part, called Fontanigge, it is separated by the bed of the Drnica stream. The Fontanigge is full of large basins which, however, are being gradually overgrown by the characteristic salt-loving vegetation – halophytes. The basins are crisscrossed by the system of ancient levees, amongst which mostly the larger ones have been preserved. Along the wide channels, the former salt-pan houses are scattered, which with their characteristic appearance co-create the truly unique image of the saline landscape. The main freshwater vein is the Dragonja river, which after few tens of kilometres of its course joins the sea at the Sečovlje salt-pans. At Fontanigge, salt-harvesting was abandoned in the 1960s, but the tradition of salt-making, which originates from the 14th century, is still practiced within the Museum of Salt-making. Here, each salt-field used to constitute an independent salt-pan with its own basins for seawater condensation and crystallisation. At Lera (still »active« pans), the salt-fields used for crystallisation of salt are separated from the fields used for condensation of seawater (evaporation basins). The difference between the two procedures of salt-making therefore lies in the technological process, associated with the preparation of brine, harvest and storage of salt, and in very diverse implements. Their common characteristics, however, lies in the fact that at Fontanigge and Lera the salters cultivate, on the bottom of salt-fields, the so-called petola , a special type of bio sediment that prevents sea mud from merging with salt and at the same time restrains separate ions from building in salt.

Landscape Park Strunjan Saltpans

Strunjan saltpans lay at Strunjan peninsula. It consists of evaporation ponds that shallow artificial ponds designed to produce salts from sea water. The harvest season lasts from June until September. The salt pans in Strunjan, which were built in the plain of the river Roja have only recently been one of the three existing town of Piran. On the plains of the river Dragonja were built the Salt pans in the plains of the river Fazan were built the salt pans of Saint Lucia. The last one no longer exists. The salt pans are the work of human hand. They are also a technical, environmental, ethnological and aesthetic monument, specific and very rare. From the standpoint of protection the saltpans are particularly important because of the ecosystems and rare plants that like salt and therefore are called the halophyte. We know two plants in salt marshes that give specific colours of the landscape. The first is called in Salicornia and make the slat pans in autumn red. The other is Limonium angustifolium, which has blue-purple flowers. Of course, this is not the only members of halophytes, which found in salt.Nature reserves and other protected areas can be, on account of certain limitations and especially due to sensible development principles, ineffective mechanism to put an end to some negative trends, which are in the sea environment caused by pollution and urbanization. The original life conditions enable existence numerous organisms which elsewhere occur quite rarely. With the preservation of important natural resources, a constant stock of organisms is thus being formed, enabling a renewal of the sea life in the near as well as somewhat distant parts of the Gulf of Trieste. These areas are extremely important also due to various educational and scientific research activities, and because they offer recreational possibilities in a close contact with unspoiled nature. All this only roughly illustrates the significance of the protected areas. The area of Strunjan Nature Reserve covers the coast of Strunjan Peninsula and some 200 m wide belt of coastal sea. The precipitous walls of the Strunjan cliffs are significant due to their exceptional geological and geomorphological phenomena and the characteristic sub

Mediterranean vegetation which, however, is at Cape Ronek joined by some typical Mediterranean elements (myrtle, arbutus). The sea floor, which is at first rocky but further out covered with silt, is a home to numerous organisms. Particularly interesting are Mesecev zaliv (moon Bay) with its subaquatic meadow strewn with Fan Mussel and Spirographis, and the exceptionally thick growth of seaweeds off Cape Ronek. Considering the fact that some 80% of the Slovene coast has been changed in some way or another and that a significant part of the sea ecosystem has been more or less destroyed due to it, the nature reserve plays an important role in the preservation of the indispensable habitats for numerous sea organisms and therefore in the retention of natural processes in the Gulf as well. In the end it of course also enables scientific research, educational work and a pleasant rest and recreation.

Slovenian coasts hosts also host water sport facilities, including sailing, boating, diving, personal watercrafts rowing, surfing. Basic sports infrastructure is located in urbanised and tourism areas. Along Slovenian coast especially in Portorž, Piran, Izola, Koper and Ankaran is available diverse offer of some water sports such as: swimming, sailing, surfing, rowing, water polo, diving, sports fishing, renting motor boats, kiting and windsurfing. Such sports are organized in some private centres and clubs. Dive centres throughout which provide diving courses (CMAS, PADI, NITROX, APNEA) that take you to exciting underwater sites. They also offer underwater photography and sport fishing. At these centres, is possible to rent equipment or have your own equipment repaired and maintained. Diving is possible all year round, due to favourable sea temperatures, and especially between the months of May and November. Especially in Portorož there are some agencies who are offering sailing, boat sailing along the Slovenian coast, Yachts - holidays on the Adriatic, boat motor yacht and charter management.

For sport fishing a license - fishing permit is required. With its purchase it is possible to catch up to 5 kg/day. For sport fishing with underwater gun must obtain a permit issued by an administrative unit of the Republic of Slovenia. Individual fishing boat can be rented only in the Piran harbour, from fishermen's. Sport fishing in the Park is possible near the coast between the mouth of the river Dragonja and channel Kurto. Fishermen can fish in the sea at a time when the park is open to visitors. Special fishing permits is not required suffices ticket to the Park.

Croatian coasts

Croatian tourism after the establishment of the national independence has passed twenty-year transition process fraught with all the problems and contradictions of economic and social development. Carrying the burden of inherited and relatively inefficient business structure, facing the consequences of war and the effects of different and often sub-optimal model of privatization, Croatian tourism has yet demonstrated its vitality thanks to the power and interests of foreign markets, the attractiveness of the country and, in particular, the resistance of tourism as a global phenomenon in the periodic disorders.

It is clear, however, that with the entry of Croatia into the EU is faced with new challenges, but also new opportunities in tourism. The EU recognized Croatia as a tourist destination with the potential, so our task is to make maximal use of them in the interest of the growth of their own well-being, and using the value system of sustainable development and competitive strategy of the EU in the field of tourism.

Among the natural attractions the most important place have sea, rugged coastline and numerous islands, but also a number of preserved natural beaches, countryside and forest that cover large parts of the territory. Croatia attracts the very large number of tourist because of protected natural areas and its biodiversity which is the best in Europe. Great potential in tourism underdeveloped areas is a tourist valorization areas along the Dunav, Sava, Drava, Una, Kupa, Cetina River and other rivers and the lakes and other inland waters. Besides the natural attractions related to the sea, such as national parks Brijuni, Kornati and Mljet, Croatia has a number of attractions associated with karsts features such as waterfalls and travertine barrier lakes and rivers waterfalls, Velebit rocks, caves, sinkholes and other karsts attractions and a large number of unique national parks and nature parks in the continental areas, such as, among others, Paklenica, Žumberak Lonja field, Papuk and Kopacki Rit. The richness of

Croatian cultural and historical heritage also makes great attractive offer in Croatian tourism. About that he witnessed a large number of cultural property under the protection of UNESCO, as well as the historic center of Dubrovnik, Diocletian's Palace in Split, Sibenik cathedral, the historical town of Trogir, Eufrazijeva Basilica in Porec and Stari Grad Plain, but a number of other valuable cultural assets as the amphitheater, the historical core of the town of Hvar, Ston walls and a number of individual buildings in a well-preserved historical complex of Zagreb and many other Croatian cities / towns. In particular it should be noted that Croatia in its rich cultural and historical heritage with more than a thousand manors, castles and forts, which is extraordinary potential for future tourism development, especially the continental part of the country. In addition, Croatia has the most intangible heritage under UNESCO protection in Europe, and the world-wide just behind China and Japan. Despite the extraordinary richness and abundance of the natural, historical and cultural attractions, only a small number of their travel evaluated and included in the overall destination offer. In the last decade Croatia has increased the amount of storage capacity measured by the number of permanent beds in registered accommodation facilities for 25%. The highest growth was recorded in the potential of the households (46%), followed by hotels (19%) and camping (12%), while the capacity of other collective facilities decreased 3%. Northern Adriatic has the largest share in the capacity (52%), achieving two percentage points higher than the share in the overnight stays as it has in the capacity. South Adriatic has 45% of the capacity of Croatian achieving three percentage points lower share in the overnight stays, while continental Croatia has an equal share in capacity and overnight stays.

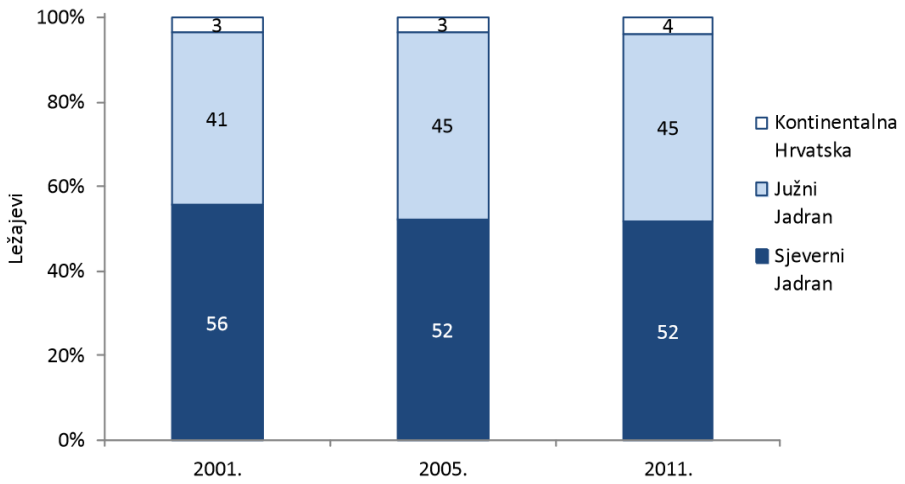


Figure 4-33 Regional structure of accommodations in%. Source: Croatian Ministry of Tourism, Tourism strategy

In addition to accommodation options in collective facilities and family accommodation, specific accommodation offer makes the 98 nautical ports. Of that number, 50 refers to the marina with berths in 11 marinas with berths on land, while the remaining 37 ports categorized as anchorages, moorings and unclassified nautical tourism. The ports of nautical tourism in late 2011., There were a total of 17,059 berths and 5,231 boat places on land. Slightly more than half of the total number of berths for vessels of 10 to 15 meters. In addition to nautical ports for permanent and transit berth boats and yachts in yachting tourism, Croatia has is about 240 ports and harbors suitable for mooring boats, boats and yachts of various sizes that mainly benefit the local people and the local economy, but also limited the ability of commercial ties . Number of nautical tourism in the last decade has been increased by almost 50% and 20% of the marina.

Tourist traffic in Croatia is concentrated in seven coastal counties whose share in total tourist nights amounted to 96%. During 2012. Largest tourism turnover was in region of Istria. The county makes 32% of total overnight stays in Croatia. All coastal counties in 2012th year

recorded an increase in overnight stays by an average of about 5%. And a large part of inland counties have recorded an increase in tourist traffic by an average of about 1%.

	2009.	2010.	2011.	2012.	Rate changes 2008-2012(%)
Total Croatia	**54.988.432**	**56.416.379**	**60.354.275**	**62.743.057**	**4,5**
Primorje-Gorski Kotar County	10.989.353	10.938.291	11.741.692	11.973.931	**3,0**
Lika-Senj County	1.519.841	1.618.941	1.697.107	1.824.036	**6,3**
Zadar County	5.831.138	6.223.824	6.481.067	6.783.072	**5,2**
Sibenik-Knin County	3.463.655	3.783.823	3.975.122	4.139.536	**6,1**
Split-Dalmatia County	8.813.208	9.364.032	10.250.215	10.517.880	**6,1**
Istria County	17.887.063	17.731.881	19.095.401	19.877.368	**3,6**
Dubrovnik-Neretva County	4.225.474	4.538.026	4.775.161	5.188.091	**7,1**
City of Zagreb	1.047.937	1.085.597	1.183.125	1.245.669	**6,0**
Zagreb County	69.804	62.198	66.502	67.703	**-0,7**
Krapin-Zagorje County	159.056	145.411	153.046	161.811	**0,8**
Sisak-Moslavina County	100.995	87.385	87.317	82.303	**-6,4**
Karlovac County	269.419	282.083	269.291	303.522	**4,3**
Varaždin County	121.017	116.601	118.597	115.008	**-1,7**
Koprivnica-Križevci County	28.126	20.075	25.351	29.037	**4,1**
Bjelovar-Bilogora County	31.835	23.981	30.468	31.924	**2,4**
Virovitica-Podravina County	39.219	34.323	32.917	29.262	**-9,2**

Požega-Slavonia County	19.623	18.786	23.627	19.299	**1,1**
Brod-Posavina County	38.901	31.951	33.127	35.585	**-2,3**
Osjek-Baranja County	187.422	159.261	173.892	168.122	**-3,1**
Vukovar-Srijem County	78.033	68.383	62.394	60.538	**-8,0**
Međimurje County	67.313	81.526	78.856	89.360	**10,4**

Table 4-34 Tourist overnight stays in Croatia by counties Source: Croatian Ministry of Tourism, Tourist analysis

Long-term trends in international tourism demand point to continued growth of tourism in the past 60 years and, despite occasional crises, his position fastest growing economic activity in the world. Europe is the most significant ongoing receptive macro region of the world which has in 2011th attracted 51.3% of total arrivals, while the Southern Europe / Mediterranean, with 18.1% of total world arrivals, is traditionally the strongest tourist receptive regions of the continent.

Coastal Croatia we share on the larger tourist regions, namely: Istria, Kvarner, north, central and south Dalmatia. Increases the proportion of Germans, Italians, French, British and other nations. To attract more tourists Croatia offers different forms of tourism, such as: nautical, swimming, adventure, mountaineering, cultural, Spa and religious. Tourism is one of the most important economic activity in the present, but mostly in the future of the Croatian economy. According to developmental opportunities in the past 10 years especially pointed nautical tourism. Nautical tourism is the tourist movement in vessels at sea, including its docking in marinas and includes all the necessary infrastructure in the marines for their acceptance. It allows closer contact with nature, escape from the noise and congested beach. Although nautical tourism Croatian tourism is becoming increasingly important, it is still not achieved adequate material gain as it could given its resources so that its real development is still expected. Indebtedness of the Croatian coast (index indented Croatian coastline is 11) with a large number of islands is one of the main advantages for the development of nautical tourism. With the jagged coastline and the attractiveness of the insular part of Croatia notable features of relief. Of the 363 ports, harbors, anchorages and marinas, Kvarner, Zadar and Dubrovnik waters are containing 60% of capacity. However, due mainly to the National Park Kornati, the most attractive is the Sibenik archipelago. Attendance follows Istria (which is generally higher attendance of tourists) and Zadar area (for nautical tourists this area is particularly interesting because of the large number of islands which contributes interesting archipelago). Most nautical tourists who come to Croatia come from developed countries in Europe, while domestic guests account for only 1/10 of boaters. The reason for such a disparity between the number of domestic and foreign nautical tourists can be found in the fact that this form of tourism requires tourists something greater spending power, that the Croats have not yet discovered the magic of nautical tourism and perhaps most of all by the fact that in general all forms of tourism in Croatia, Croats make up a very small percentage . Total number of nautical of tourists in reality is somewhat higher since quite yet drop anchor in the "wild" and some are not even registered. The tendency of nautical tourists is to cruise the coastline and islands (71% of them), while a small part of them (25%) reside in the home port from where they go on the trips.

The biggest rival of Croatian nautical tourism are other countries in the Mediterranean - Italy, Greece, Spain, France and Turkey. Because of the relatively large physical distance and

current situation of inadequate quality Croatian roads are not as accessible to those central and western sailors who come by road. For the development of nautical tourism is extremely important air traffic. With a developed network of airports in the receptive field of boat owners can quickly and comfortably reach the receptive field. In this connection, if any infrastructure conditions and sufficiently skilled workforce can offer servicing and anchoring of boats in marinas throughout the year which would bring the local economy significant financial effects. The categorization of nautical ports in the Republic of Croatia is carried out on the basis of the Law on Tourist Activity (NN, Nos. 8/96, 19/96 and 76/98) and the Ordinance on Classification and Categorization of Nautical Ports (NN, Nos. 142/99, 47/00, 121/00, 45/01 and 108/01). In the new Ordinance on Classification and Categorization of Nautical Ports (NN, No 72/08), which was issued in 2008 according to the Provision of Tourism Services Act (NN, No 68/07), there is a note that nautical ports holding decisions according to the previous Ordinance shall not be the subject of harmonization with the new one. According to the new Ordinance (NN, No 72/08), a type of marina is marked by anchors (two anchors, three anchors, four anchors, five anchors).

County of	Total	Anchorage	Mooring	Land marina	Marina 1st category	Marina 2nd category	Marina 3rd category	Marina, categorised and marked by anchors	Uncategorised nautical ports
Republic of Croatia	98	17	13	11	6	24	17	4	6
Primorje - Gorski kotar	29	8	6	6	1	3	3	1	1
Zadar	19	7	2	2	-	4	4	-	-
Šibenik-Knin	13	1	-	-	2	4	5	-	1
Split-Dalmatia	16	1	2	2	-	5	3	2	1
Istria	15	-	2	-	3	6	2	1	1
Dubrovnik-Neretva	6	-	1	1	-	2	-	-	2

Table 4-35 Nautical ports 2012.Source: Croatian beareu for statistics, Traffic in seaports 2013, First release

4.3.2 Focus Area 2

For the Focua Area 2 the main feature and issue of Greek and Apulian coasts and island are described below. Further contribution on missing coastal areas may be included in the further revisions of the document also on the basis of the inputs of ADRIPLAN observers and stakeholders.

Greece is ranked 15th worldwide as a tourist destination. Tourism contributes more than 18% to the annual Gross National Product (DG-MARE 2011).

According to the Hellenic Statistical Authority, in 2010, the Regional unit of Corfu welcomed over 52% of total arrivals of the Ionian Islands, with an increase for 2004 to 2010 being as high as 129,1%, the highest in the Ionian Islands region (Table 4-36a).

	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
No	463.168	439.801	245.879	563.321	564.636	555.539	555.352	567.442	603.438
%	51,3%	51,2%	38,7%	57,4%	57,4%	51,0%	52,5%	50,6%	52,9%

arrivals in the region									

Table 4-36a. Arrivals in hotels (except camping) in Corfu Island. Source: Hellenic Statistical Authority, MEECC-a

The Special Framework for Spatial Planning and Sustainable Development for Tourism in Greece has set two centers for maritime tourism in FA2. These are:

- Corfu and Lefkada with a radius of influence reaching the coast of Western Greece, including the Amvrakikos Gulf, northwestern Peloponnese and the Ionian islands.
- Patra with a radius of influence reaching the coast of Korinthiakos and Patraikos Gulf, of Western Greece and the Ionian islands.

At the Region of Epirus, tourism development is mainly located along the coastal area from Preveza to Thesprotia. The dynamics of the coastal front are underscored by a thickening trend of tourist ports and marinas (Parga, Sivota, Preveza). Total tourist activity has been enhanced by the operation of the Egnatia Motorway improving the accessibility of tourist destinations in the Region with northern and central Greece, while significant resources of the coast, who could contribute to spatial, thematic (enrichment) and temporal (lengthening the tourist season) expansion of the area, remain undeveloped. According also to the SFSPSD for Tourism, the region has significant opportunities for beach tourism development, from the northern coast (Parga-Sivota) till the southern area around Preveza which is directly connected to Lefkada through the mainland.

In the sourthern part of the Adriatic-Ionian macro-region, the coast of the Corinthian Gulf and the Gulf of Patra show a linear seasonal tourism growth mostly from urban populations in Attica and Patra. In contrast, the coasts at the southern parts of the region are more attractive to visitors from abroad.

Ionian Islands Region has a prominent place in tourism development at a national as well as Mediterranean and European level. The main basis for the development of the tertiary sector in the Region of Ionian Islands is tourism. The natural and human environment and the quality of the coastal areas constitute the islands as important destinations for holiday even the small islands both within the country and abroad thus creating a high-traffic tourist activity.

Overall, the capacity of the Region of Ionian Islands in hotel beds amounts to 88,793, according to data of the Association of Greek Tourist Enterprises in 2011. The greatest potential of beds and units is located at Corfu and Zakynthos followed by Kefalonia and the other islands.

According to the Hellenic Statistical Authority, in 2010, the Regional unit of Corfu welcomed over 52% of total arrivals of the Ionian Islands followed by the RU of Zakynthos with 30% , the RU of Kefalonia - Ithaki with 10,1% and the RU of Lefkada with just 7%. From 2004 to 2010, the largest increase occurred in Corfu (129.1%) and Lefkada (125.7%). The same happened for Kefalonia and Lefkada with respective growth rates of 52.4 % and 43.9 % during the years 2006-2007. Tourism is also a dominant sector for small islands especially hotels, leisure and commercial activities such as retail outlets (grocery stores, supermarkets, butchers, shops selling building materials, etc.) (Table 4-36b).

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ionian Islands	902.074	859.737	635.711	981.119	984.347	1.089.738	1.057.219	1.121.242	1.140.147
RU of Corfu	463.168	439.801	245.879	563.321	564.636	555.539	555.352	567.442	603.438
RU of Lefkada	45.675	42.935	22.999	51.914	52.860	76.073	75.896	82.826	79.508
RU of Kefalonia-Ithaki	104.811	94.250	91.082	90.252	87.201	132.918	121.409	116.050	115.442
RU of Zakynthos	288.420	282.751	275.751	275.632	279.650	325.208	304.562	354.924	341.759

Table 4-36b Number of arrivals in hotels (except camping). Hellenic Statistical Authority, MEECC (under review-a)

The hotel capacity of the area includes a large number of apartments and rooms, as well as restaurants and campings. The main problems of tourism in the area is the provision of low-level services and the old tourist infrastructure, suggesting a saturation tendency of the sector, which is also reflected by the slight decrease of overnight stays during the period from 2007 to 2010. Additionally, during the last decade new forms of tourism emerged, such as cruise and marine tourism, which in combination with alternative forms of tourism, have set new standards in tourism industry.

Diving is believed to be the upcoming trend within the tourism sector. The Ionian Sea is renowned for its underwater routes. Corfu, Zakynthos, Kefalonia and Lefkada are considered diving destinations. Small islands, such as Kastos, Arkoudi, Atokos also attract scuba divers while on the opposite shores of Epirus there are diving centres which have contributed considerably to underwater exploration.

In the Ionian Islands, 45 bathing sites out of 190 in the region meet the requirements of the Directive 2006/7/EC on management of bathing water quality and have been awarded with blue flags, 27 in Corfu (62 meet the requirements), 2 in Lefkada (31 meet the requirements), 10 in Kefalonia (57 meet the requirements), 6 in Zakynthos (39 out of 40 meet the requirements) (Figure 4-34).

Figure 4-34 Bathing water quality reported during the 2012 bathing season in Greece. MEECC, 2013

The hotel capacity of the Greek part of Focus area 2 includes a large number of apartments and rooms, as well as restaurants and campings. In 2012, in Corfu Island there were 394 accomodation units, with a capacity of 43536 bed places, and 8 campsites, with an overall capacity of 1860 bed place.

The main problems of tourism in the area is the provision of low-level services and the old tourist infrastructure, suggesting a saturation tendency of the sector, which is also reflected by the slight decrease of overnight stays during the period from 2007 to 2010. These are usually family-owned businesses, which probably support business planning competition in price and not quality. This situation is a major structural problem of the tourism sector in the area and the reason urging the need for incentives for the development of high quality accommodation that will attract quality tourist activities. Additionally, during the last decade new forms of tourism emerged, such as cruise and marine tourism, which in combination with alternative forms of tourism, have set new standards in tourism industry and require special protection measures for coastal and marine landscape, the traditional production activities and the

development of the agri-food model. These include require major new infrastructure in ports and marinas, which are considered lucrative because they involve port fees contributing to the local economy.It should also be noted that in all developed tourist areas suchas Corfu and Zakynthos, networks of infrastructure such as communications, transport and sectors of water and sanitation are facing a lot of pressures at the peak months of tourism, resulting in the need for immediate and significant improvements.

Given that the current model for tourism development combines the existing mass tourism with the development of special and alternative forms, proposals related to green development, maritime strategy, protection of the marine environment and coastal areas should be introduced. In Corfu Island 27 out of the 62 that met the requirements) the requirements of the Directive2006/7/EC have been awarded a blue flag (Figure 4-35).Additionally, scuba-diving is an important touristic activity Corfu Island, where 17 diving centers (Figure 4-36) are offering their service to the "explorers of the underwater Greece".

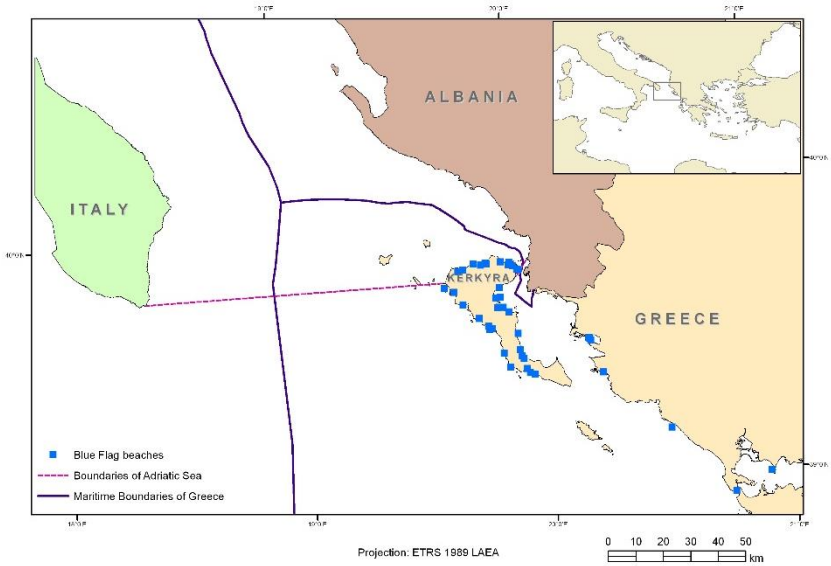


Figure 4-35 Blue-flagged bathing sites in Corfu Island. CoCoNET project, 2014

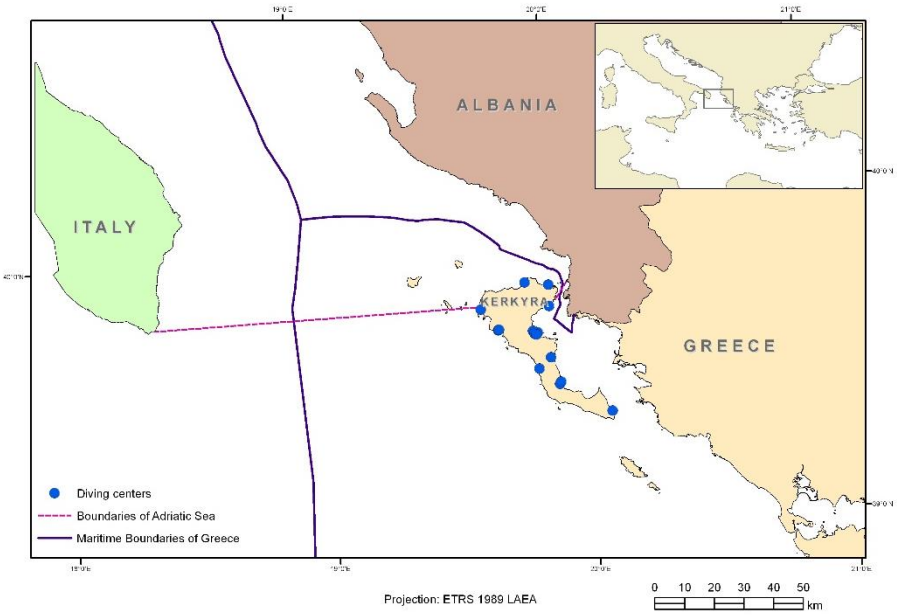


Figure 4-36 Diving centers in Corfu Island. Official data-base of the Amateur Divers club "TITHIS"

On the western part of Focus area 2, in the last decade, Apulian tourism has recorded a steady increase in national and international tourist flows. Tourism in Apulia had better performances compared to the national average. Official data from 2012 show over 3.2 million arrivals and 13.3 million of total tourist presences. The comparison with 2011 shows a minimum reduction of arrivals, estimated in 0.1% and a reduction in tourism presence of 1.6%. The economic crisis has resulted in a greater impact on Apulian market, which records a compression in both the number of arrivals and in the average duration of stays. On the other hand the loss has been compensated with a significant increase in foreign tourist flows, (7 % more arrivals and +5% presences). This information is even more important if we consider the physical distance of Apulia from the main markets of international tourism in Italy.

In 2012 Apulia consolidated its position in the foreign market, achieving significant growth rates of arrivals and international presences. The impact of foreign tourism increased by about 1 percentage point, from 16.7% of arrivals in 2011 to 18.0% in 2012 and 16.1% of admissions in 2011 to 17.2% in 2012. Apulia consolidated its position on some major markets such as Germany (+15.7% arrivals), France (+24.6% arrivals), Switzerland (+22.8% arrivals), United Kingdom (+19.5% arrivals), Belgium (+23.0% arrivals) and USA (+10.4% arrivals). 69% of the foreign presence is concentrated in hotels, compared with 59% of Italians. Foreigners prefer the 4-star hotels (37.6%, 29.1% more than the Italians), followed by 3-star (17.9% and 18.8% for Italians). The share of foreign presence in the structures of high level (5 star and 5 star luxury) is higher than that induced by the national tourism (5.1% to 2.3% for foreigners and Italians). The share of visitors in the lodging options grew both for Italian and foreign presences. Over the 60% of tourist flows in Apulia is concentrated in coastal locations during summers (from June to September), although there is an increase of cultural and natural tourism in the inland areas. Ten locations were awarded with the Blue Flag in 2013, eight on the Adriatic coast (Rodi Garganico, Polignano a Mare, Monopoli-Lido Rosso/Castello S.Stefano/Capitolo, Fasano, Ostuni, Otranto, Melendugno, Castro) and two on the Ionian coast (Salve, Ginosa-Marina di Ginosa) (Figure 4-37).

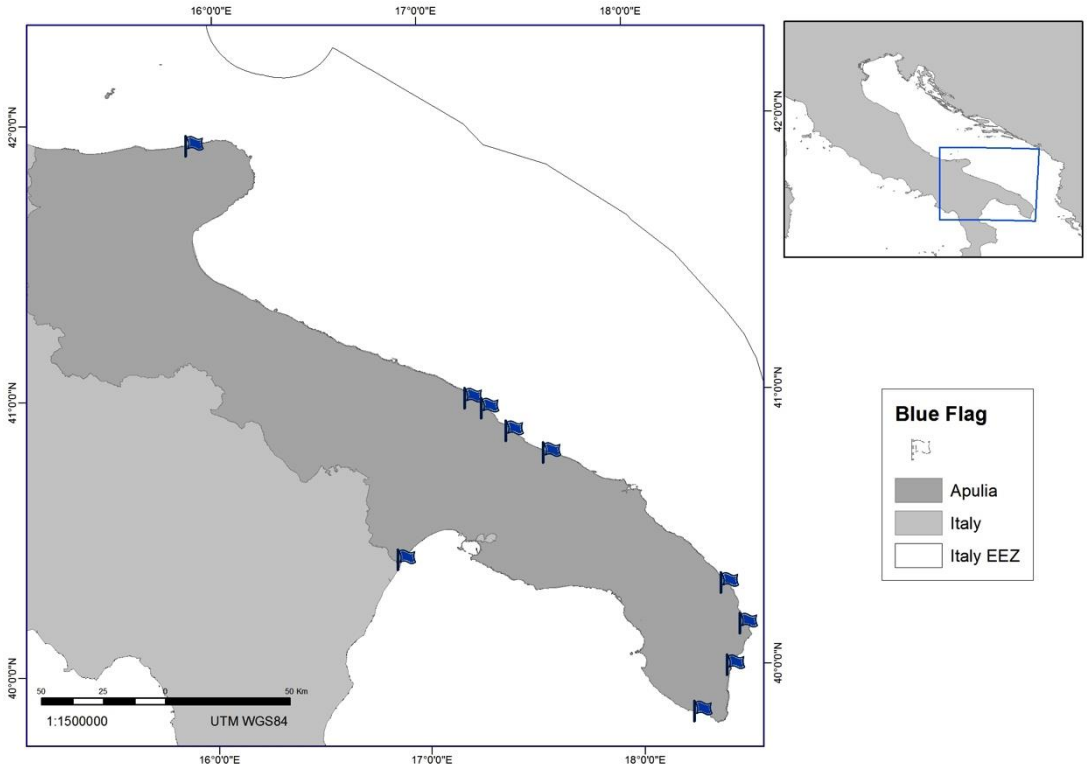


Figure 4-37 Blue Flag sites in Apulia. Source: CoCoNet project, 2014.

4.4 Fisheries (commercial and recreational) and aquaculture

F. Grati, L. Bolognini, S. Fraschetti, G. Farella, F. De Leo, P.K. Karachle, A. Kokkali, S. Kavvadas, P. Panayiotidis, P. Drakopoulou, V. Vassilopoulou, T. Papatheochari, S. Niavis, T. Primožič, S. Belošević

The excellent quality of water and the high biodiversity of the Adriatic-Ionian Sea have led to an intense fishing activities development. The relative fishing activity of the region against the activity of fisheries' sector at all of the European Seas is depicted in Table 4-37. It presents the annual fishing captures of the countries in the aforementioned statistical regions against the total catches at european seas and the total active fisheries' fleet of the region against the total active european fleet. As can be seen of the Table fish captures of the three regions represent 2.5% of the total fish captures at european seas. Moreover, the fishing vessels registered at Adriatic-Ionian ports are about 17,000, a number which represents about 20% of the total european registered vessels. Taking into account the gross tonnage of fishing fleet the Adriatic-Ionian vessels accounts about 10% of the total gross tonnage of european fleet. Finally, in power terms the fishing fleet of Adriatic-Ionian countries reaches up to 17% of the total power of european fleet.

At the country level, Italy is the dominant country in fishing industry, as in 2010 the catches of Italian fisheries exceeded 160k t. Croatia is the second country in fishing volumes (51,939 t.) and Greece is following with 7,796 t. The other countries present a significantly lower activity which is reasonable taking into account their relative size. The largest fleet is found in Croatia in terms of number of vessels and in Italy in terms of total gross tonnage of vessels and total power of vessels (Table 4-37).

Country	**Catching (t)**	**Fleet**	**G.T.**	**KW**
Albania	3,064	280	-	-
Croatia	51,939	7,242	48,102	390,404
Greece	7,796	2,895	8,579	63,385
Italy	165,613	6,274	112,216	673,795
Montenegro	597	113	-	-
Slovenia	770	170	598	8,425
Total Adriatic-Ionian	229,780	16,974	169,495	1,136,009
Total Europe	9,094,000	87,460	1,687,205	6,689,619
Adriatic-Ionian / Europe	**2.5%**	**19.4%**	**10.1%**	**17%**

Table 4-37 Fishing Activity and Fleet Characteristics per Country (2010). Community Fishing Fleet Register, 2014; FAO, 2013; Own Elaboration

Fleets' characteristics are significant elements of fishing sector denoting the structure of fishing industry of each country. This is becoming evident from the figures of Table 4-38 in which the characteristics of fishing fleet at NUTS III level is presented. As can be seen, Italian fleet is not only the dominant fleet in terms of number of vessels but also, in terms of vessels' size and power. Moreover, vessels' average gross tonnage in Italian prefectures ranges from 3.79 to 46 and the power 47. 75 to 183.35 KW. Additionaly, the average gt of croatian vessels do not

exceed 10 GT and 100 KW at any of the prefectures of the country. Finally, the fleet of Coastal Greek and Slovenian prefectures present significantly less capacity than Italian and Coratian fleets.

		No	GT/Vessel	KW/Vessel
Greece	Thesprotia	82	3.07	20.29
	Preveza	496	1.72	13.36
	Zakynthos	184	3.10	25.03
	Kerkyra	593	2.93	23.02
	Kefallinia	319	2.29	17.34
	Lefkada	424	3.34	23.55
	Aitoloakarnania	480	1.66	14.50
	Achaia	317	7.02	45.31
Croatia	Primorsko	1758	5.46	45.27
	Lisko	231	2.58	32.79
	Zadarska	1513	9.35	59.06
	Sibensko	443	3.74	47.18
	Splitsko	1235	9.31	63.97
	Itarska	1038	6.41	71.62
	Dubrovacko	1024	3.83	38.71
Italy	Trieste	67	5.06	66.19
	Ferrara	445	12.02	101.06
	Venezia	739	19.77	129.84
	Rovigo	120	3.96	50.69
	Udine	211	5.28	72.60
	Gorizia	170	5.73	70.22
	Ravenna	83	9.25	101.11
	Forli-Cesena	88	20.61	164.57
	Rimini	305	20.70	128.23
	Pesaro-Urbino	265	15.32	104.43

	Ancona	370	23.41	111.04
	Macerata	187	31.66	141.14
	Ascoli Picento	345	25.44	126.56
	Teramo	319	17.64	85.24
	Pescara	182	46.31	183.35
	Chieti	278	15.88	72.86
	Campobasso	116	30.21	131.19
	Foggia	640	16.08	89.90
	Bari	587	27.74	158.65
	Taranto	181	6.77	72.90
	Brindisi	136	3.79	47.85
	Lecce	440	6.26	63.41
Slovenia	Obalno-Kratska	170	3.52	49.56

Table 4-38 Fishing Fleet in Adriatic-Ionian Region (2014). Community Fishing Fleet Register, 2014; Own Elaboration

The dominance of Italy in the fisheries sector is also testified by the total fish production per capita (p.c.) figures during the period 2006-2011, which are presented in Figure 4-38. As can be seen from figures, Italian fishery sector provides the country with over 20 kg p.c. of fish products. Production is exceeding 25 kg p.c. in 2011. Lower but significant is the production of Greek fisheries sector which provides the market with around 20 kg p.c. of fish products. The lower production is observed in Albania. Finally, it should be noted that with the exception of Greece all countries managed to strengthen their supply in the period 2006-2011 as p.c. fish production is steadily increasing.

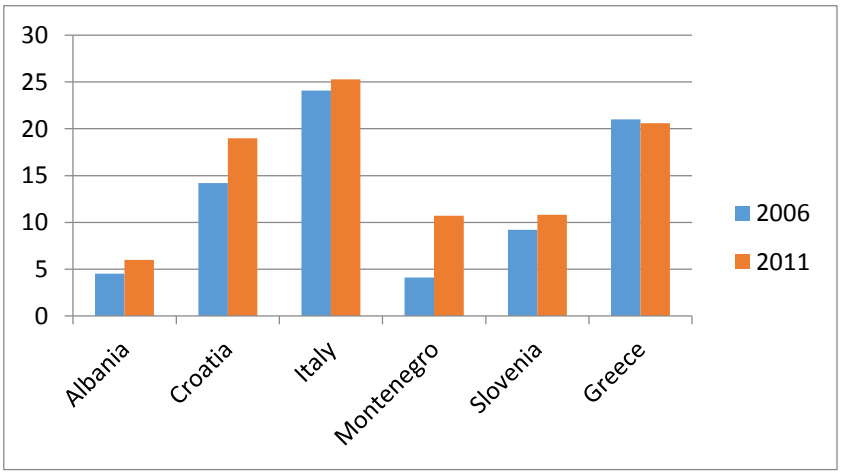


Figure 4-38 Fish Production Per Capita in Adriatic-Ionian Countries(2006-2011). FAO, 2014; Own Elaboration

Moreover, the structure of the fishery sector in the Adriatic Ionian region differs from country to country according to the load of captures and aquaculture to the total fish production. As can be seen from Figure 4-39 the highest share of captures is observed in Croatia and Montenegro and the highest share of aquaculture is observed in Greece.Slovenian and Italian fishing sector are characterised by a relative balanced production between captures and aquaculture.

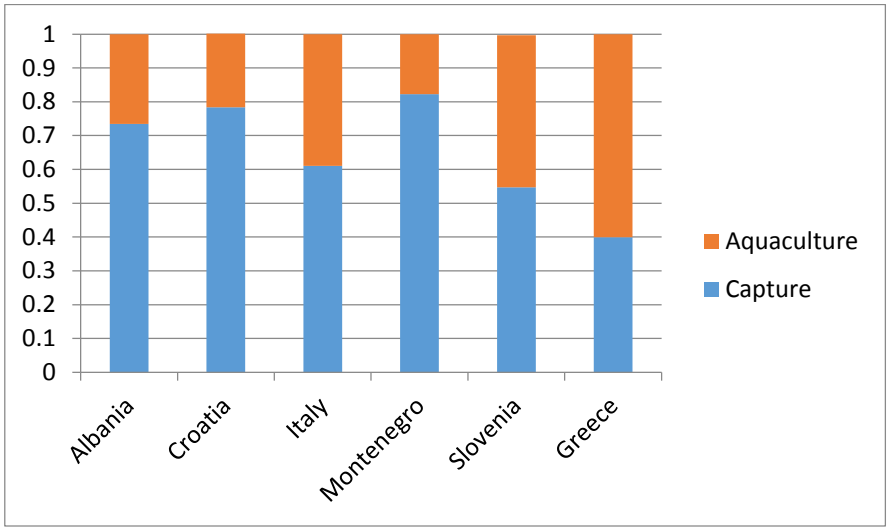


Figure 4-39 Sea Fishing and Aquaculture Share To Total Fish Production Per Country (2006-2011). FAO, 2014; Own Elaboration

The weight that every country gives to the aforementioned kinds of fish production significantly affects the general picture of the region. As can be seen from Figure 4-40 total production based on open sea fishing is steadily exceeding 60% in the period 2006-2011. Nevertheless, aquaculture share is increasing, as in 2006 accounted about 32% of total fish production, while in 2011 is reaching 40%.

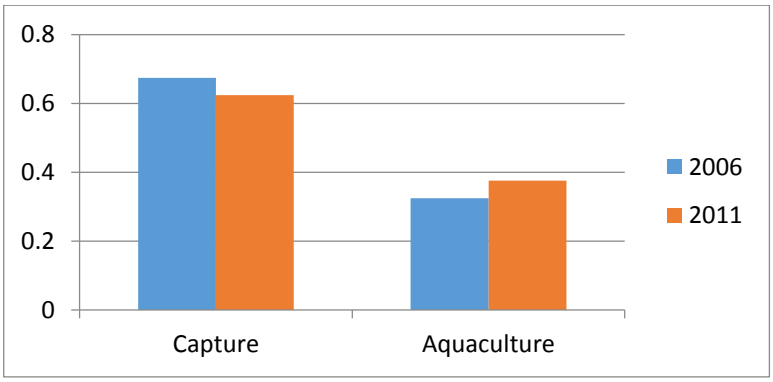


Figure 4-40 Sea Fishing and Aquaculture Share To Total Fish Production Evolution (2006-2011). FAO, 2014; Own Elaboration

Commercial fisheries

In the Mediterranean fisheries statistics and management are highly oriented by the division in Geographical Sub-Areas (GSA) of the General Fisheries Commission for the Mediterranean (GFCM) Area (FAO Area 37). The definition of GFCM-GSA was done on the basis of various criteria and analysis carried out in the first half of last decade (oceanographic, biological, fishery, continuity of FAO-GFCM capture statistics, etc.).

The Adriatic-Ionian Macro-region includes the GSA17 (Northern Adriatic Sea), the GSA18 (Southern Adriatic Sea), the Northern portion of GSA19 (Western Ionian Sea) and the Northern portion of GSA20 (Eastern Ionian Sea) (Figure 4-41).

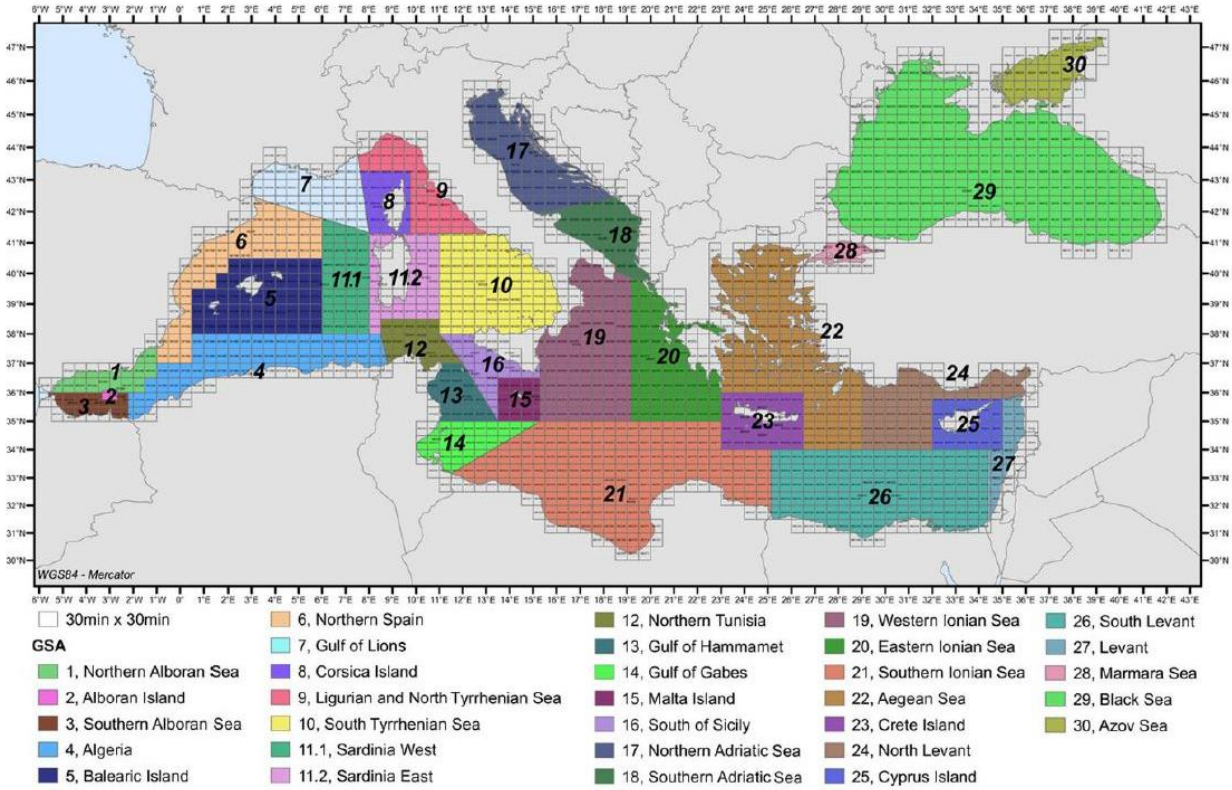


Figure 4-41 Mediterranean and Black Sea Geographical Sub-Areas (FAO Area 37), GFCM.

In summary, Scientific, Technical and Economic Committee for Fisheries (STECF) and GFCM Scientific Advisory Committee (SAC) reviewed 121 stock assessments of 38 species. Forty-two updated stock reviews considered analytically assessed exploitation rates which were evaluated with regard to proposed management reference points (F_{MSY}). Advice on the most up to date available analytical stock assessments is provided for: 2 small pelagic species (anchovy, sardine) in 2 Geographical Sub-areas (GSAs 17 and 18); 11 demersal species (giant red shrimp, blue and red shrimp, monkfish, European hake, blue whiting, red mullet, Norway lobster, pink shrimp, greater forkbeard, spottail mantis shrimp and common sole) in 17 Geographical Sub-Areas.

Overall, 40 (93%) out of the 42 analytically assessed and reviewed stocks in the Mediterranean are classified as being subject to overfishing.

The management advice for fisheries exploiting the assessed demersal fish, crustacean and mollusc stocks focuses on the need for a consistent approach to establishing multi-annual management plans (Council Reg. (EC) No 1967/2006) to reduce fishing mortality towards the proposed reference points consistent with high long term yields and low risk of through fishing effort reductions. This advice reflects the fact that Mediterranean demersal fisheries are characterized by a pronounced multi-species/stocks catch profile, while each of the species/stocks has different management and conservation requirements. It is further noted that most of the demersal fisheries exploit mainly early life stages and/or small growing species.

The protection of the so-called essential fish habitat (EFH: those habitats where fish concentrate for recruitment, spawning or feeding) from the negative impacts of human

activities, including fishing, is one of the requirements of the Ecosystem Approach to Fisheries (EAF). It is recognised within the latest European Common Fishery Policy that in order to maintain the integrity, structure and functioning of ecosystems, safeguarding of fish nursery areas is advisable. In this context, the Council Regulation of the European Community (EC reg. no. 1967/2006) provides some guidelines for the implementation of the EAF in the Mediterranean, with particular attention devoted to the protection of nursery areas. The regulation has the potential to yield important conservation benefits and it is based on 2 assumptions: (1) juvenile fish are particularly vulnerable to fine mesh trawl fishery (Caddy 1993), especially when they concentrate in nursery areas, and (2) a reduction in fishing mortality of immature fish represents a fundamental prerequisite for sustainable fisheries (Beverton and Holt 1957). At the same time when fish aggregate in the spawning areas are particularly exposed to fishing. This can result into abrupt reduction in the spawning biomass and reproductive success of stock units as already demonstrated for many commercial stocks. The implementation of management measures aimed at reducing the impact of fishing on juveniles, spawners and their habitats requires the spatial identification of areas where recruitment and spawning took place. This information is also crucial to investigate the spatial structure of populations (e.g. identification of stock boundaries).

Over the last years, issues relating to marine protected areas had been addressed, especially their role as a tool for fisheries management, with the final goals of a) preserving fisheries resources and/or b) minimizing the impact of fishing on specific habitats with a high value from a biological point of view. Regarding the establishment of fisheries restrictions within limited areas, the so-called "fisheries restricted areas" (FRA), placed under the GFCM authority, had the scope of regulating or prohibiting fisheries activities within a certain area (Figure 4-42).

With regard to the existing FRAs only Italy and Cyprus seemed to be aware of the implications generated by the establishment of the FRA of Santa Maria di Leuca and of the Eratosthenes Seamount, since it emerged that these countries were willing to protect properly the areas, under the provisions of the GFCM recommendation (GFCM, 2014).

Figure 4-42 Location of the four GFCM FRAs (red) and 1000 m isobaths (blue). From left to right: the FRA in the Gulf of Lion, the FRA off Santa Maria di Leuca, the FRA above the Eratosthenes Seamount, and the FRA off the Nile Delta area. The total area covered by these FRAs is 26,248 km2 (0.15% of the Mediterranean Sea). GFCM, 2014).

Recreational fisheries

In general, recreational fisheries can be defined as a non-commercial (i.e. not for sale, barter, or trade) subset of capture/harvest fisheries; motivated by catching fish for fun, pleasure, or sport. More formally, Cacaud (2005) defined recreational fisheries as "all types of fishing activities including sport fishing activities undertaken by any individual, with or without a boat, for leisure purposes, and does not involve the selling of fish or other aquatic organisms". This definition further assumes that recreational fisheries activities are not motivated by a dependence on fish for food.

Recreational and sport fisheries are growing activities in the Mediterranean areas. The development of tourism in various regions and the enhancement of charter fishing tours have contributed to the extension of recreational fishing to almost all Mediterranean countries. This phenomenon has not come without raising concerns on the potential effects of such activities on fish stocks as well as interactions with commercial fishing activities (Gaudin and De Young, 2007). However, without a proper analysis, it is not possible to identify the potential conflicts between recreational and commercial fisheries in the Mediterranean Sea. The increasing significance of recreational fisheries in Mediterranean waters in general and particularly in some areas, such as the Adriatic Sea, will require that countries (at the national, subregional, and basin-wide levels) define sustainable policies and adopt adequate management measures, on the one hand, to guarantee the benefits (e.g. economic, cultural, and social) generated by recreational fisheries and, on the other hand, to protect the marine resources from overfishing and other negative impacts of fishing. However, the importance of recreational fisheries in the Mediterranean has been largely underappreciated, whether it be from the point of view of its impacts on marine resources or of its socio-economic potential. This under-evaluation may stem, in part, from a lack of investigations into the values and impacts of recreational fisheries.

Albania, Croatia, Slovenia, Greece, Serbia-Montenegro and Italy have detailed regulations for recreational fisheries (Gaudin and De Young, 2007; Pawson et al., 2008). Although necessary, the simple existence of a legal framework is not sufficient for promoting sustainable development of this sector, particularly if the regulations are obsolete or irrelevant and enforcement is non-existent or inefficient. Indeed, countries belonging to the Adriatic-Ionian Macro-Region demonstrated a tendency to neglect the management of recreational fisheries and particularly its monitoring and control for management purposes (Gaudin and De Young, 2007).

In the Adriatic-Ionian Macro-Region the recreational fisheries interact with commercial fishing in many ways. The main areas of conflict are (a) competition for resources, especially where unlicensed recreational or "hobby" fishermen compete with commercial pot or net fisheries both for the resource and by supplying low priced fish to markets and (b) competition for space and gear interactions, for example between anglers and fixed nets, set close inshore or around wrecks. On the positive side, chartering by angling parties provides alternative employment opportunities for commercial fishing vessels (Pawson et al., 2007; Stelzenmuller et al., 2013).

Besides the socio-economic importance of this sector in the Adriatic-Ionian Macro-Region, specific studies focusing on it are scarce and aged (Anagnopoulos et al., 1998; Karagiannakos et al., 2001).

Aquaculture

Current situation on aquaculture development is reported only for Italy, Croatia (as far as the bluefin tuna farm) and Greece. Information about the other AIM states and on current regulamentary framework will be included in further revision of the present document.

Italian aquaculture is characterized by the farming of a wide range of different species and applied technologies owing to the diversity of available sites (Table 4-39). Some production areas are the result of traditions of ancient origin, while others became important with the

introduction of modern intensive farming techniques. The geographical distribution of the aquaculture areas is characterized by valliculture in the north/east regions, pond farming in Central Italy and the Islands and by shellfish farming in the coastal areas.

Common name	**Species**	**Production facilities**	**Market focus (export/domestic)**
European seabass	*Dicentrarchus labrax*	Monoculture in land-based and sea cage (SW)	Domestic
Gilthead seabream	*Sparus aurata*	Mono and polyculture in land-based and sea cage (SW)	Domestic
Sea breams	*Diplodus spp. Puntazzo puntazzo*	Polyculture in land-based and sea cage (SW)	Domestic
Mullets	*Mugil spp.*	Extensive and semi-intensive polyculture (BW/SW)	Domestic
European eel	*Anguilla Anguilla*	Intensive monoculture in land based (FW)	Domestic
Rainbow trout	*Onchorynchus mykiss*	Intensive monoculture in land based (FW)	Domestic
Catfish	*Ictalurus spp. Ameiurus spp.*	Semi-intensive monoculture in land based (FW)	Domestic
Common carp	*Cyprinus carpio*	Extensive/semi-intensive monoculture in land based (FW)	Domestic
Sturgeon	*Acipenser spp.*	Intensive monoculture in land based (FW)	Domestic
Other fish	*Pagrus spp., Umbrina cirrosa, Argyrosomus regius, Dentex dentex , etc*	Monoculture in land-based	Domestic
Mussels	*Mytilus galloprovincialis*	Monoculture fixed (<10%), single ventia long-line (75%), multi-ventia (Trieste long-line)	Domestic (95%)
Clams	*Tapes philippinarum*	Monoculture, management of natural resources and	National domestic (76%)

	Tapes decussates	hatchery-restocked juveniles.	Regional domestic (74%)

Table 4-39 Main species and production systems currently in practice.FAO, 2005.

Aquaculture in Italy can be divided into four different farming systems: extensive farming (inland plants), semi-extensive farming (inland plants), intensive farming (inland and offshore plants) and mussel culture (longlines).The current real trend in Italian aquaculture development is the increasing production of marine species, both molluscs and finfish. The growth in aquaculture production is mainly due to the mastering of seed production techniques for European seabass and gilthead seabream and to the application of new farming technologies. For intensive farming, which is traditionally land based, limiting factors related to environmental impact and the lack of land due to the intensive use of coastal areas have stimulated the development of offshore aquaculture. The production of mussels has followed the same trend.

Bluefin tuna (*Thunnus thynnus*) farming is also a very important activity in the eastern side of the Adriatic Sea (Katavić and Tičina, 2005). The first pilot farming of bluefin tuna started in 1996, applying the technology developed during the farming activities on the southern bluefin tuna in Australia that had been practiced since the 1980s (Miyake et al., 2003). Since 1996 the farming of bluefin tuna in Croatia has developed rapidly. In 2001, on the Eastern Adriatic Sea coast there were six medium- to large- farms with nine rearing sites which included 43 cages (Figure 4-43). Cages used for tuna farming are constructed as 50 m diameter floating circles with a suspending net of about 20 to 25 m in depth (Katavić et al., 2003; Miyake et al., 2003).

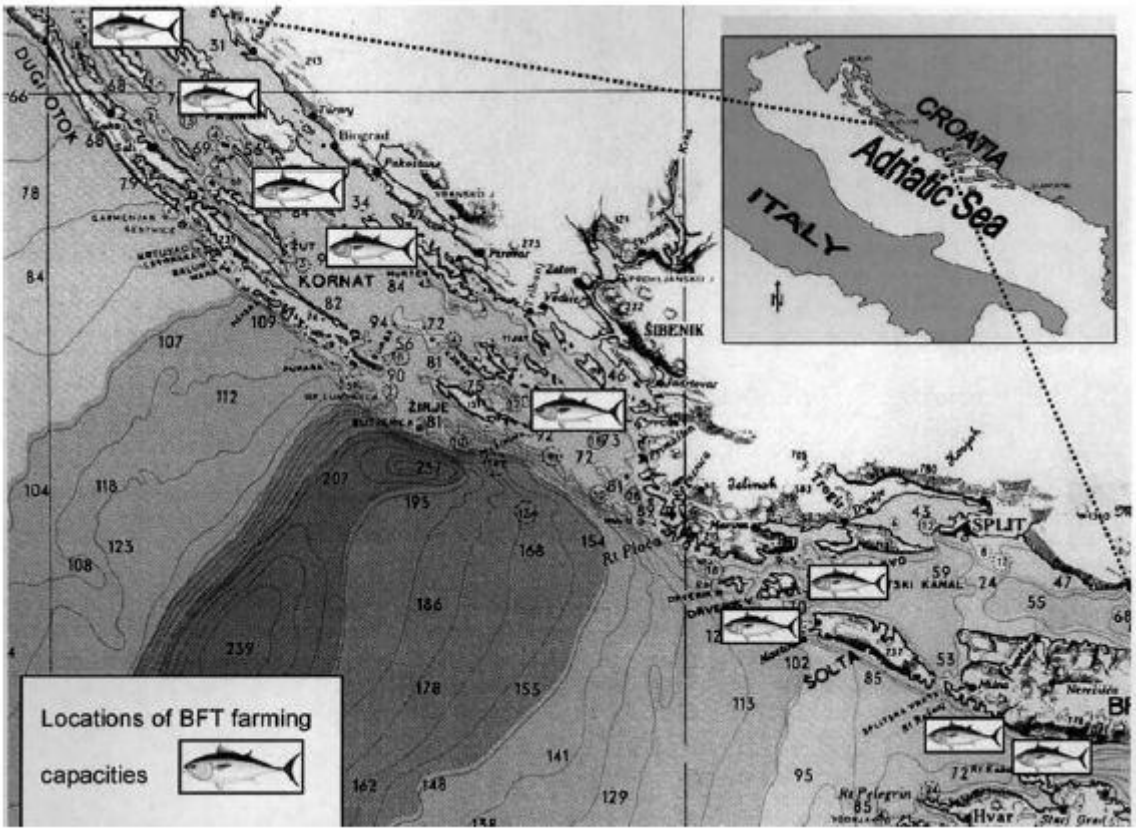


Figure 4-43 Location of the Bluefin tuna farms in the central-northern Adriatic Sea From Katavić and Tičina, 2005.

Farmed tuna are mainly exported to the Japanese sashimi markets, but this constitutes only 4 percent of the total amount required. From 1998 to 2001 the tuna supply (all species) to the Japanese market ranged from 451,000 to 507,000 tonnes, but the most important is a high valued product called "toro". As all other human activities, tuna farming has a certain local environmental impact. According to the results of some recent studies presented at the International Meeting "Tonno e dintorni" (Castellammare del Golfo, 24-26/10/2003, Italy), no significant environmental changes have been noticed in water columns and sediment at a distance of >100 m from the grow-out floating cages for tuna farming located at 45-50 m depth. In order to avoid negative interactions with other commercial activities, coastal zone management plans should be developed. Another issue of concern was the possible impact this activity could have on small pelagic fish stocks in the Adriatic, since these species are used as fish feed in tuna farming practices. In order to properly assess the availability of the resource and to prevent this problem, small pelagic fish stocks in the Adriatic Sea are monitored by annual acoustic surveys. It should also be pointed out that more than 50 percent of the tuna fish feed is imported from other fishing areas of the Atlantic.

4.4.1 Focus Area 1

Commercial fisheries

The Adriatic is characterized by high biodiversity, including numerous commercially exploited species of fish and invertebrates (Coll et al., 2013). The Adriatic ichthyofauna exhibits quite a high rate of biodiversity in comparison to other Mediterranean regions, from 407 fish species enumerated in the checklist of Adriatic fishes proposed by Jardas in 1996 to 432 species checked by Dulčić in 2004 (Dragičević and Dulčić, 2010).

The total number of Italian fishing vessels operating in the FA1 is 1,826, 78% of these vessels are located in Veneto and Emilia Romagna while only 22% in Friuli Venezia Giulia (400, Table 4-40, Table 4-41, Table 4-42).

Artisanal fisheries dominate in each Region in terms of number of vessels (1,024), followed by bottom trawl (440), hydraulic dredges (259), pelagic trawl (79), purse seines (13) and polyvalent passive gears (11; Figure 44).

Bottom trawlers generally dominate in terms of Gross Tonnage and Engine power, while artisanal fishers dominate in terms of crew number (1,551) and total number of days at sea (100,213). The total production in FA1 during 2012 was 49,432 tons, corresponding to a revenue of 127,260,000 €.

	Units (N)	Tonnage (GT)	Engine power (kW)	Crew (N)	Days at sea	Catches (t)	Revenues (mln €)
Bottom trawl	37	681	6,521	110	3,757	1,033	4.29
Pelagic trawl	6	163	1,468	29	752	591	0.84
Purse seine	13	123	1,509	65	1,106	422	1.01
Hydraulic dredge	42	446	5,016	84	2,720	496	2.53
Artisanal fishery	302	536	12,374	445	37,239	1,498	11.75
Polyvalent passive	-	-	-	-	-	-	-
Total	**400**	**1,949**	**26,889**	**733**	**45,574**	**4,039**	**20.41**

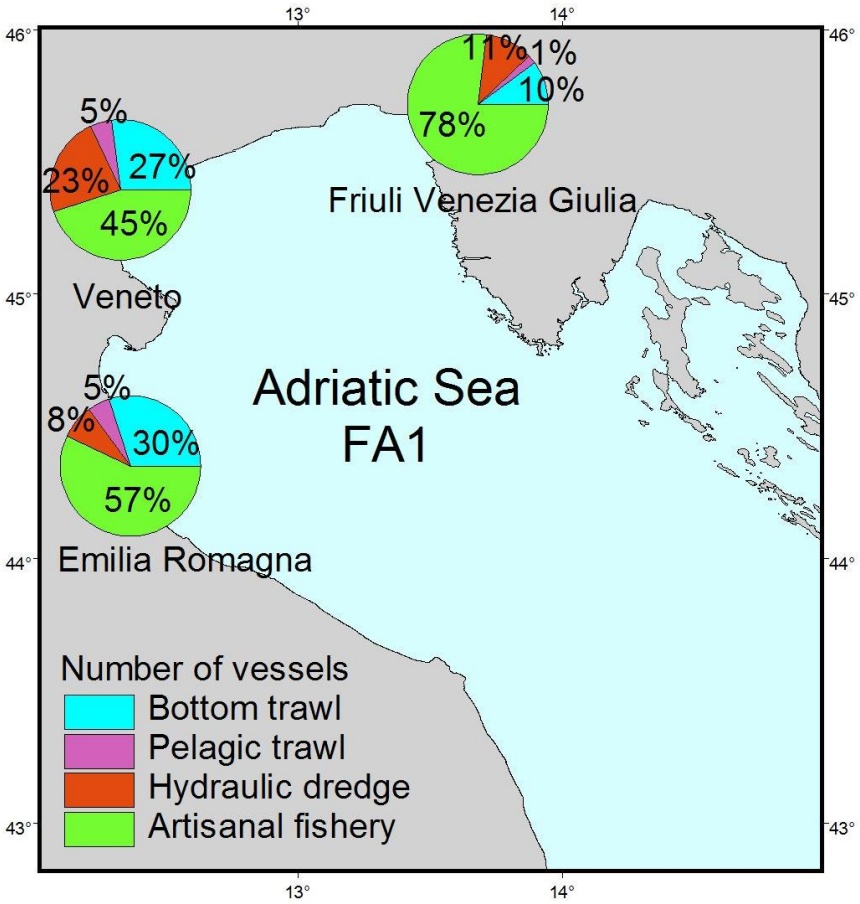
Table 4-40 Fishing fleets, fishing effort and catches in Friuli Venezia Giulia Region in 2012 (Mipaaf-IREPA)

	Units (N)	Tonnage (GT)	Engine power (kW)	Crew (N)	Days at sea	Catches (t)	Revenues (mln €)
Bottom trawl	190	6,499	38,899	593	22,516	4,096	21.69
Pelagic trawl	38	2,647	11,198	184	5,298	12,274	12.16
Purse seine	-	-	-	-	-	-	-
Hydraulic dredge	163	1,836	17,915	326	12,871	4,935	12.33
Artisanal fishery	321	789	12,854	541	28,600	948	6.90
Polyvalent passive	-	-	-	-	-	-	-
Total	**712**	**11,771**	**80,866**	**1,644**	**69,285**	**22,253**	**53.08**

Table 4-41 Fishing fleets, fishing effort and catches in Veneto Region in 2012 (Mipaaf-IREPA)

	Units (N)	Tonnage (GT)	Engine power (kW)	Crew (N)	Days at sea	Catches (t)	Revenues (mln €)
Bottom trawl	213	4,967	32,925	528	16,475	4,326	23.20
Pelagic trawl	35	2,205	11,662	258	6,007	13,759	9.66
Purse seine	-	-	-	-	-	-	-
Hydraulic dredge	54	785	5,610	108	6,858	3,407	7.82
Artisanal fishery	401	829	19,994	565	34,374	1,639	12.97
Polyvalent passive	11	165	2,351	43	92	11	0.12
Total	**714**	**8,951**	**72,541**	**1,501**	**63,806**	**23,140**	**53.77**

Table 4-42 Fishing fleets, fishing effort and catches in Emilia Romagna Region in



2012 (Mipaaf-IREPA)

Figure 4-44 Composition (%) of the main four fleet segments in the Regions of the Focus Area 1 in 2012. Italian Ministry of Agriculture, Food and Forestry-IREPA.

The commercial fishing effort in FA1 is mainly related to the species of small pelagis fish, demersal fish, common sole, red mullet and European hake, that are described below.

Small pelagic fish

These species are widely distributed in the Adriatic Sea and play an important role in the commercial fisheries of all countries located along the coast of the Adriatic Sea. The main species of small pelagic fish are sardine (*Sardina pilchardus*), anchovy (*Engraulis encrasicolus*), Atlantic mackerel (*Scomber scombrus*), chub mackerel (*Scomber japonicus*) and sprat (*Sprattus sprattus*). Other species also occasionally caught in small pelagic fisheries in the Adriatic Sea are the horse mackerel (*Trachurus trachurus*), Mediterranean horse mackerel (*Trachurus mediterraneus*), Mediterranean sand smelt (*Atherina hepsetus*), Blotched pickarel (*Spicara maena*) and bogue (*Boops boops*). Small pelagic fishes are the main fisheries resources of the Adriatic Sea, accounting for a large share of the total catches. Anchovy, together with sardine, is one of the most important commercial species of the Adriatic Sea. The stock of anchovy living in the northern and central Adriatic Sea (GFCM-GSA 17) is shared between Italy, Slovenia and Croatia. The stocks are exploited by mid-water trawlers and purse seiners. In 2007, the Italian fleet was composed of about 130 (65 pairs) pelagic trawlers (volante) mainly operating from Trieste to Ancona (average GRT 43, average engine power 290 kW; Figure 4-45) and about 45 purse seiners attracting fish with light (lampara), operating in the Gulf of Trieste (24 small lampara, average GRT 9, average engine power 110 kW) and in the Central Adriatic (21 big lampara, average GRT 97, average engine power 390 kW). In 2007, the Slovenian fleet was composed of 1 pelagic trawler pair and 7 purse seiners; Croatian purse seine fleet is composed by 134 units with LOA greater than 15 meters. No data are available for purse seine boats with LOA lower/equal than 15 m. In 2011, a total of 122 vessels from Italy, Croatia and Slovenia, including both pelagic trawlers and purse seiners, were operating in GSA 17. The main fraction of the total catch has been usually taken by the Italian fleet but, in recent years, the fraction relative to the fleets of the eastern part of the GSA17 has increased. Fisheries by boat seines and small trawlers targeting the transparent goby (*Aphia minuta*) as well as fries of small pelagic species are authorised for 60 days in wintertime in Italy. Italian regulations prohibit fishing with trawls and mid-water pair trawls for about 25/30 days between July and September. This closed season does not apply to purse seiners. Fishing activity is suspended during the weekend (STECF, 2013).

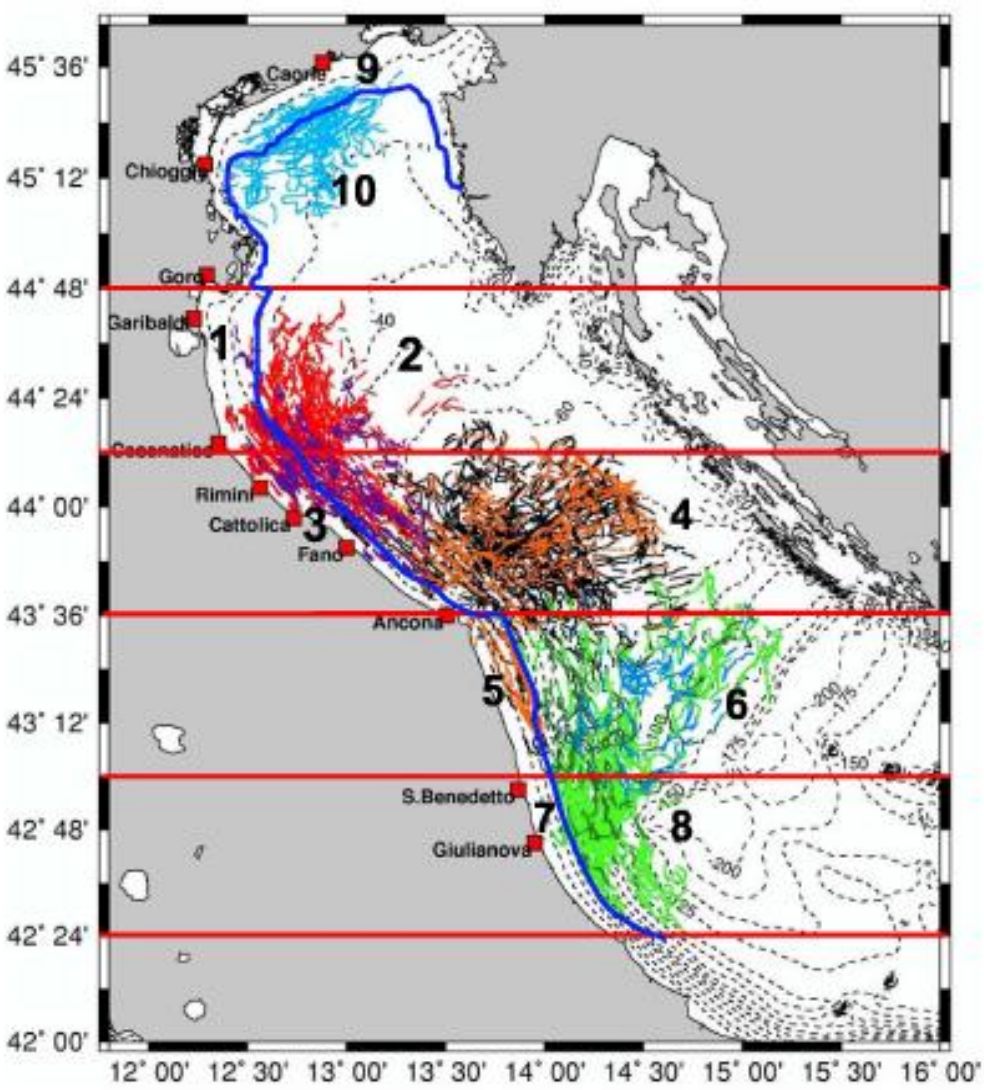


Figure 4-45 Fishing grounds of Italian pelagic trawlers in the GSA 17. Green tracks indicate the hauls carried out by the fishing vessel from Giulianova, in dark green and cyan the hauls of the two trawlers from S. Benedetto del Tronto, in black and orange the tracks of two vessels from Ancona, in purple and red the tracks of Rimini vessels and in light blue the tracks of Chioggia vessels. From Falco et al., 2007.

Demersal fish

The demersal fisheries mainly comprise juveniles of several target species, e.g. common sole, red mullet and European hake. Invertebrates (cephalopods, crabs and scallops) also constitute an important proportion of the catch. The north-central Adriatic Sea is also a strategic area for marine vertebrate conservation, supporting important populations of seabirds, marine mammals and turtles (Coll et al., 2013). Most of the GSA 17 is suitable for trawling activities and high levels of fishing pressure exist (ISPRA, 2013; Figure 4-46).

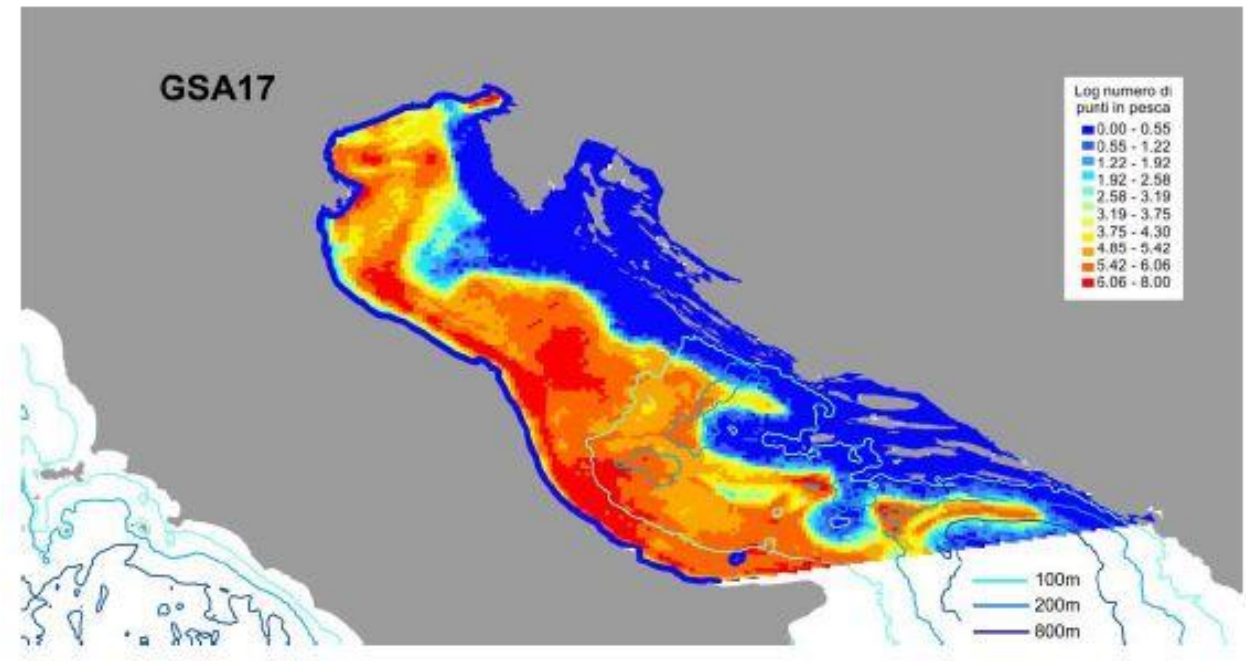


Figure 4-46 Mapping of the fishing effort of trawling activities for demersal resources in the GSA 17. From ISPRA, 2013

Common sole

The Italian fleets exploit common sole with rapido trawl and set nets (gill nets and trammel nets), while only trammel net is commonly used in the countries of the eastern coast. Sole is an accessory species for otter trawling. More than 80-90% of catches come from the Italian side. Landings fluctuated between 1,000 and 2,300 t in the period 1996-2011 (data source: FAO-FishStat and 2012 official data call). The main Italian rapido trawl fleets of GSA 17 are sited in the following harbors: Ancona, Rimini and Chioggia. The Italian artisanal fleet in GSA 17, accounted for around 500 vessels widespread in many harbors along the coast. They use gill net or trammel net especially from spring to fall and target small and medium sized sole (usually smaller than 25 cm TL). The eastern part of the basin contributes for about the 10-20% of the total landings, with on average 8 t from Slovenia and 200 t from Croatia. Rapido trawl landings were traditionally dominated by small sized specimens; they are basically composed by 0+, 1 and 2 year old individuals. Set net fishery lands mostly the same portion of the population, while the otter trawl fishery, exploiting wider fishing grounds, shows a different size distribution of the landings. In the eastern part of the basin common sole is exploited mainly by set netters using trammel net. The catch composition, as suggested by preliminary data collection started in 2010 by Croatian colleagues in the framework of Primo Project, is dominated by adult.

Red mullet

In the Adriatic, red mullet is mainly fished by bottom trawl nets from both Italian and Croatian fleet. Smaller quantities are also caught with Italian trammel-nets and gill nets. Slovenian catches are low: the highest catches between 2006 and 2011 were 2 t reported in 2007. A closure of 45 days in late summer have been enforced in 2011-2012 for the Italian fleet. Before 2011 the closure period was 30 days in summer. Along the Croatian coast bottom trawl fisheries is mainly regulated by spatial and temporal fisheries regulation measures, and about 1/3 of territorial sea is closed for bottom trawl fisheries over whole year. Also bottom trawl fishery is closed half year in the majority of the inner sea.

European hake - The hake fishery is one of the most important in GSA 17. In GSA 17 hake is a target species for the otter trawlers and Croatian long liners, but it is also caught in smaller quantity in the gill-net fisheries. The species is mainly fished with bottom trawl nets, but long-lines and trammel-net are also used. An overall decreasing trend in effort of the major bottom

otter trawl fleets occurred in the recent years. Fishing grounds mostly correspond to the distribution of the stock. On the basis of the Italian data collected through DCF from 2004 to 2008, landings of bottom otter trawlers account for over 95% of the total. The hake total catch peaked in 2006 (4,339 tons) and decreased in the subsequent years. In 2008 it amounted to 3,177 tons. No effort and catch data were provided in 2009 by the Italian authorities.

OTHER FISHERY RESOURCES – In the Northern Adriatic Sea, in addition to the above mentioned resources exploited using otter trawl, pelagic trawl, rapido trawl, set nets, and purse seines, there are other important and peculiar resources: the baby clam (*Chamelea gallina*) harvested with hydraulic dredges, the changeable nassa (*Nassarius mutabilis*) caught with basket traps and the Mediterranean mussel (*Mytilus galloprovincialis*) harvested by scuba divers on wild banks. Besides their socio-economic importance up to date there are no data available on the stock assessment at national or GSA level.

Recreational fisheries

Recreational and sport fisheries in the northern Adriatic Sea are very important activities under both the social and economic point of view. In spite of that, specific studies focusing on the typology of fishing, the number of vessels and quali-quantitative composition of catches are scarce and aged (Anagnopoulos et al., 1998; Karagiannakos et al., 2001; Romanelli and Fiori, 2013). During 2010 the Italian Ministry of Agriculture and Forestry Policies carried out a national census establishing an individual enrolment of marine sport and recreational fishermen in a national register (D.M. 06/12/2010). A total of 794,588 fishermen replied to the on-line questionnaire. Overall, the main fishing categories were shore fishing (44%), followed by boat angling (36%) and free diving spear fishing (20%). In particular, among the fishing techniques the rod angling was the most important, followed by hand lines and spear fishing. Concerning the use of a boat, the majority of fishermen have their own boat (91%), while only a small fraction use fishing charters (4%). The remaining percentage rent the boat.

The Italian Regions were recreational fishing is greater are the two main islands (Sardinia and Sicily; Table 4-43). The Adriatic Regions in total have a medium-low fraction. Nevertheless, this table does not take into account the possible economic impact of the northern Adriatic recreational fishery, mainly including boat anglers targeting the bluefin tuna.

REGION	%
Sardinia	11.5
Sicily	9.5
Apulia	8.6
Tuscany	8.5
Liguria	8.2
Calabria	7.9
Latium	7.1
Campania	6.9
Veneto	5.6
Emilia Romagna	4.9

Marche	4.6
Friuli Venezia Giulia	4.5
Molise	4.2
Abruzzo	4.1
Basilicata	4.1
TOTAL	100.0

Table 4-43 Results of the on-line census D.M. 06/12/2010: distribution of recreational fisheries among Italian Regions. From http://portale.fipsas.it/

Acquaculture

In FA1 the aquaculture sector is characterized on one hand, by strong socio-economic traditions, mainly in freshwater and *valliculture* and on the other hand, by the presence of numerous vacated areas which are suitable for the construction of farms. With regard to mussel production, Italy is one of the main producers and the most important area of production is represented by the Adriatic regions. Figure 4-47 presents locations of aquaculture farms in the North Adriatic.

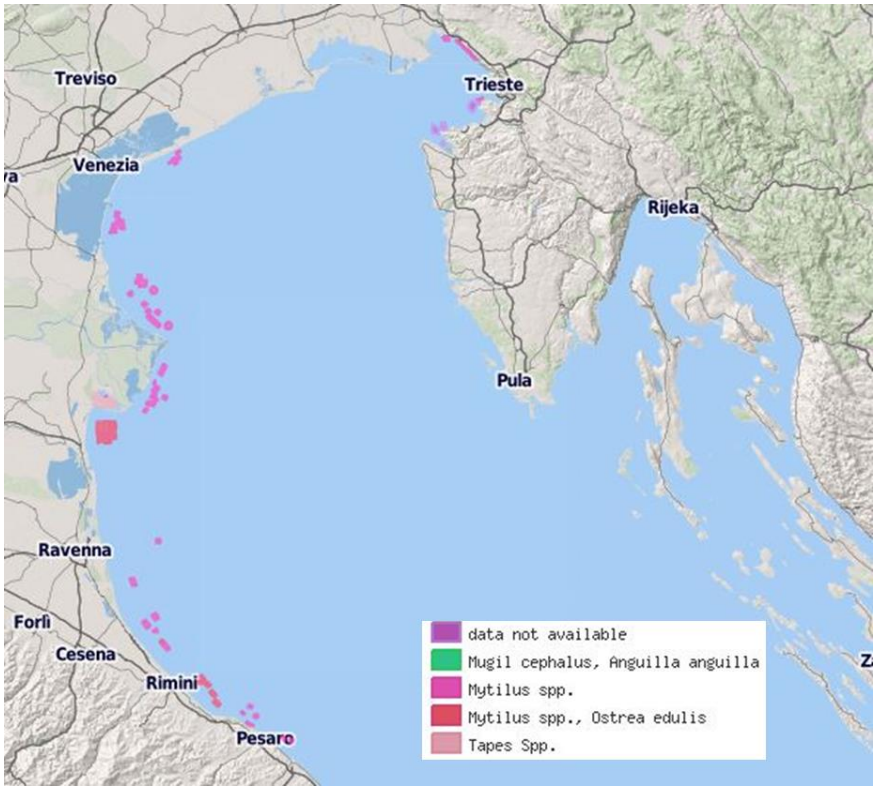


Figure 4-47 Location of the aquaculture farms in the Focus Area 1. SHAPE Project, 2014

In 2011 a total of 813 aquaculture farms operated in Italy: 410 were dedicated to fish production, 392 produced molluscs and 11 produced crustaceans. More than 52% of this

facilities were located in the Focus Area 1 (some farms were dedicated to freshwater production, in particular in Friuli Venezia Giulia Region, where freshwater production contribute for more than 74% of the total production). The main technologies adopted for the different production sectors are:

- crustaceans: basins, lagoons, tanks;
- molluscs: suspended longlines (e.g. mussels), lagoons/on the bottom (e.g. clams);
- fish: basins, lagoons, cages, tanks.

The total production of marine aquaculture in the FA1 in 2011 was 816.9 tons of fish (mainly grey mullets, gilthead seabreams and European seabass), 68,445.8 tons of molluscs (mainly Mediterranean mussels and Manila clams) and 5.9 tons of crustaceans (AMA pers. comm.). The production of each species farmed in FA1 during 2011 is reported in Table 4-44.

Species		**Tons**
Fish	grey mullet (*Mugil cephalus*)	213.7
	gilthead seabream (*Sparus aurata*)	251.7
	European seabass (*Dicentrarchus labrax*)	238.3
	European eel (*Anguilla anguilla*)	105.5
	shi drum (*Umbrina cirrosa*)	7.7
Molluscs	Mediterranean mussel (*Mytilus galloprovincialis*)	36,193.5
	Manila Clam (*Ruditapes philippinarum*)	32,250.6
	oyster (*Crassostrea gigas*)	1.7
Crustaceans	common prawn (*Palaemon serratus*)	2
	kuruma prawn (*Penaeus japonicus*)	3.9

Table 4-44 Marine aquaculture production in FA1 during 2011.

FA1 represents an important area for aquaculture production, in fact around 56% of the national production comes from this area. In particular, FA1 harvests around 22% of mussels and 20% of clams of total national production (Figure 4-48).

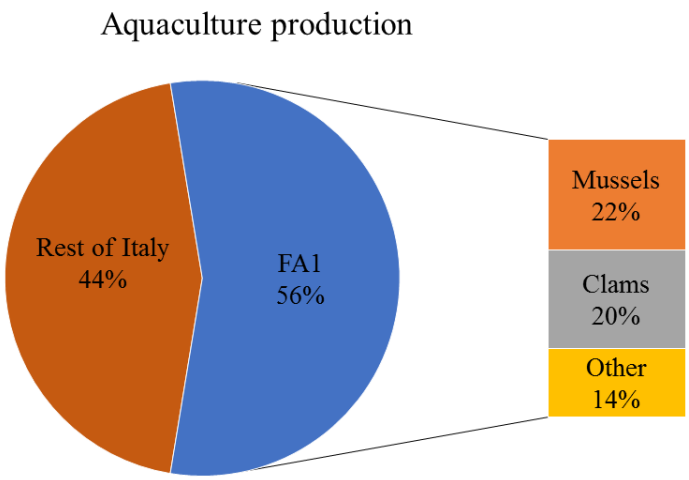


Figure 4-48 Aquaculture production in the Focus Area 1 and in the rest of Italy (2011).

The different farming techniques adopted in FA1 exhibit great differences in biomass production, in particular suspended longlines represent the main activity (36,145.2 tons) and are mostly located in Emilia Romagna Region, followed by molluscs farmed on the bottom (32,250.6 tons - mostly from Emilia Romagna and Veneto Regions, Table 4-45; the bottom farming is also assimilated to culture in the lagoons).

Technology	Species	Emilia Romagna	Friuli Venezia Giulia	Veneto	FA1
Tank	Crustaceans	10.3	-	-	10.3
	Fishes	76.2	14,772.2	6316.5	21,164.9
On the bottom	Molluscs	16,244.4	850.9	15,155.3	32,250.6
Fences	Crustaceans	0.5	-	-	0.5
	Fishes	174.0	-	-	174.0
Suspended	Molluscs	20,426.0	3,772.2	11,997.0	36,145.2
Cages	Fishes	-	290.4	-	290.4
Basins	Crustaceans	18.8	0.1	8.0	26.9
	Fishes	191.8	82.9	482.4	757.1

Table 4-45 Regional productions obtained in the 2011 for different culture technologies and for different productivity sectors

Another important thing is the eggs production devote for restocking and for fattening. In the 2011 a total of 12,750,000 eggs produced in Friuli Venezia Giulia and Veneto were commercialized, 71.4% has been produced for fattening and 28.6% for restocking purposes. At the same time the fry production was estimated for this year around 16,000,000 of gilthead seabream fries, all from Friuli Venezia Giulia Region. In the last few years a general decrease of fry production was observed in Emilia and Veneto, particularly evident for marine fries.

Under a social point of view, aquaculture represents an important source of employment in the FA1. In the last census 4,730 employed were counted, approximately 64% of the total national workers involved in aquaculture activities. In detail, Veneto and Emilia Romagna Regions represent the first and the second region for number of employed in Italy, respectively. A little portion of this staff (4%) is with temporary contract while the remaining with permanent contract.

Slovenia coast

Concerning Slovenia, by statistical classification of economic activities, the fisheries sector in Slovenia comprises fisheries economic activities (fishing and aquaculture – farming of aquatic organisms) and the production of fishery products. In Slovenia, commercial fishing is limited exclusively to marine fisheries, while aquaculture comprises mariculture (breeding of fish and shellfish in the sea) and freshwater fish breeding. Commercial marine fishing is important to the Coastal-Karst Region, i.e. to the three coastal municipalities of Koper, Izola and Piran. Shellfish farms are located in the Slovenian marine territorial waters in the Bay of St. Bartholomew at Debeli rtič, Strunjan Bay and the Bay of Piran at Seča.

The area where Slovenian fishermen perform their fishing activities is very limited and extremely shallow (up to 30 m). It covers less than 6 nautical miles (usually the territorial sea comprises 12 nm). The Slovenian fisheries sector is still affected by the unresolved political issue of establishing maritime borders with the Republic of Croatia and the non-implementation of the fisheries part of the bilateral agreement, which adversely affects the commercial fisheries in the area of unsettled maritime borders, and consequently the traditional area of the Piran netting fishermen has been more than halved.

At the national economy level, the contribution of value added at basic prices in the fisheries sector is negligible, amounting to less than 0.02%. Nevertheless, the contribution of the fisheries related activities and the economic and traditional role of commercial fishing activities in the region should not be neglected since fishing is a traditional activity and is therefore also important in terms of preserving the cultural heritage.

The Slovenian fishing fleet mainly consists of vessels used in marine fisheries. In 2011/12, more than 160 vessels were recorded in the Community Fishing Fleet Register. The data show that a vast majority of vessels in the Slovenian fishing fleet are less than 12 meters long. Vessels with an overall length of 18 meters represent a negligible part of the total fleet. The fleet has declined in recent years (in 2012, the fishing boats Riba 1 and Riba 2, the former pride of Slovenian fisheries that used to catch more than 1,500 tonnes of fish per year, but only 600 to 800 tonnes in their last years, were scrapped). In addition to them, six other fishing vessels were scrapped. The fleet is old – the calculated average age of vessels was about thirty years in 2012.

If the fleet broken down by fishing gear there are three fishing technologies, i.e. passive fishing gear (nets, traps, fyke nets, longlines) mainly for fishing of high-quality white fish, two types of active fishing gear (demersal trawls) for catching the whiting fish and molluscs (cuttlefish, squid, musky octopus) and encircling seine nets for little blue fish (pilchard and anchovy), used only seasonally (May to October). Fishing technology for small blue fish by pelagic trawl nets is used on two vessels, while the floating trawls (volante) were lost due to the scrapping of Riba 1 and Riba 2 and with this 80% of the catch of small blue fish.

Sea fishing gas been steadily declining since 1991. In 1990, the total quantity of marine fish catch reached about 6,000 tonnes, while in the 1993-2004 period, the average annual catch was about 1,700 tonnes. In recent years, the catch has stabilized at the amount of approx. 700-800 t/year and approx. 400 t of harvested shellfish annually. After the »loss« of floating

trawls, the annual catch dropped to just over 300 tonnes, which will hopefully remain the annual catch and not continue to decline.

Year	2005	2006	2007	2008	2009	2010	2011	2012
Total catch (CATCH F00)	1,012	933	913	686	866	763	719	329

Table 4-46 Commercial marine fishing catch in tonnes by year Source: Statistical Office of the Republic of Slovenia until 2005 and the Ministry of Agriculture and the Environment from 2006 on.

CATCH [kg]	**2010**	**2011**	**2012**
Catch of marine animals - TOTAL (CATCH F00)	763621	719053	329133
Catch of marine animals: fish, total (CATCH F03)	700326	660489	278942
Catch of marine animals: fish: European pilchard (PIL)	402727	305887	18344
Catch of marine animals: fish: European sprat (SPR)	19353	5670	1945
Catch of marine animals: fish: European anchovy (ANE)	143782	163364	43628
Catch of marine animals: fish: Atlantic mackerel (MAC)	1652	3201	3266
Catch of marine animals: fish: Chub mackerel (MAS)	486	1057	174
Catch of marine animals: fish: Jack and horse mackerels nei (JAX)	7634	12979	6738
Catch of marine animals: fish: Garfish (GAR)	123	269	57
Catch of marine animals: fish: Northern bluefin tuna (BFT)	50	49	-
Catch of marine animals: fish: Atlantic bonito (BON)	783	448	283
Catch of marine animals: fish: Frigate and bullet tunas (FRZ)	2	-	12
Catch of marine animals: fish: Little tunny (LTA)	6	10	-
Catch of marine animals: fish: Leerfish / Garrick (LEE)	29	104	101
Catch of marine animals: fish: Greater amberjack (AMB)	22	21	7
Catch of marine animals: fish: Whiting, Poor cod and European hake (WHG+POD+HKE)	-	-	-

Catch of marine animals: fish: Whiting (WHG)	68662	56112	80775
Catch of marine animals: fish: Poor cod (POD)	229	148	137
Catch of marine animals: fish: European hake (HKE)	98	342	395
Catch of marine animals: fish: Red mullet and Striped mullet (MUR+MUT)	1305	6091	3724
Catch of marine animals: fish: Common dentex (DEC)	1	0	1
Catch of marine animals: fish: Mullets n.e.i. (MUL)	6028	23979	31761
Catch of marine animals: fish: Golden mullet (MGA)	2677	14151	11407
Catch of marine animals: fish: Flathead grey mullet (MUF)	419	275	328
Catch of marine animals: fish: Mullet (Thinlip MGC, Leaping LZS, Boxlip ODL and Thicklip grey MLR)	28	128	113
Catch of marine animals: fish: European eel (ELE)	3	-	-
Catch of marine animals: fish: European conger (COE)	500	693	1421
Catch of marine animals: fish: European seabass (BSS)	3564	3820	2865
Catch of marine animals: fish: Gilthead seabream (SBG)	4833	4872	10911
Catch of marine animals: fish: Picarels (PIC)	2535	3154	3024
Catch of marine animals: fish: Bogue (BOG)	607	2207	1244
Catch of marine animals: fish: Silversides / Sandsmelts (SIL)	1443	1893	1542
Catch of marine animals: fish: Saddled seabream (SBS)	95	102	25
Catch of marine animals: fish: Black seabream (BRB)	-	1	-
Catch of marine animals: fish: Salema / Strepie (SLM)	2839	13204	4773
Catch of marine animals: fish: Scorpionfishes: n.e.i. (SCO)	87	27	28
Catch of marine animals: fish: Common sole, Turbot and European flounder (SOL+TUR+FLE)	-	-	-

Catch of marine animals: fish: Common sole (SOL)	8434	13323	8502
Catch of marine animals: fish: Turbot (TUR+BLL)	980	2043	1534
Catch of marine animals: fish: European flounder (FLE)	5671	4423	4681
Catch of marine animals: fish: Dogfish sharks n.e.i. (DGX)	16	5	35
Catch of marine animals: fish: Smooth-hounds n.e.i. (SDV)	936	1358	1431
Catch of marine animals: fish: Catsharks / Nursehound (SCL)	-	-	-
Catch of marine animals: fish: Raja rays n.e.i. (SKA)	190	161	147
Catch of marine animals: fish: John dory (JOD)	856	440	125
Catch of marine animals: fish: Annular seabream (ANN)	975	1753	2751
Catch of marine animals: fish: Sand steenbras (SSB)	656	1226	6456
Catch of marine animals: fish: Common pandora (PAC)	5749	5766	16114
Catch of marine animals: fish: Black goby (GBN)	380	660	460
Catch of marine animals: fish: Shi drum / Corb (COB)	270	82	340
Catch of marine animals: fish: Common eagle ray (MYL)	58	88	106
Catch of marine animals: fish: Ray-finned fishes n.e.i. (CBC)	122	739	611
Catch of marine animals: fish: Gurnards and Searobins (GUX)	1224	1858	3464
Catch of marine animals: fish: Sharpsnout seabream (SHR)	89	97	1876
Catch of marine animals: fish: Monk (MON)	13	33	52
Catch of marine animals: fish: other	1107	2176	1228
Catch of marine animals: cephalopods, total (CATCH F57)	50952	51574	48564
Catch of marine animals: cephalopods: Common squids (SQC)	24481	18027	12986
Catch of marine animals: cephalopods: Common cuttlefish (CTC)	6940	8355	10106
Catch of marine animals: cephalopods: Common, Horned and Musky	19531	25192	25472

octopuses (OCC+OCM)			
Catch of marine animals: crustaceans, total (CATCH 40)	5481	4208	1327
Catch of marine animals: crustaceans: European lobster (LBE)	-	-	3
Catch of marine animals: crustaceans: Spinous spider crab (SCR)	0	1	2
Catch of marine animals: crustaceans: Spottail mantis squilid (MTS)	5165	3776	897
Catch of marine animals: crustaceans: other	316	431	425
Catch of marine animals: shells and snails, total (CATCH F04)	6861	2782	300
Catch of marine animals: shells and snails: European flat oyster (OYF)	56	10	-
Catch of marine animals: shells and snails: Mediterranean mussel (MSM)	-	-	-
Catch of marine animals: shells and snails: Arcidae (RKQ)	2706	1220	19
Catch of marine animals: shells and snails: Striped venus (VEV)	3882	1346	157
Catch of marine animals: shells and snails: other	218	206	124

Table 4-47 Marine fishing, catch of marine animals in kilograms, Slovenia, annually

Marine aquaculture represents more than a half of the Slovenian commercial catch and breeding. Mariculture comprises shellfish farms (blue mussel) and floating cages for sea bass breeding.

Year	2011	2012
Mariculture, total	449	364

Table 4-48 Aquaculture – quantity of farmed aquatic organisms in Slovenia in tonnes by years Source: Ministry of Agriculture and the Environment

Year	2011	2012
Sea fish, total (AQUA 03)	56.2	52.0

Table 4-49 Aquaculture – quantity of farmed aquatic organisms in Slovenia in tonnes by years Source: Ministry of Agriculture and the Environment

Year	2011	2012
Mollusc, total (AQUA 54)	438	312

Table 4-50 Aquaculture – quantity of farmed aquatic organisms in Slovenia in tonnes by years Source: Ministry of Agriculture and the Environment

In Slovenia there are only a few companies that are fully engaged in fish processing. The companies that process sea fish and other marine animals are located on the Slovenian coast.

Croatia coast

The whole Adriatic Sea includes 138.595 km2. The Croatian part of Adriatic Sea includes 56.964 km2 and it is divided:

- Costal Sea of Croatia is part of the Sea where Croatia has sovereignty 31.757 km2 (inner sea area 12.461 km2 and territorial sea 19.296 km2)
- Croatian protected biological and fishery area – ZERP includes 25.207 km2

The main objectives of the Croatian fisheries policy is to straighten and restructure fishing sector as a whole, to insure the long-term sustainable management of fishing resources in accordance with fishing possibilities. It is important to develop aquaculture in order to explore the marine biological capacity with the highest environmental and quality standards. Since the program period covers the period from the date of accession until 31 December 2013th year (with implementation by December 31, 2015th year) , provided that during this period the Republic of Croatia received funds from the European Fisheries Fund , IPARD program and national budget to achieve the following objectives and priorities :

1 Adaptation of the fishing fleet

- Establishing a sustainable balance between fishing capacity and available fishing resources

2 Sustainable Aquaculture

- Increase productivity and enhancing the competitiveness of the aquaculture

3 Sustainable processing and marketing of fishery and aquaculture products

- Strengthening the processing and marketing capacity

4 Improving administration in fisheries sector and the use of structural support through technical assistance

- Improving the administrative capacity and information sector stakeholders

National strategic plan for fisheries development (NSP) is the foundation for the development of the OP that will further define the measures and activities aimed at achieving the objectives defined in this Plan.

Sharing a common resources in the Adriatic Sea with neighbouring countries is a continuous challenge. In relations between Croatia and Italy, there is significant difference in exploitation of the Adriatic Sea. The Italian catch is around 120 000 t/y and Croatian one around 50 000 t/y. Croatia has signed an agreement with EU related to the capacity of the fishing fleet in Adriatic Sea.

There are two basic categories of fishing in Croatia - economic and non-economic . Within the commercial fishing differs commercial fishing in the narrow sense of the new category of small-scale coastal commercial fishing , which is severely limited by the tools and conditions to perform . Non-economic fishing is a sports and recreation , and in the interim period enabled the retention and small fishing for personal use .The Register of Croatian fishing fleet entered the 4039 vessel . The largest percentage of the fleet (over 80 %) are vessels less than 12 meters in length , which also constitute the largest share in the power of the fleet (around 50

% kW). The most significant part of the total tonnage of Croatian fishing fleet consists of purse seine, and the most important part of the total power multi-purpose vessels. The total strength of the fleet is somewhat more than 310,000 kW and tonnage of slightly more than 40,000 GT.The largest number of vessels registered as a multi-purpose vessels (over 45 %). These vessels are typical for the Mediterranean form of fishing , in which it usually does not target species and where fishermen frequently changing tool during the year . Purse account for about 5 % of the fleet and the vessels achieved the greatest amount of catches , while boats trawl fishing accounted for about 14% of the Croatian fishing fleet. The total catch of Croatian in the 2008th year amounted to 48,976 tons , the 2009th year of 55,319 tons, and 2010. 52,360 tons. Encircling fishing gear (purse seine) is achieved by far the largest amount of catches (89 %). Drift fishing tools account for about 8 % of the catch , while gillnets achieved just over 1 % of the total catch. Percentage grant other fishing gear are represented individually with less than 1% of the total catch . The bulk of the catch - over 80 % - makes little blue fish (sardine and anchovy). Of the total catch , the proportion of catches of white and blue fish is about 96 %, about 2 % of cephalopods , crustaceans and shellfish around 2 % .Unloading is done at 264 disembarkation points , out of which 63 unloading points unload 95 % of the total unloading. The most significant unloading of the 2010th year of the little blue fish were Kali, Zadar, Biograd and Pula, and the trawl catch and catch white fish generally Mali Losinj , Tribunj and Zadar.

Index of species in biomass are showing that in Croatian part of Adriatic Sea there is 2-3 times more fish than in Italian part. All fisheries are based on mixed catch and because of that applying of quota system are economically important for Croatia. Most of the larger species are presently available only in the part of the Sea that belongs to Croatia – like sea cat. Large intensity of exploitation over many years and too warm sea has caused a drastic reduction in biomass of shrimp.

The fish processing industry in Croatia with its 130 years old tradition is one of the prime industries in coastal area of Croatia. Today we have more than 40 companies in Croatia engaged in production of fish products with 20 000 t of fish processed annually.

GFCM Sub areas	1	3	5	6	7	8	9	10	11	17	18	19	20	22	23
Area	Balearic (1,3,5,6)				Gulf of Lions (7)	Sardinia (8,9,10,11)				Adriatic Sea (17,18)		Ionian Sea (19, 20)		Aegean Sea anc Crete (22+23)	
Anchovy	2008	2002		2008	2008	2001	2001	2001	2001	2008	2007	2001	2001	2007	2001
Black Sea Whiting															
Blue whiting															
Bogue														2001	
Breams		2001												2001	
Common dentex															
Flat fish															
Greater forkbread															
Gurnads															
Grey mullet															
Hake	2004		2008	2008	2008	2001	2008	2001	2001	2001	2001	2001	2001	2001	2001
Horse Mackerel		2003												2001	
Mackerel															
Megrim															
Pilchard -Sardine	2008	2005		2008	2007	2001	2001	2001	2001	2008	2007	2001	2001	2007	2001
Poor cod															
Red Mullet	2008	2004	2008	2008	2001	2001	2003	2003	2004	2001	2001	2001	2001	2001	2001
Sea Bass															
Sardinella															
Sole										2008					
Sprat															
Stribet red mullet			2008												
Bluefin tuna	2009														
Swordfish	2009														

Outside safe biological limits | Within safe biological limits | No assessment | Not found in the area

Table 4-51 State of commercial fish stocks in Mediterranean Sea. Source: European Environment Agency, Status of marine fish stocks (CSI 032) Sep 2011

Fisheries are an important element of overall export of agricultural products of Republic of Croatia. The total value of exports of fisheries products in 2010 was 113 119 244 USD (29 375 tonnes) including fresh, chilled, frozen and salted products, and 22 276 036 USD (4 575 tonnes) of processed products. The total value of export reached 135 395 280 USD. Export of aquaculture products, especially farmed tuna, (total value of 42 775 405 USD in 2010) holds the very high fifth place in total export of agricultural products of Republic of Croatia. Aquaculture is playing important role in Croatian fisheries. Farming of aquatic organisms comprises marine aquaculture and farming in fresh (inland) waters. Marine finfish farming is dominated by European sea bass (Dicentrarchus labrax), gilthead sea bream (Sparus aurata), and Atlantic blue fin tuna (Thunnus thynnus). Shellfish farming comprises farming of Mediterranean mussel (Mytilus galloprovincialis) and European flat oyster (Ostrea edulis). Freshwater aquaculture includes production of warm-water (cyprinid or carp-like) species and cold-water (salmonid, trout-like) species, dominantly common carp (Cyprinus carpio) and rainbow trout (Oncorhynchus mykiss). Total aquaculture production in 2010 was 20 172 tonnes. Croatian aquaculture is managed by the Ministry of Agriculture, Development Directorate of Fisheries. Recognising marine aquaculture as very promising activity for the

total development of Croatian economy, big effort has been done in order to complete total legal framework that should organise and encourage further development of this activity. Total procedure for licensing has been simplified, potential sites have been evaluated and included in physical planning, and integrated coastal zone management has been used for coastal zone planning in areas where marine aquaculture is dominating. As Croatia is primarily tourist country, there was competition for place between these two activities, but using integral planning all potential conflicts could be avoided. Development of tourism is enlarging domestic fish market, when in the same time fish supply from capture fisheries cannot fulfil growing demand. As aquaculture can offer fresh fish at same size and quality all year around, this offer is very important for tourist demand. Croatia is planning to start new farms and to support future development of existing farms, in terms of increased production, product diversification, higher sanitary standards, all accompanied by environment friendly technologies.

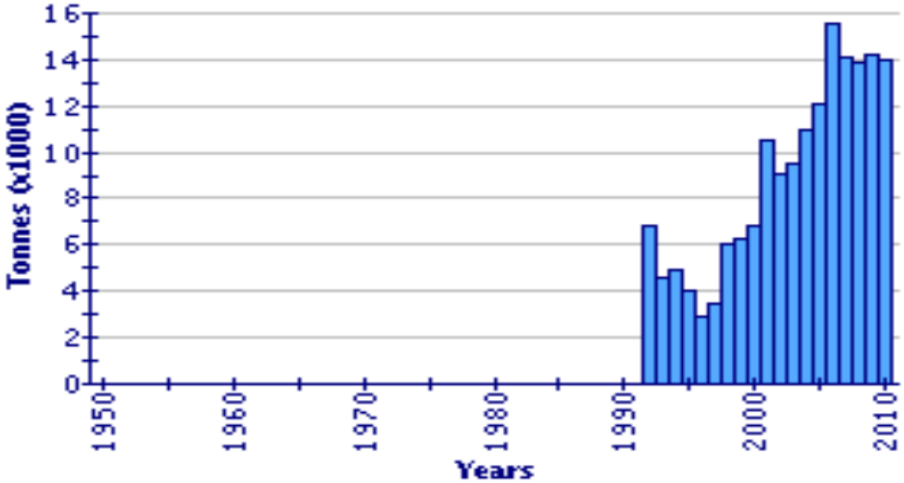


Figure 4-49 Reported aquaculture production in Croatia (from 1950). Source: FAO Fishery Statistics, National Aquaculture Sector Overview

According to the CBS, in 2007 the gross value added of the Croatian fisheries sector was about USD 118 million. Fisheries contribute a total of about 0.2-0.3 percent to GDP, so does not contribute significantly to the national economy. However, recent analysis indicate that real contribution of the fisheries sector to the national economy has been underestimated. If the value of an informal sector and accompanying activities related to fisheries is to be taken into account, the contribution of fisheries in national GDP exceeds 1 percent. Per capita consumption of fish is low in Croatia - only 8 kg/year or about 12 percent of the total meat consumption per person.

4.4.2 Focus Area 2

The sea has historically characterized the economy of FA2 coastal areas, where communities lived the sea as a place of exchange, communication and work. Along with agriculture and maritime trade, fishing has been, for centuries, one of the main activities of coastal populations, which obtained from the sea fundamental products for their economies.

Deep-sea fishing characterized fisheries fleets like Molfetta (Apulia), whose boats are pushed up to the North Africa shores during the fishing seasons. In Bari (Apulia) still operate fishing companies for exploiting areas out of the Mediterranean waters, even if in more limited number than in the past. Oceanic fishing, such as semi-industrial trawling activity, has evolved during the economic wellness of sixties and the related processes of industrial development which, later on, have changed appearance and life of activities like fishing. An emblematic case is perhaps Taranto (Apulia), a historical fisheries marina, where fishing has become over time a residual activity, while aquaculture tries to keep operating, facing the pressure of industrial activities. Consider that until the eighties it was possible to find, in the Ionian city, one of the rarest and most sought after professionals in the fisheries, the fishermen of juvenile fish, able

to recognize and capture juveniles of several species, such as mullet, sea bass, sea bream, croaker, eel, to be used for aquaculture and fish farming.

In Apulia, in 1962, the regional fleet numbered 1467 motor boats with a total tonnage of 14274 GRT and production was approximately 29000 tonnes (Taberini, 1969). In 1982, the experimental program PESTAT (Bazigos et al., 1984; Cingolani et al., 1986), with a substantial sampling effort, estimated the presence of 2,460 motor boats in the region, with a total tonnage of 22885 GRT and a production of about 38670 tonnes.

The Irepa 2002 data, after 40 years, showed the presence of 1992 vessels of 23293 GRT, with a production of 68911 tonnes (Figure 4-50). The current situation (2010, Irepa data) recorded a further decline in the number of ships (1962 units) with a capacity of 19072 GRT and a production of 29648 tonnes. By using simple capacity/impact indicators (number of ships x tonnage) and productivity or resources abundance (catch per unit of effort, where the stress is given by the capacity indicator), the only calculable for the entire time period taken into exam, can be observed (Figure 4-50) that, at the lower capacity of 1962, is one of the highest values of CPUE, with an intermediate production level than in later years. The production grows rather short in 1982, when the capacity of the fleet is around 160% than 1962, while the CPUE decreased. During these years an efficient intervention in terms of specific management tools was needed, so the first regional law on fisheries was approved (lr 57/1981) and, after, the national law 41/82. During the following 20 years was realized the containment measures of the fleet, which leaded to a reduction in the capacity, as evidenced by the data of 2002. Production and CPUE grew due to the higher efficiency of the fleet, in terms of fishing capacity, during the first years. Later, efficiency will no longer show the same performances, when the decline in CPUE may be a sign of reduced productivity of the system, in terms of abundance of marine resources.

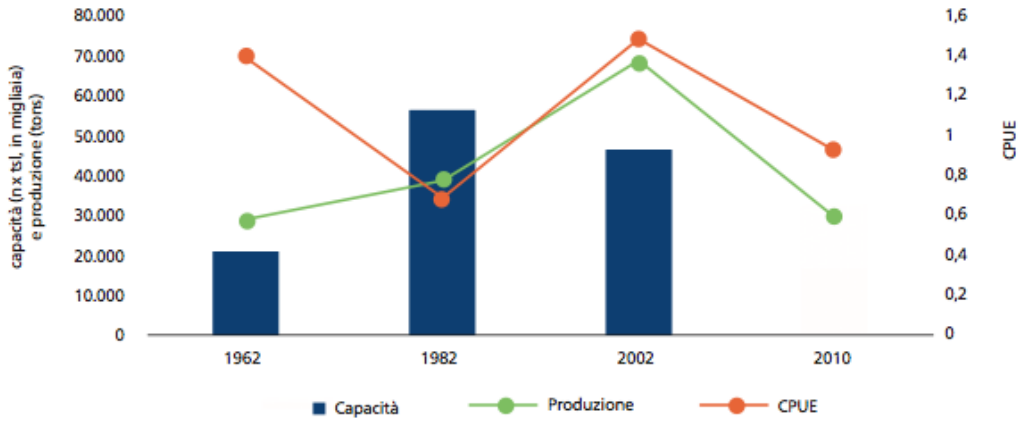


Figure 4-50 Values of fishing vessels capacity (number of vessels × tsl/1000), production and catches per unit of effort (CPUE = production / capacity) of the Apulian regional fleet in 1962 (by Taberini, 1969), 1982 (PESTAT data), 2002 and 2010 (Irepa data)

Overall, the hallmarks of the major regional marinas do not show heavy changes over time: Molfetta remains specialized in deep-sea fishing, while coastal settlements of the Salento (Southern Apulia), such as Gallipoli and Porto Cesareo, but also along the Gargano (Northern Apulia), are mainly devoted to artisanal fisheries. These areas, along with Manfredonia, which is actually the most significant at regional level, Mola di Bari and Monopoli, represent about the 80% of the regional fleet capacity (Table 4-52 and Figure 4-51).

	Vessels		GRT (tsl)		Power kW	
	v.a.	%	v.a.	%	v.a.	%
Bari	296	16,8	3.564	17,5	31.469	19,9
Brindisi	112	6,4	436	2,1	5.269	3,3
Gallipoli	417	23,7	2.204	10,8	22.086	14,0
Manfredonia	532	30,2	5.367	26,3	42.213	26,7
Molfetta	223	12,7	7.947	39,0	45.318	28,7
Taranto	181	10,3	871	4,3	11.593	7,3
Puglia	1.761	100,0	20.388	100,0	157.949	100,0

Table 4-52 Structural indicators of Apulian fleets. Lembo and Donnaloia, 2007

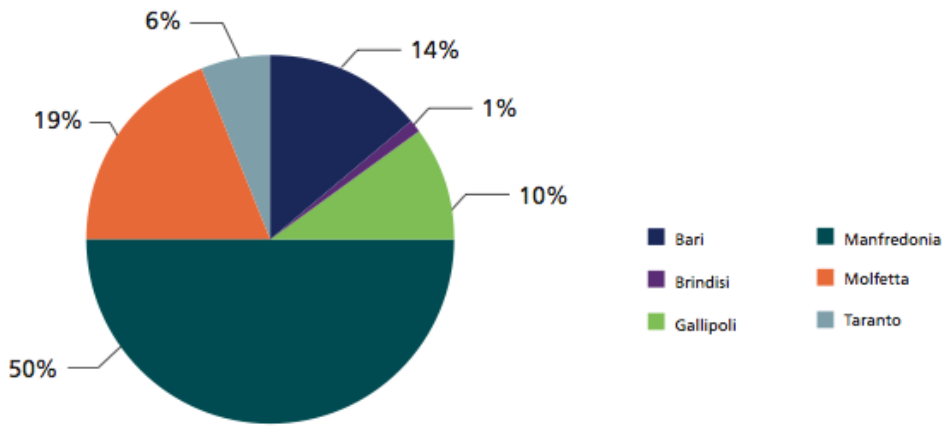


Figure 4-51 Percentage distribution of capacity (number of vessels × GRT) of the Apulian regional fleets

Apulia fleets contribute substantially to the capacity of national fleet and production quotas amounting, respectively, to approximately 13% and 16% (Irepa, 2010). The compartment with the largest number of vessels is Manfredonia, while capacity and power are higher in Molfetta.

The ancient traditions and the eterogeneity of aquatic environments along the region have generated an impressive variety of capture systems, especially in artisanal fisheries. For example, typical of Lesina lagoon is fishing with fishing boats, weirs and traps for catching eels. The trebuchet (trabucchi in italian) is instead an old fishing machine, generally installed on coastal projections, which uses large nets. This system of fishing, prevalent in the Southern Adriatic Sea, in the north along the coasts of Apulia and Abruzzo, is currently quite a traditional memory, protected in Apulia, such as monuments, from the Gargano National Park. Typical and still widely practiced along the Apulian coast is an ancient fishing technique, with harpoon and a metal tube with a mirror at the bottom, to catch sea urchins and octopuses. In Manfredonia squid fishing in late spring (May-June) is typical, involving the assignment of coastal traits to fishermen. This once was regulated by ministerial decrees (Taberini, 1969) and now is under the control of the local fishing cooperatives along with the Coastal Guard.

In Gallipoli and Porto Cesareo the tuna fishing with traps (tonnare) was one of the main activities until the late sixties (Taberini, 1969). Even the square-net fishing (squadrare, Parenzan, 1983) to catch lobsters, stingrays and sharks has been disappearing over time. Subsequently, large pelagic fishes have been captured with longlines (palangari and ferrettare). Nowadays, Gallipoli and most of the Salento (South Apulia) marinas, such as the nearby Porto Cesareo, are mainly characterized by coastal artisanal fishing, practiced with different types of species-specific gillnets, such as for picarels fishing (Spicara smaris). In

Gallipoli, over the past 20 years, trawlin specialized towards the bathyal deep-sea fishing for the capture of prawns and, in particular, Aristeus antennatus.

Currently, bottom trawling is the predominant regional activity considering vessels capacity, while static gears, typical of small-scale fisheries, are still used by the largest number of boats, although the variety of crafts is getting poorer if compared to the past.

Recreative fishing is widely practiced in this area, especially during summers, although there are no official data, with the exception of marine protected areas.

The following figures include maps representing the number of vessels per fishing port and gears used: it is clearly evident that most activities are distributed along the coast of Apulia.

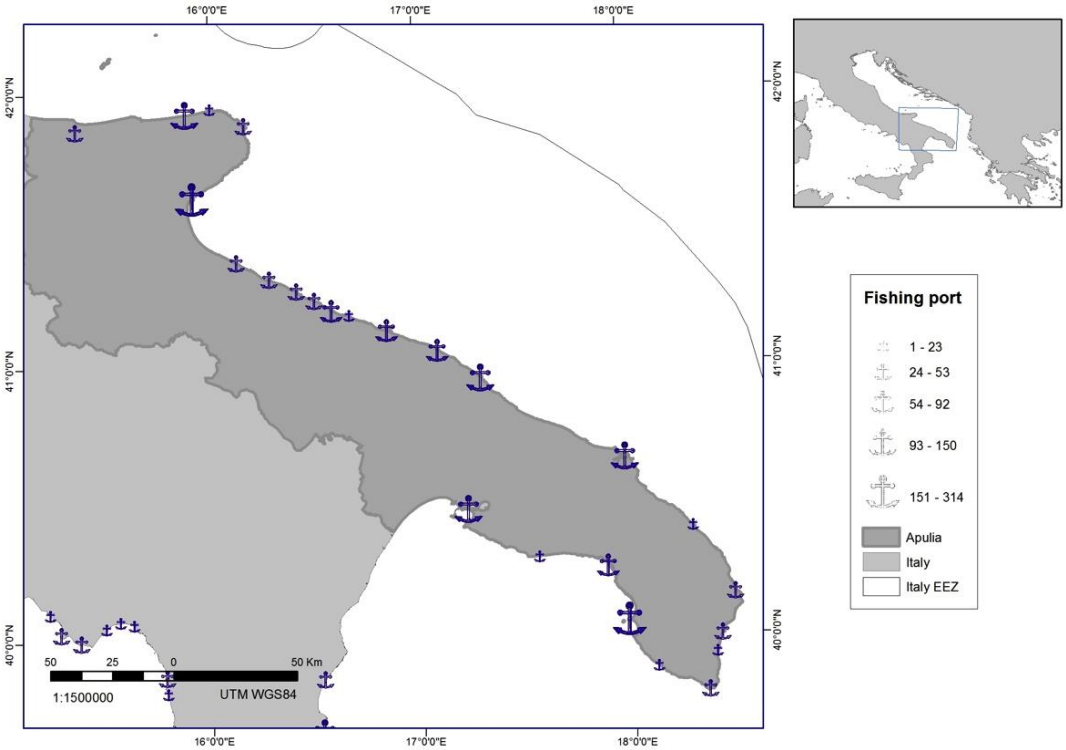


Figure 4-52 Fishing ports in Apulian coast. CoCoNet project, 2014

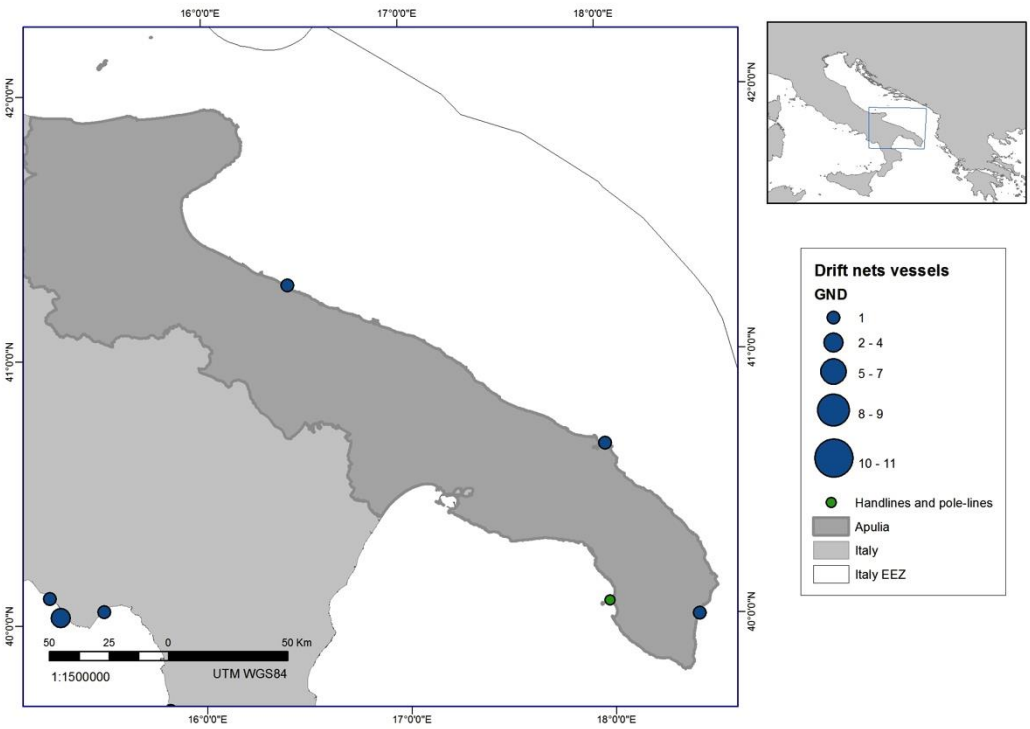


Figure 4-53 Drift net vessels in Apulian coasts. CoCoNet project, 2014

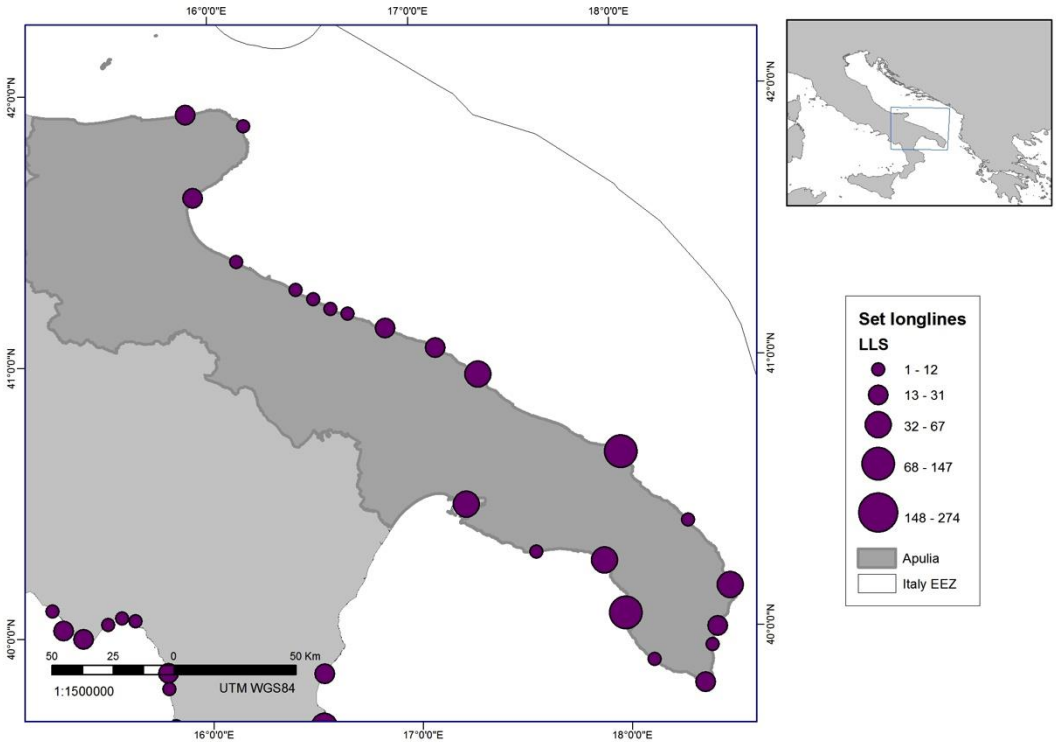


Figure 4-54 Set longilines in Apulian coasts. CoCoNet project, 2014

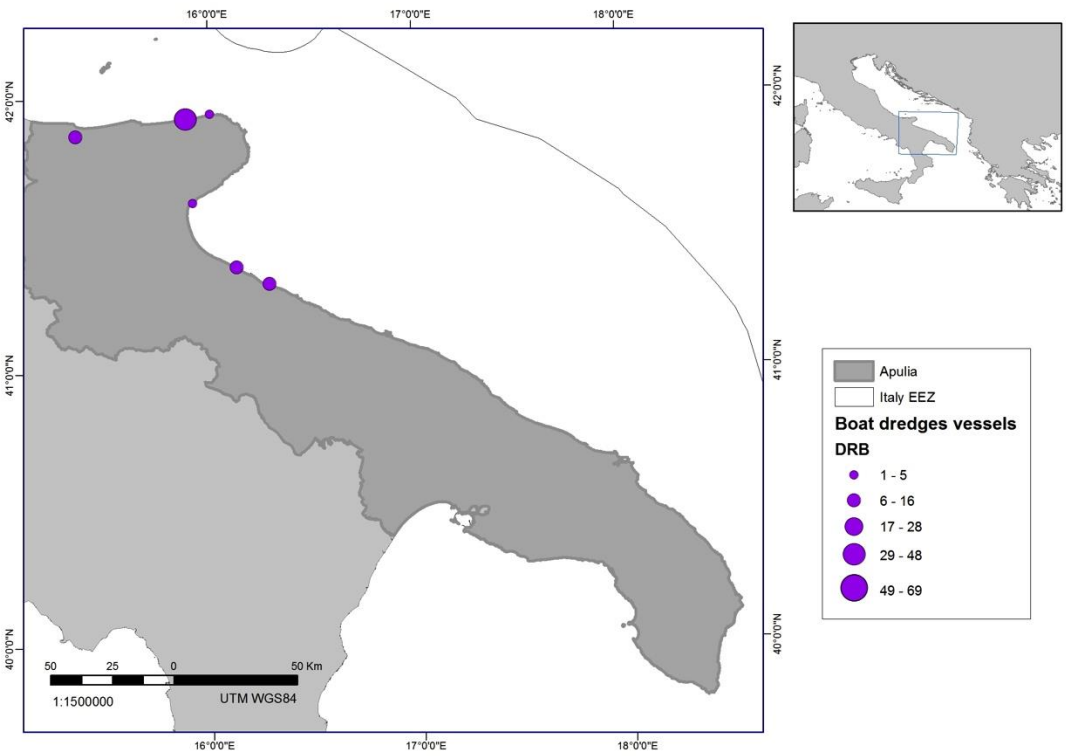


Figure 4-55 Boast dredge vessels in Apulian coast. CoCoNet project, 2014

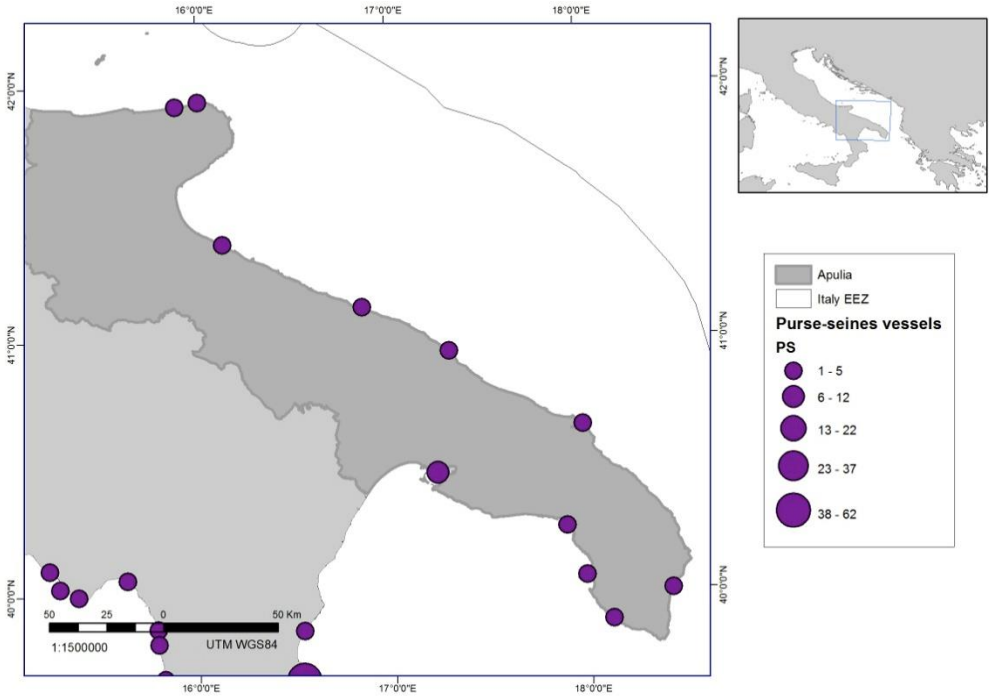


Figure 4-56 Purse seines vessels in Apulian coasts. CoCoNet project, 2014

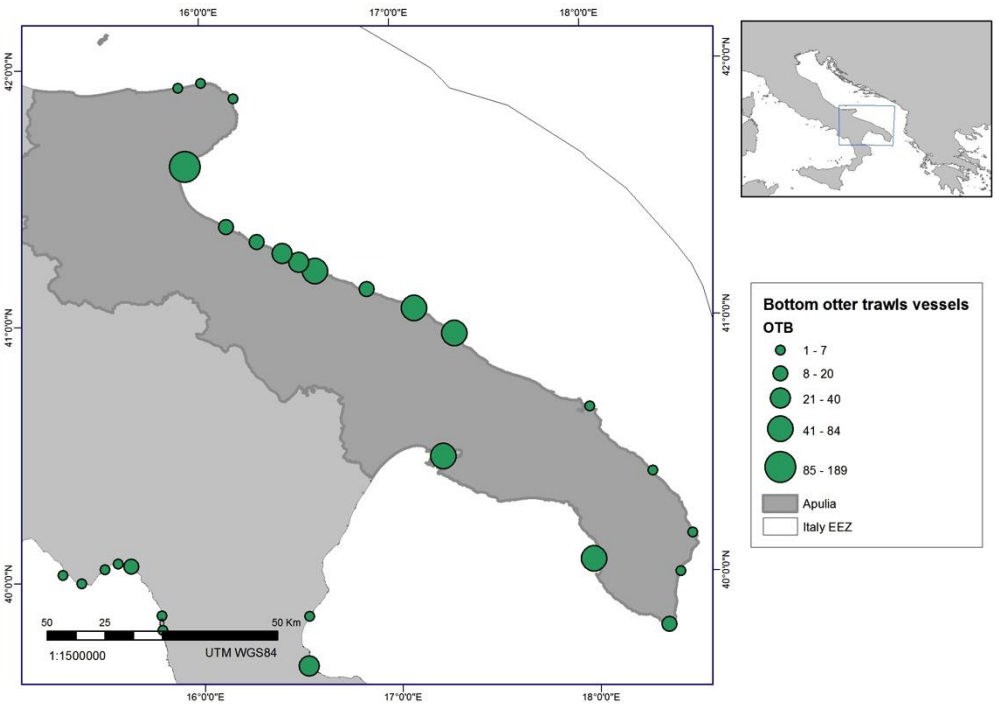


Figure 4-57 Bottom otter trawls vessels in Apulian coasts. CoCoNet project, 2014

The Ionian Sea is separated into three case study areas (NSSG; Figure 4-58) according to the registered fleet based on registration port. The three areas are: Coasts of Ipiros and Kerkyra, Coasts of Kefalonia and Gulf of Patras, Amvrakikos Gulf and Coasts of Lefkada Island. In all three areas fishing activity is based on trawlers, boat seiner, purse seiner and artisanal operation.

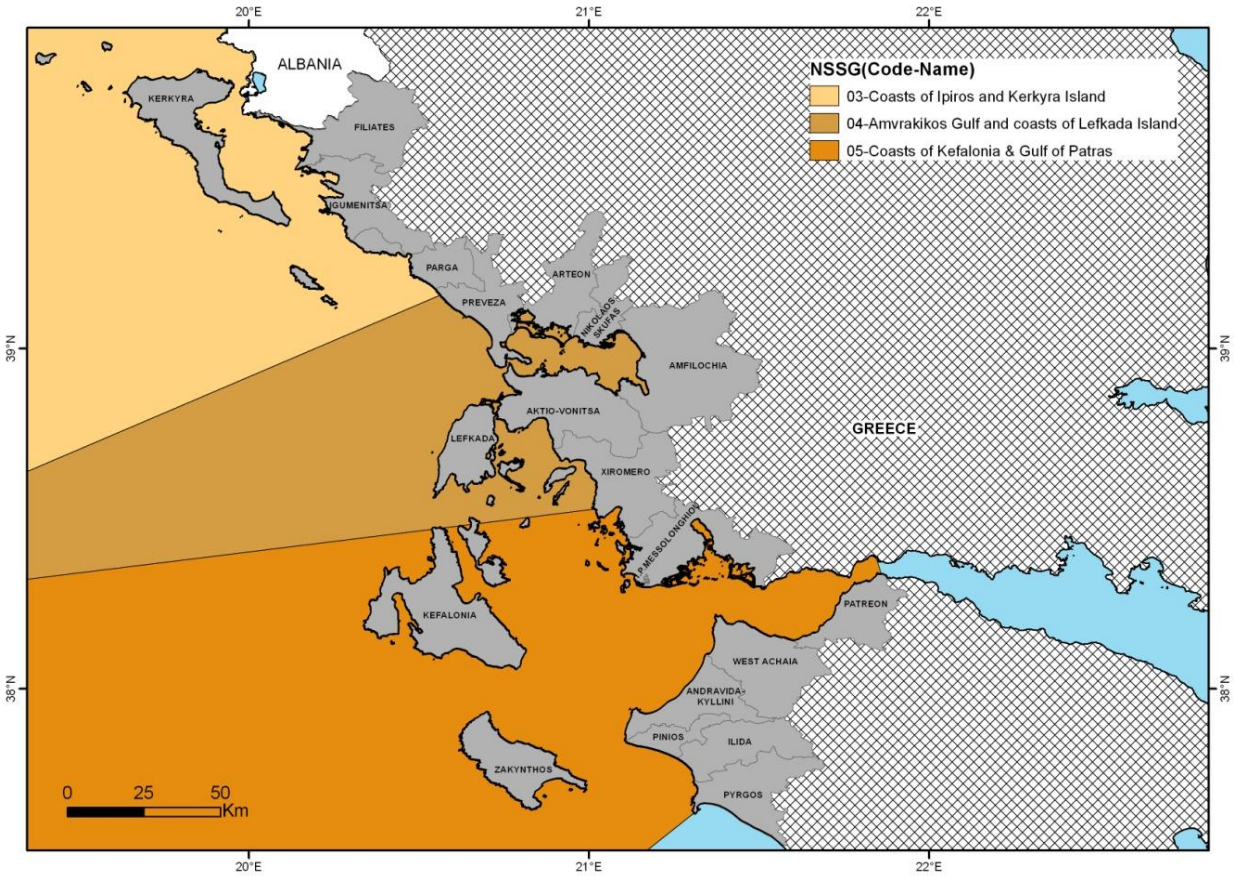


Figure 4-58 Division of the Ionian Sea into case study areas. Hellenic Statistical Authority; data from CoCoNET project

There are are overall 27 major fishing ports in the Ionian Sea, eight in NSSG 03, six at NSSG 04, and 13 in NSSG 05. The fleet registered in each of these major ports, per category of fishing operation type is presented in Figure 4-59. Available information regarding the main fishing grounds exists only for trawlers and purse seiners (Figure 4-60) that in certain cases greatly overlap.

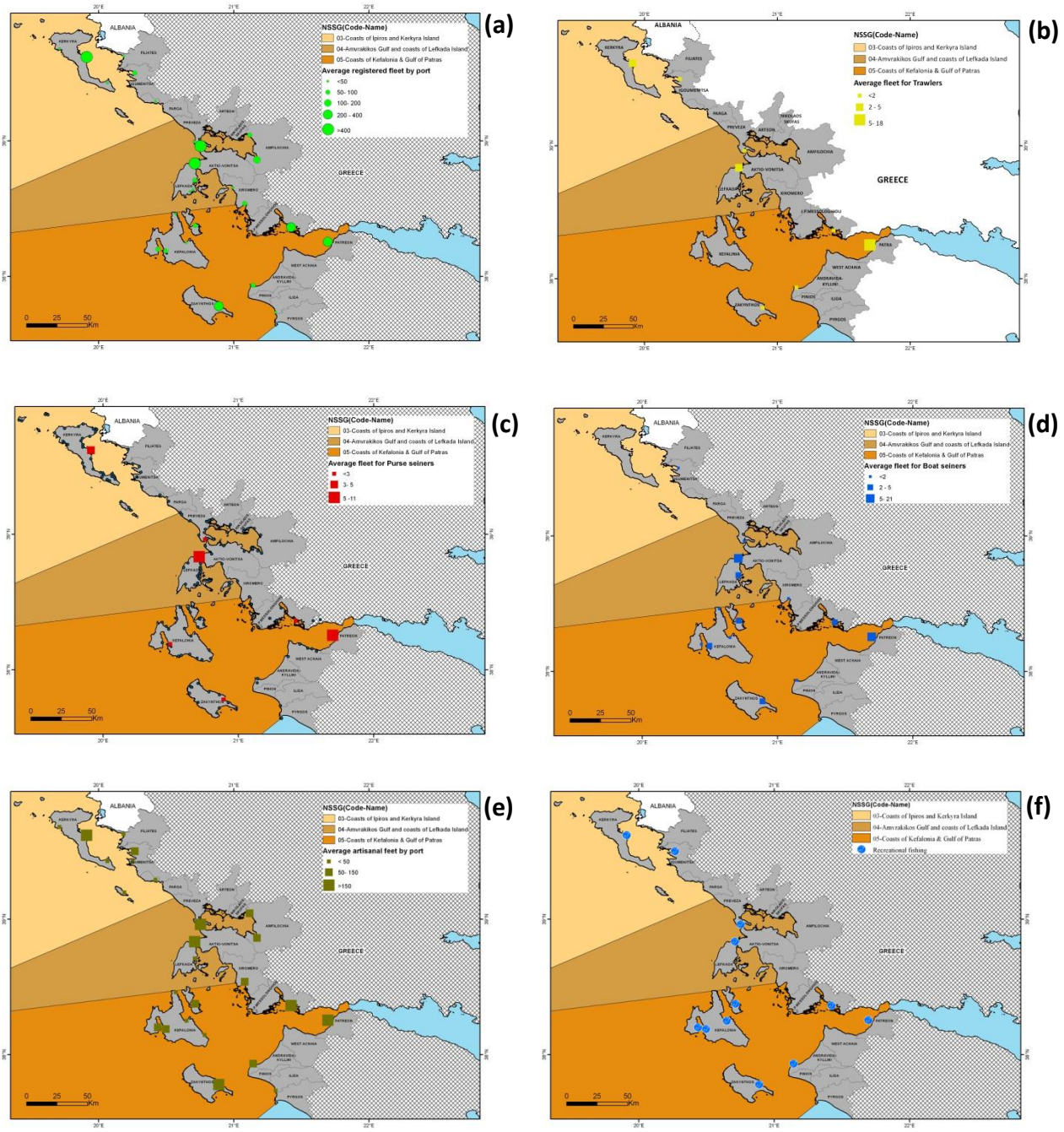


Figure 4-59 Average registered fleet per port in the Greek Ionian Sea (source: Hellenic Statistical Authority; data from CoCoNET project). (a) total; (b) trawlers; (c) purse seiners; (d) boat seiners; (e) artisanal vessels; and (f) recreational boats.

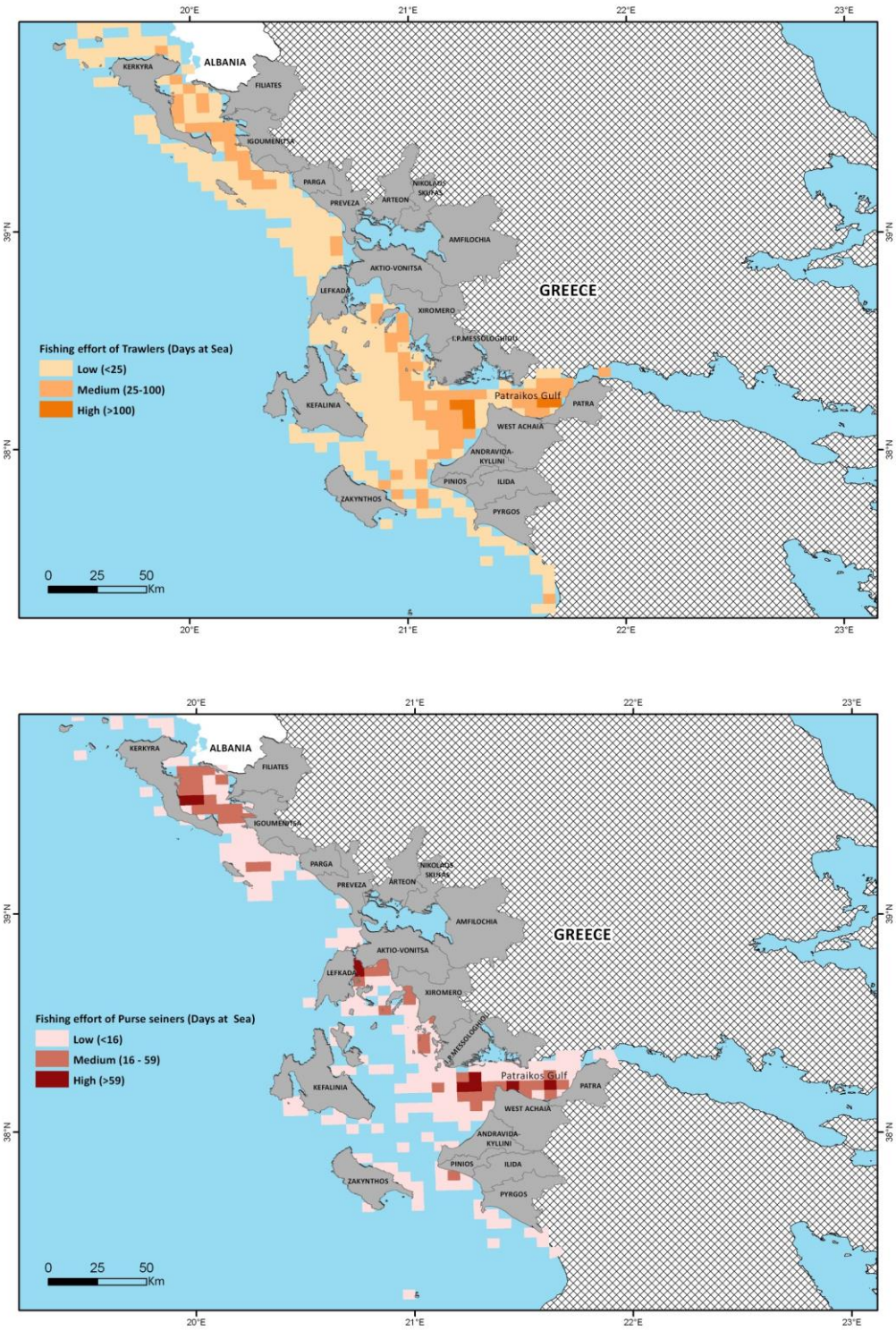


Figure 4-60 The main fishing grounds and the fishing effort of trawlers (top) and purse seiners (bottom) in the Greek Ionian Sea Hellenic Statistical Authority; data from CoCoNET project

In the Greek Ionian Sea there are located three wholsale markets, at the cities of Preveza, Mesologgi and Patras. The largest wholesale market is that of Patras, where in 2011 1715 tonnes of fish were sold, followed by that of Mesologgi (422 tonnes), whereas in Preveza only 200 tonnes of fish were sold. The specificities of the fishing fleet, the local demands and the ecosystem characteristics in each NSSG, are also being reflected in the diversity of fishes that

were sold in the three markets (Table 4-53). Indeed, in Mesologgi which is located close to Etoliko Lagoon, the main fisheries products sold are those of *Anguilla anguilla*, *Sparus aurata* and *Atherina* spp. In Preveza wholesale market, that receives fishereis products from trawlers and purse-seiners from the North Ionian Sea, the vast majority of fisheries products refer to pelagic and benthopelagic species. Finally, in Patras, which is a large populated city and receives fisheries products from all around the Ionian Sea, the fisheries products sold are the same with the other two markets, whereas in higher quantities.

Species	**Preveza**	**Mesologgi**	**Patras**
Anguilla anguilla		**24550**	
***Atherina* spp**	2858	**66870**	19861
Boops boops	**7679**	5652	**51209**
Dicentrarchus labrax	1971	**29132**	**103264**
Engraulis encrasicolus	**27946**	**11745**	**315177**
Liza aurata	135	**29499**	5024
Liza ramada		**13450**	291
Loligo vulgaris	**4726**		**50725**
Melicertus kerathurus	3071	83	**95030**
Merluccius merluccius	**25911**	448	**176723**
Mugil cephalus	**13317**	**35374**	**92175**
Mullus barbatus	**13836**	519	36884
Octopus vulgaris	**4828**	897	6603
Parapenaus longirostris	**5435**		2319
***Raja* spp**	741	**9636**	2687
Sardina pilchardus	**25352**	**10664**	**143746**
Sepia officinalis	**5409**	2443	10513
Sparus aurata	4676	**141966**	**333264**
Spicara smaris	3836	590	**49603**

Table 4-53 The most important, in terms of weight (in kilos), fisheries products that were sold at the Greek wholesale market of the Macroregion, 2011. Bold typing indicates the ten most important species in each market, whereas blank cells correspont to absence of the product in the market. ETANAL, 2014

There are eight major fishing ports in the Greek part of the FA2, namely Gaios, Igoumenitsa, Corfu, Lefkimi, Paleokastritsa, Parga, Sagiada and Sivota, with the port of Corfu being the most active one, since the majority of fishing vessels dock there. A total of 678 fishing vessels

operate, the majority of which (77.6%) are registered at the Port of Corfu Island (Table 4-54). Of those 678 vessels, eight are trawlers, six are purse-seiners and 17 are boat seiners, whereas the remaining 647 are small-scale fishing boats.

Year	Gaios	Igoumenitsa	Corfu	Lefkimi	Paleokastritsa	Parga	Sagiada	Sivota
1991	53	95	528		1	75		
1992	53	89	528		1	75		
1993	53	82	526		1	70		
1994	53	83	524		1	66		
1995	52	83	516		1	64		
1996	52	83	513	1	1	60		
1997	52	86	514	1	1	58		
1998	49	86	522	1	1	56		
1999	48	83	520	2	1	49		
2000	48	86	523	1	1	49		
2001	48	91	531	1	1	49		
2002	49	88	529	1	1	46		
2003	50	87	526	1		43		
2004	49	83	531	1		40		
2005	48	84	530	1		40		
2006	47	72	533			39	9	3
2007	45	60	535			38	13	10
2008	44	60	548			35	14	10
2009	44	56	547			32	17	10
2010	43	55	553			31	17	10
2011	43	52	542			29	18	11
2012	44	51	527			28	18	12
2013	44	51	526			27	18	12

Table 4-54 Total fleet per registered port in NSSG 03 -Coasts of Epirus and Corfu. Hellenic Statistical Authority; data from CoCoNET project

The most important fishing grounds of trawlers and purse-seiners in the area are presented in Figure 4-61. It is evident that the bulk of the fishing effort of these two gears is limited in the straits between Corfu Island and Epirus, and to a smaller extent in the waters north of Corfu

Island, in the area of Diapontia Islands (Figure 4-61). Both fleets also operate at the marginal territorial waters of Greece and Albania, competing with the fleets from these countries for the same fishing stocks. On the other hand, the small-scale fishing fleet is primarily located close to the city of Corfu, operating mainly in the Corfu straits (Figure 4-61) which may suggest the existence of conflicts between small and medium scale fisheries.

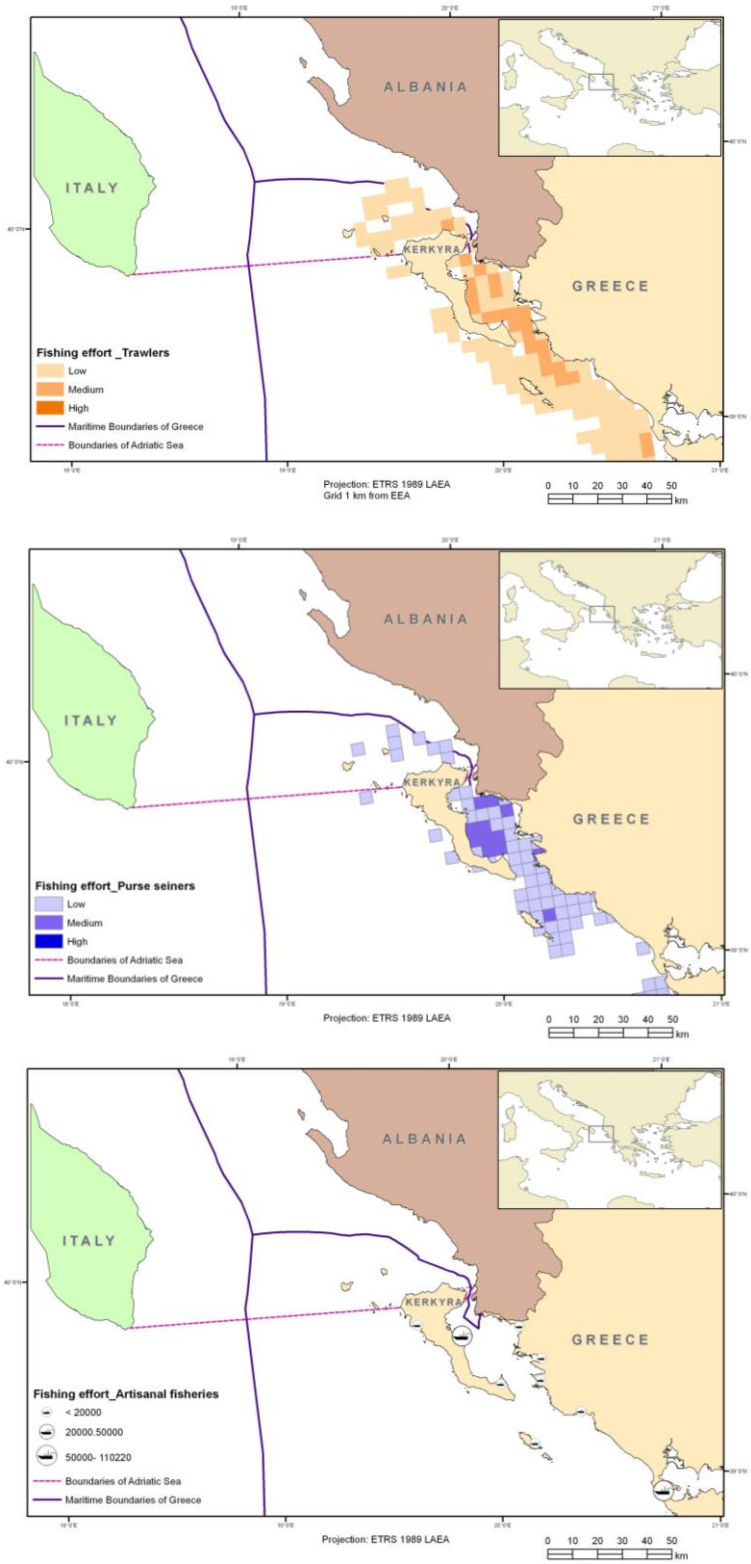


Figure 4-61 The main fishing grounds and the fishing effort of trawlers (top) and purse seiners (middle) and the main fishing ports for small scale fishing vessels in the Greek part of FA2. Hellenic Statistical Authority; data from CoCoNET project.

The major fisheries catches at the coasts of Epirus and Corfu are presented in Table 4-55 Estimates of the most important landings (in kg) per fishing gear in NSSG 03 -Coasts of Epirus and Corfu, 2007 (Kapantagakis et al. 2008; modified).. distinguished into catches from trawlers, purse seiners, small scale vessels, and boat seiners (the latter gear has been banned since 2010).

Species	**trawlers**	**purse-seiners**	**boat seines**	**small-scale fishing**
Merluccius merluccius	91693			264820
Mullus barbatus	61829		6190	
***Loligo* spp**	39529		13679	
Boops boops	42133	218922	40511	
***Octopus* spp**	14964			120061
Engraulis encrasicolus		477729		
Sardina pilchardus		424375	9039	
Scomber colias		180144		
***Trachurus* spp**		19725		
Spicara smaris			113282	
Scorpaenidae				139035
Mullus surmuletus				85420
Dentex dentex				82312
Mugilidae				59432
Sparus aurata				16358
***Sepia* spp**				14553
Others	44508	244170	12780	643143

Table 4-55 Estimates of the most important landings (in kg) per fishing gear in NSSG 03 -Coasts of Epirus and Corfu, 2007 (Kapantagakis et al. 2008; modified).

Being a touristic destination, Corfu Island also holds the vast majority of licenses for recreational fishing. Indeed, in 2010 at Corfu port there were issued (both registered for the first time and registration renewals) more than 1800 such licenses and Igoumenitsa port authorities issued some 1100 recreational fishing licenses (Figure 4-62).

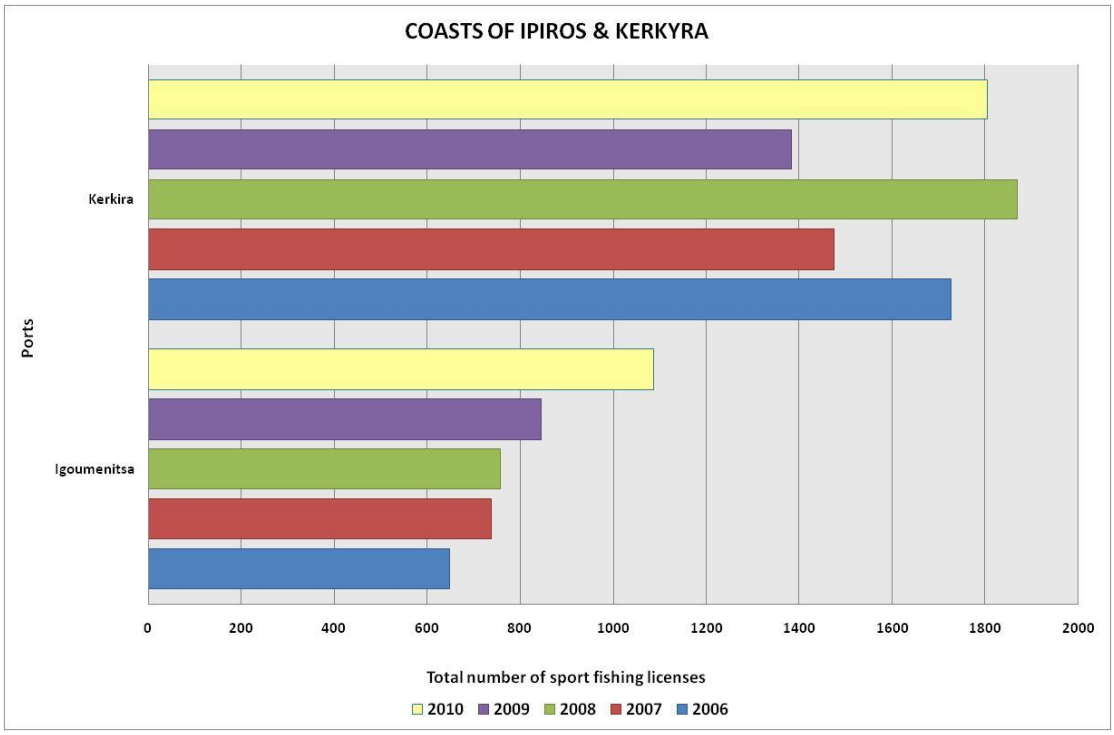


Figure 4-62 Sport fishing licenses in NSSG 03 -Coasts of Epirus and Corfu (2006-2010) (source: Hellenic Statistical Authority; data from CoCoNET project).

Acquaculture

Aquaculture is a considerable economic activity in FA2. From the fifth century B.C., fish farming was widely performed in the Mediterranean Sea, in Egypt as in Greece or Sicily. Also along the coasts of Apulia is possible to see many remains of Roman villas equipped with small farming pools. Over time, these pools become real nurseries, in which the fish is bred to be sold. The economic purpose forced various structural transformations, depending on the type of coastline and natural environments. The Mar Piccolo of Taranto became famous for the oyster and mussel farming, with the invention of modern aquaculture. A rather simple system, which already during the nineteenth century allowed large-scale production: on the sea floor mastic bundles were placed, two or three months after they were withdrawn and the branches, covered by juvenile oysters, were hung with ropes to other wires placed on the surface of the sea, between piles fixed in the sand.

Nowadays, Apulia plays a prominent role in the Italian aquaculture, with a strong consolidation of the Apulian productive base, which consists of 15 active fish farms, 5 in the province of Foggia, 5 in Taranto, 2 in Bari, 2 in the province of Lecce 2 and 1 in Brindisi. There are also 3 hatcheries specialized in the sea bass and sea bream breeding.

The farmed species are mainly seabass (Dicentrarchus labrax) and seabreams (Sparus aurata, Diplodus puntazzo, Diplodus sargus). There are, also, productions of eels (Anguilla anguilla), mullets (mugilidae spp.), meagre (Argyrosomus regius). More than the 50% of the plants is located in the sea, a large proportion compared to the recent past in which the location on the ground was the most widespread.

The regional production in 2009 amounted to about 2730 tons and was dominated by seabass (about 1480 tonnes) and seabream (about 940 tons), followed the white seabream with 287 tons and croaker, mullet and eels with minor quantities. The production of juveniles, also in 2009, amounted to about 19 million pieces for seabasses and about 11 million units for seabreams. Almost the 50% of the production is located in the province of Foggia (about 1310 tons), followed by Taranto (about 670 tons), Bari (about 420 tons), Brindisi (160 tons) and Lecce (120 tons). The wholesale prices are: croaker with an average value of 10€/kg,

seabream with 7€/kg, the seabass with 6.2€/kg and mullet with 3€/kg. The production cycles last on average 20 months, with a minimum of 12 and a maximum of 24. The stocking density is, on average, 20 kg/m3. The feed consumption necessary to support the 2009 production was approximately 4650 tons, with a Food Conversion Ratio on average equal to 1.7, oscillating in different farms between 1.2 and 2.3.

The two poles of the shellfish farming are Taranto and Foggia with, respectively, the 94% and the 6% of the 92 facilities surveyed. The production, essentially consisting of mussels, was about 12400 tons in 2009, and it is more equally distributed between the two provinces, with approximately the 46% (5690 tons) in Taranto and the 54% in Foggia (about 6710 tons).

The international economic situation and the increasing competition with other producing countries such as Greece or Turkey have greatly reduced the Apulian company incomes, forcing the urge to produce with imporvements in terms of quality. Some farms have adopted voluntary certification protocols, such as ISO 9000. More recently, some companies have made the choice to produce organically, becoming certified in accordance with the EC reg. 710/2009.

In the Ionian part, most units –in number and capacity- operate in Kefalonia& Ithaki with a spatial concentration in Echinades Islands, in Sagiades strip, Amvrakikos Gulf and the coast of Louros. Particularly in the Region of Western Greece, fish farm sare a dynamic production sector in the region with the products of intensive aquaculture constituting this condexportation product of the country. Additionally, the aquaculture sector contributes positively in research, in the production of new or improvement of existing products.

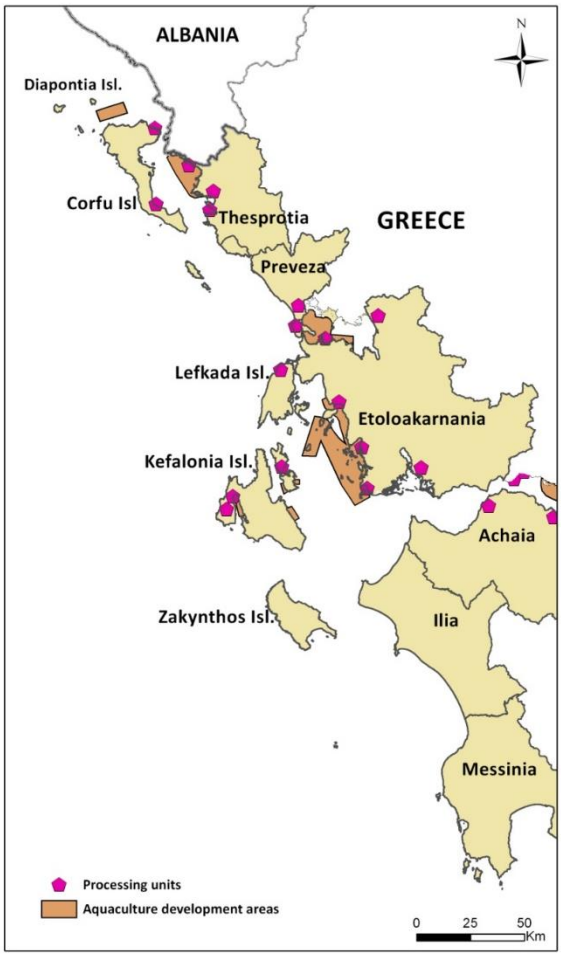


Figure 4-63 Aquaculture development in the Ionian Sea (source: Ministry of Environment, Energy and Climate Change, 2011)

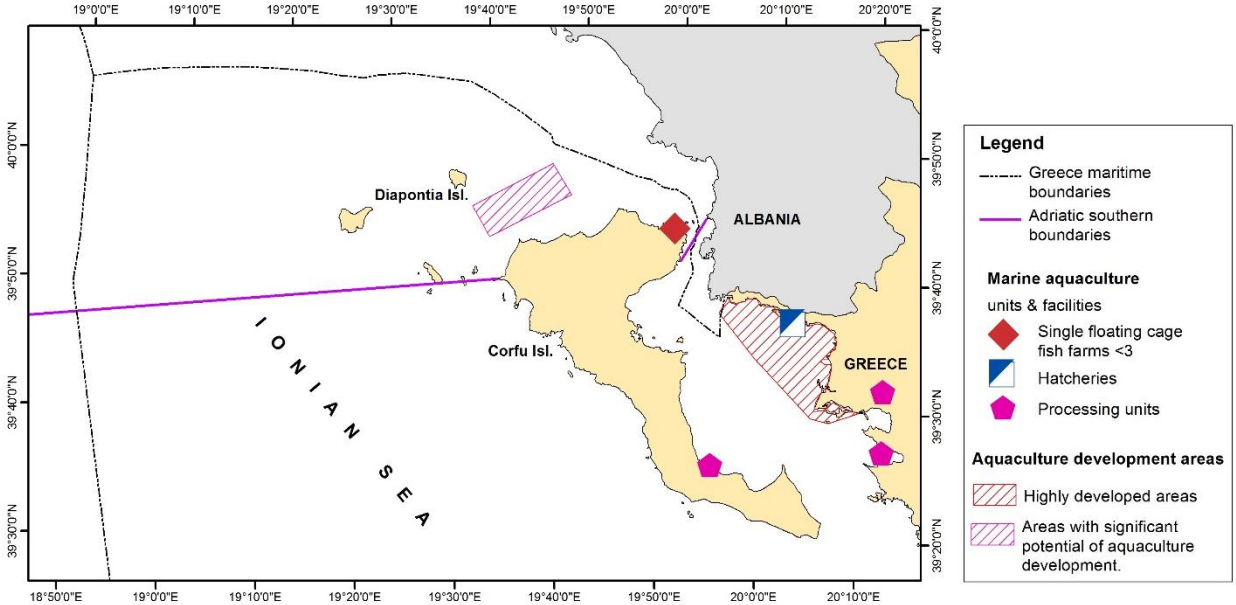


Figure 4-64 Aquaculture development in the Ionian Sea

4.5 Renewable Energies (wind, wave, tidal)

R. Mosetti, M. Lipizer, A. Kokkali, V. Vassilopoulou, S. Fraschetti, G. Farella, F. De Leo

Offshore renewable – notably wind but also wave and tidal - are expected to play an important role in reaching the EU's 2020 renewable energy targets. According to their national projections, European Union (EU) Member States are set to achieve around 45 GW of offshore renewable generation capacity by 2020, which is more than a ten-fold increase of today's capacity. Offshore wind energy accounts for the majority of this development (approximately 43 GW) with the remainder (approximately 2 GW) coming from wave and tidal. The European Wind Energy Association (EWEA) and the European Ocean Energy Association (EU-OEA) confirm the projected role offshore renewables will play in 2020, with their expectations of 40 GW of offshore wind power, and 3.6 GW of wave and tidal capacity to be installed in the same time frame.

Recent advances in floating foundations have cleared the way to installations for offshore, in depths of 200 meters or more, where the wind field is less affected to other structures. The potential for combined wind and wave energy production arises since waves still carry the energy content. Even if the Mediterranean Sea is less windy than the Northern European Sea, a growing market of wind farm is expected also due to the technological progress in buoyant wind turbines (Seanergy 2020, 2012).

Offshore renewable energies are a new comer, now competing for space with other traditional sectors, such as fishery, shipping, military, environmental protection. Offshore wind is the most developed technology within the offshore renewable ones and thus currently more concerned by the management of sea space and the share of space available. Although wave and tidal to date have not progressed as far as the full-scale deployment, they will definitely reach the same issue in the coming years (Figure 4-65).

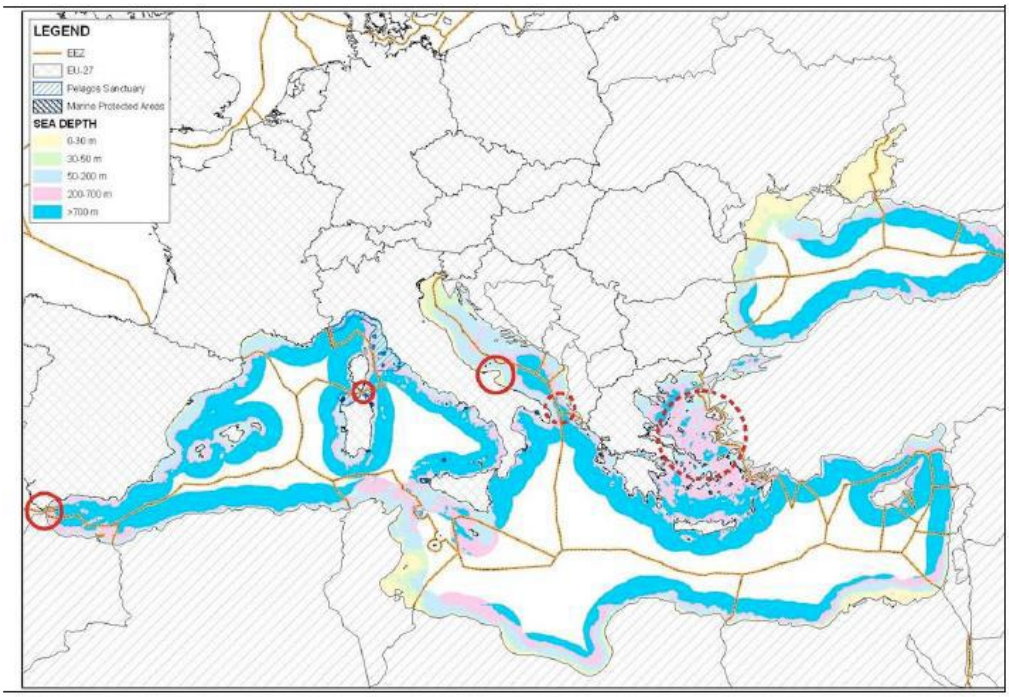


Figure 4-65 Mediterranean areas for combined wind and current use. Continuous line: suggested areas for possible demonstrator. dotted line: interesting areas for examination. Airoldi et al, 2012.

As far as current and waves energy, in the Mediterranean basin, the annual available wave power level off the coasts of the European countries varies between 4 and 11 kW/m, the highest values occurring for the area of the south-western Aegean Sea. So, presently there are

no plans for of this kind of energy within the AI Macroregion, as it is for energy extraction from tidal currents.

As far as offshore wind energy, many studies for offshore wind potential have been carried out for the AIM (Burlando 2002, Tricoli 2006, Cassola 2007, Airoldi 2012) observing a relevant potential for central-south Adriatic and even more for the Ionian sea (Figure 4-66 and Figure 4-67).

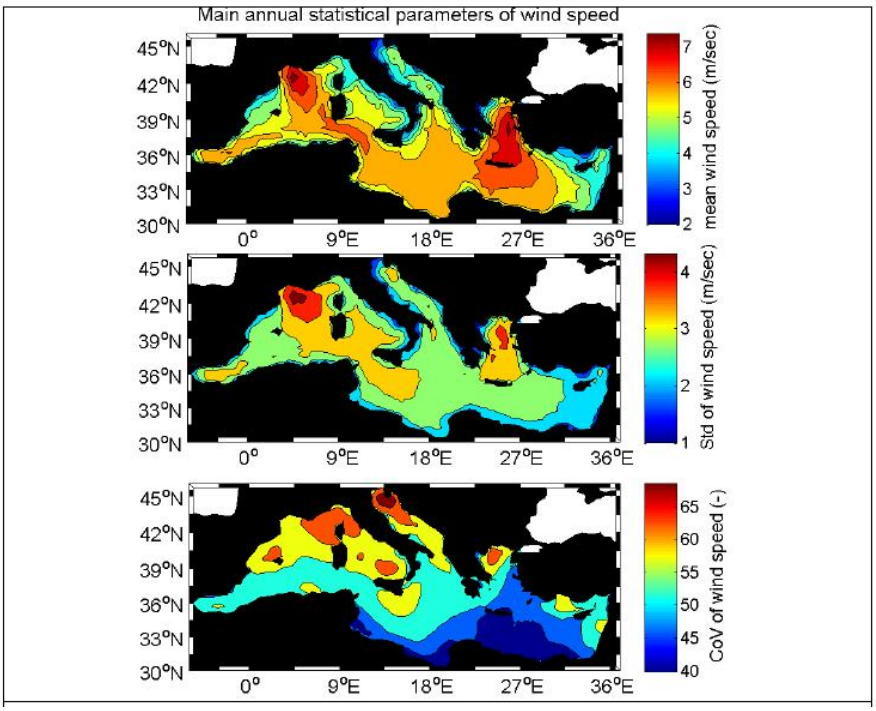


Figure 4-66 Mean value, standard deviation and coefficient of variation of annual wind speed

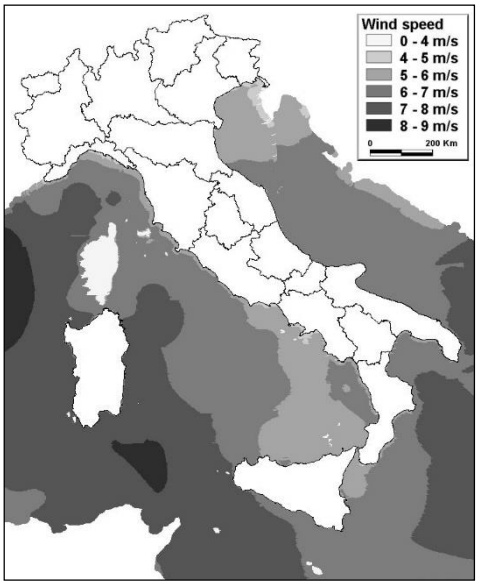


Figure 4-67 Italy's offshore wind map, made up of a regular grid (2 km x 2 km) containing for each point the estimated annual wind speed [m/s] at 60 m height.

Following the study by Tricoli et al. (2006) keeping some criteria fixed (hub height at 60 m with wind speed > 6 m/s; minimum distance to the coast >= 3 km), two scenarios called "2010" and "2020" as future projections have been developed by using a third criterion, the sea bottom depth (being one of the critical factor) considering moving respectively 20 m and

50 m. The following figures shows the final scenarios taken into consideration for the selection of suitable offshore windfarm sites and the calculation of installable power energy productions.

The minimum distance from shore of 3 km is mainly due to environmental reasons: it reflects a general rule proposed by some countries to impose a coastal buffer zone for very large offshore wind farms on visual grounds (Greenpeace, 2008). Indeed, offshore wind turbines are massive structures at sea indeed: in the case of future windturbines of 3 - 5 MW, the tower's height is around 80 - 100 m plus 40 - 50 m of blade.

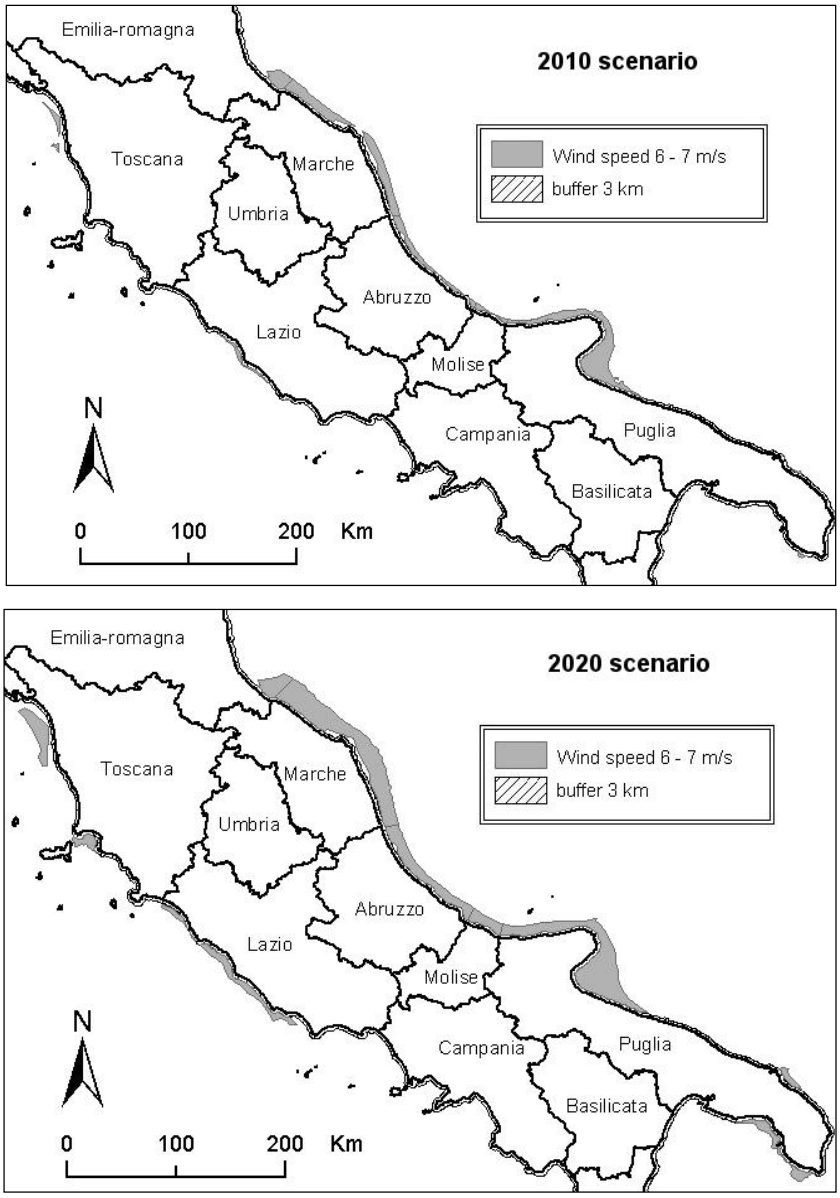


Figure 4-68 Scenarios for suitable offshore wind farms locations along Italian coasts. Tricoli et al. 2006

Currently, no offshore wind plants are installed in AIM. In the Brindisi deep waters a tension leg floating platform with a 80 kW wind turbine has been tested in 2008 as a prototype of 90 MW offshore wind farm (Gaudiosi et al 2010).

In this paragraph, the present situation on on relevant legislation, competent authorities and permitting is traced for Italy and Greece. In depth-analysis, also related to environmental aspects (pressures) to offshore windfarm development is on-going and will be included at a later stage. Pending request and on the way permitting for offshore windfarm in AIM, already

included in ADRIPLAN data portal, will be further described at their level of implementation with a follow-up during the project.

In Italy, Law No L. 10/1991 "Regulations for the implementation of the National Energy Plan in matters of rational energy use, energy saving and development of renewable energy sources" introduced the *Regional Energy Plan* instrument. Using this plan, regions are planning their interventions in the energy field, governing the actions of local authorities and harmonising the decisions taken at the various levels of spatial planning. The Energy Plan includes the starting points, short, medium and long term strategic objectives, practical instructions, available instruments, legislative and regulatory reference frameworks, funding opportunities, constraints, obligations and rights of economic operators in the sector, large-scale consumers and normal users. In conformity with the Regional Energy Plans, the authorisation for building offshore Windfarms is regulated by the Italian National Action Plan (NREAP) for the promotion and use of renewable energies, issued by the Ministry for Economic Development in 2010, according to Legislative Decree nr. 387 of 29 December 2003, which transposes into the Italian legislation the European Directive 2001/77/EC. According to NREAP, the authorisation for building offshore plants is issued by the Ministry for Transport, after hearing the opinions of the Ministry for Economic Development and the Ministry for the Environment, Land and Sea, through a procedure issued by the competent maritime Authority granting permission to use the maritime property concerned. The authorisation permission is issued at the end of a single procedure in which all the authorities concerned participate, carried out in accordance with the principles of simplification (Law No 241/1990). The issued authorisation represents the right to construct and operate the plant in accordance with the approved plan and must include the operator's obligation to restore the site once the plant has been decommissioned. An offshore power plant is also subject to an environmental impact assessment (EIA), issued by Ministry for the Environment, Land and Sea (Environment Protection Department) supported by the Ministry for Economic Development.

In Greece, the permitting and licensing procedures are settled by Law 3851/2010, According to which offshore wind farms could be developed only in specific areas proposed by the Government. The offshore wind farms will be developed under an international tender procedure, after a Strategic Study of Environmental Assessment and preliminary permissions from specific authorities, mainly the Ministry for the Environment, Energy and Climate Change. The Hellenic Transmission System Operator (HTSO) is responsible for the grid connection permission.

4.5.1 Focus Area 1

Several recent projects are addressing the setting of strategies, methods and suitable areas for the development of off-shore wind farms in the Adriatic Sea (e.g. Adriatic IPA Powered, http://www.powered-ipa.it/the-powered-project/; CoCoNET http://www.coconet-fp7.eu/).

A list of Offshore Wind Farms (OWF) projects for the Adriatic and Ionian Seas derived from the 4COffshore (http://www.4coffshore.com/windfarms/marthakiou-greece-gr17.html) and the The WindPower (http://www.thewindpower.net/country_maps_en_7_italy.php) databases is listed in Table 4-56 and the map of the only planned OWF in FA1 is presented in Figures 4-69. According to the world database, the OWF "Gulf of Trieste" is in a phase of "Concept/early planning definition" and would have a total nominal power: 30,000 kW (http://www.thewindpower.net/windfarm_en_16597_golfo-di-trieste.php, last visit: 7/10/2014).

Place	Leader	Total		Distance shore	Depth	Comments	Stage
ITALY: More than 25 projects by 2020							
ADRIATIC SEA							
Margherita di Savoia, Foggia	WPD & Daunia Wind	720 MW	120*6 MW		15-20m	Construction should begin 2014-2015	
Gargano South, Foggia	WPD Ventitalia	855 MW				Construction should begin 2014-2015	
Gargano North, Foggia	WPD Ventitalia	600 MW	110 WT		20-45m	Construction should begin 2014	
Termoli, Region of Abruzzi	Blue H	441 MW	126*3,5 MW		113-126m	Grid connection planned for 2016	
Bari, Region of Puglia	Blue H	441 MW	126*3,5 MW	22 km	113-121m	Grid connection planned for 2015	
Cerano, Strait of Otranto	Blue H	441 MW	126*3,5 MW	17 km	110-121m	Grid connection planned for 2016	
Tricase 1, Strait of Otranto	Blue H	92 MW	24*2,4 MW	20 km	118m	Floating- begin supplying the grid from 2011	
Tricase 2, Strait of Otranto	Blue H	308 MW	188*3,5 MW	17 km	120m	Floating- construction begun	
Golfo di Manfredonia 1	Gamesa Energia Italia	300 MW	66*4,5 MW				
Golfo di Manfredonia 2	TREVI Energy	300 MW	100*3 MW	8 km	15-20m	Monopile- should begin 2015	
San Michele, Molise	Effeventi	162 MW	54*3 MW (Vestas)	4,5 km	12-20m	Monopile- grid connection in Larino is planned in 2012	
Chieuti, Region of Puglia	TREVI Energy	150 MW	50*3 MW	5 km	17-24m	2015	
Torre San Genaro, Region of Puglia	TREVI Energy	150 MW	50*3 MW	3 km	17-30m	Monopile- 2015	
Secche di Vada a.k.a Rosignano	Ravano Green Power and PRO GECO	60 MW				Tyrrhenian Sea	
Golfo di Trieste	Ravano Green Power and PRO GECO	30 MW		24 km			
CROATIA: 840 MW planned							
Bilice	Blue H	448 MW	128*3,5 MW	40 km	148-167 m	Floating- commisionning expected in 2015	
Dubrovnik	Blue H	392 MW	112*3,5 MW		232-305 m	Floating- by 2016	
ALBANIA: 539 MW planned							
Durazzo	Blue H	539 MW	154*3,5 MW	36 km	186-320 m	Floating- commisionning expected in 2016	

Table 4-56 list of Offshore Wind Farms (OWF) projects for the Adriatic and Ionian Seas.

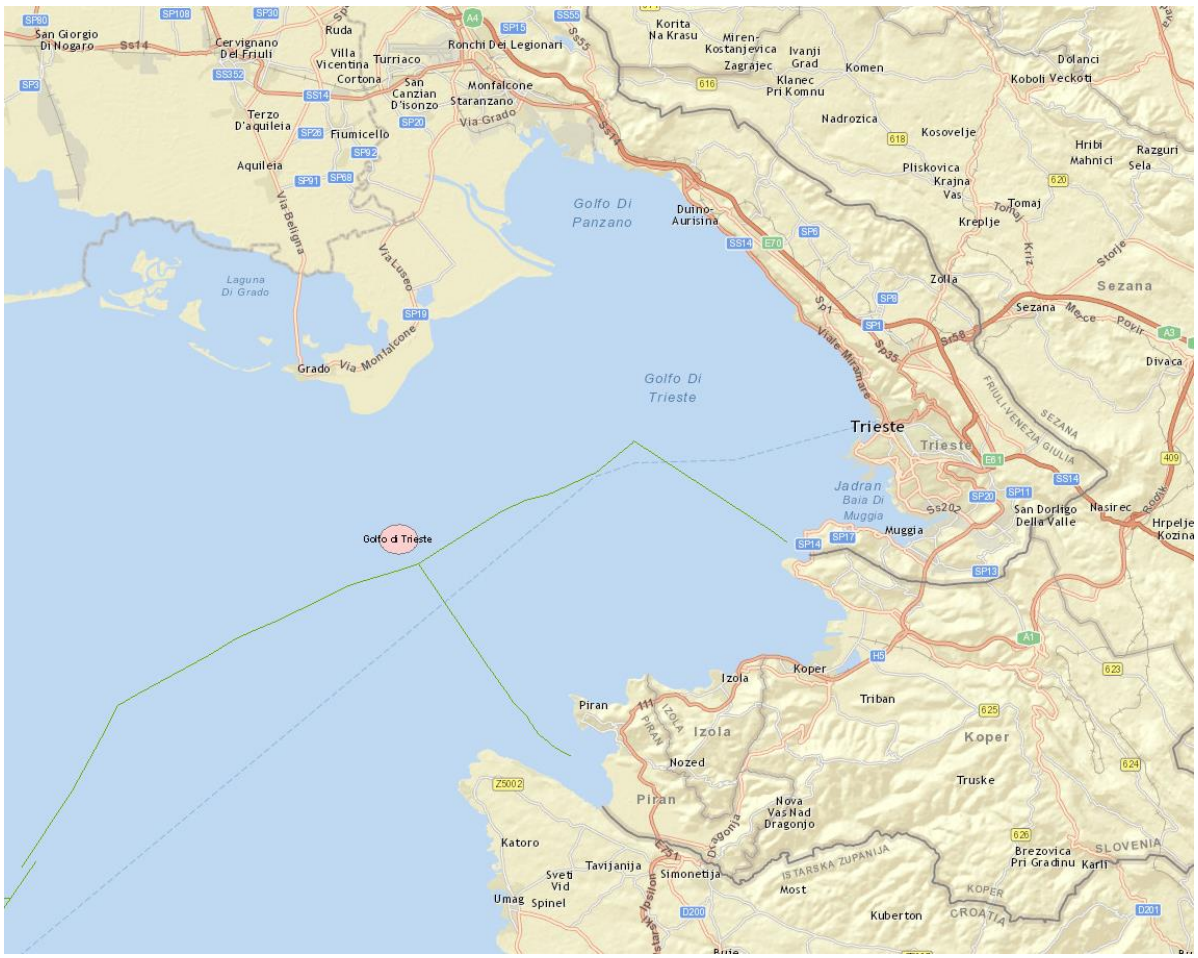


Figure 4-69 Position of the OWF "Gulf of Trieste". Total nominal power: 30,000 kW (http://www.thewindpower.net/country_maps_en_7_italy.php; last visit 6/10/2014).

4.5.2 Focus Area 2

In Epirus Region in Greece, the total average annual energy production is estimated at 587 GWh, representing 50% of energy consumed in the region in 2011. The three hydroelectric stations of Epirus contribute to the 24% of the generated hydropower and to the 1% of total energy in the country. The construction of a new substation 29 MW is expected to contribute to the overall annual production of 46 GWh. A large number of projects or RES has been implemented and operates RES (mainly Photovoltaic and Small Hydroelectric projects) of a total installed capacity of 62 MW. There is also the potential for utilization of biomass due to the rural character of the region. Regarding the electricity transmission infrastructure, the role of FA2 has been upgraded in the last decade due to the inclusion of the Greek network to the European interconnected system and through the opening of energy market in the Balkan region.

However, these new developments often cause problems, especially in the case of the Ionian Islands, such as the degradation of the natural environment due to the coverage of important natural resources. According to the Regulatory Authority of Energy (www.rae.gr) in Greece, the proposed areas for the development of offshore wind farms in FA2 are illustrated in Figure 4-70 and Figure 4-71.

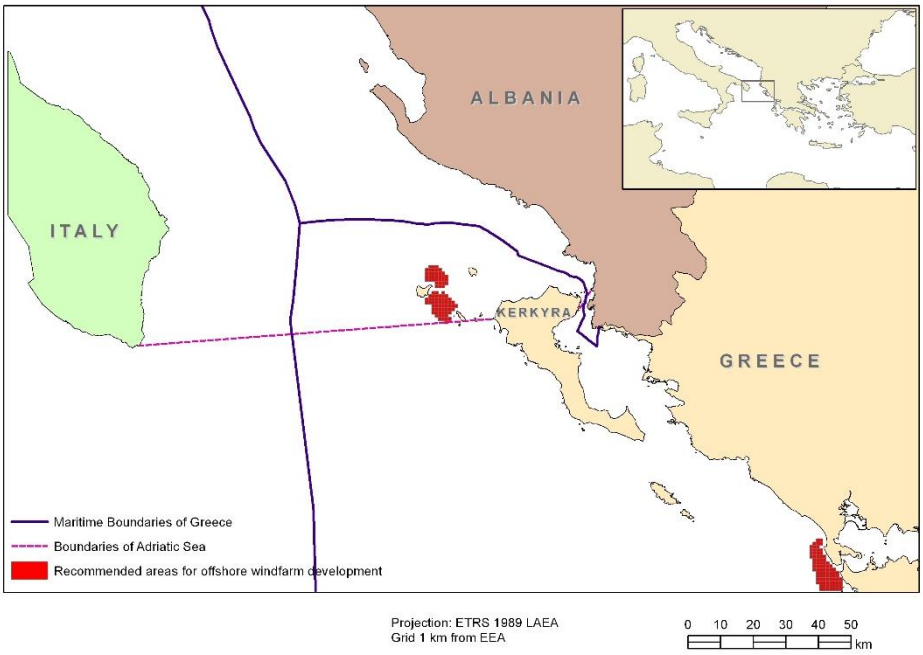


Figure 4-70 Recommended areas for offshore wind farm development

Four investment companies have expressed their interest in developing offshore wind farms in Dapontia Islands and one in the area between the Amvrakikos Guld and Lefkada Island. All applications are still in request. Summarizing the total amount of power that would be produced in in the first case according to the characteristics given by each applicant is almost 930MW and for the latter is 24MW (www.rae.gr).

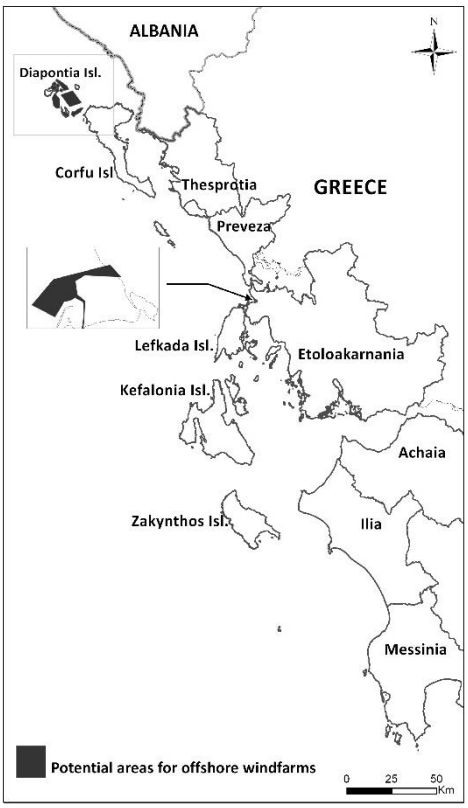


Figure 4-71 Potential offshore windfarm development in the Ionian Sea

In Apulia there are no offshore wind farm still implemented but preliminary evaluations of environmental impact assessment have been carried out recently in the area of Molfetta and Brindisi. In CoCoNet project, the wind speed time series for Gargano sud, in the Adriatic Sea, has been collected since an offshore wind farm is scheduled to be developed shortly.

In 2007 Apulia Region adopted its Regional Energy and Environmental Plan (Piano Energetico Ambientale Puglia - P.E.A.R. Puglia).

The main law of Apulia regarding renewable energies is the Regional Law n. 31 "Regulations governing the production of energy from renewable sources, the reduction of pollutant emissions and in the energy field" (Official Bulletin Apulia Region n.167), issued in October 2008. This law forbids the construction of renewable energy plants on:

- valuable agricultural areas, as recognized by the main urban regulatory instruments;
- Natura 2000 sites;
- national protected areas established under the Act nr. 394 of 6 th December 1991 (Framework Law on Protected Areas).
- regional protected areas established under the Regional Act nr. 19 of 24th July 1997 (Regulations for the establishment and management of protected natural areas within the Apulia Region) and natural reserves established under the Regional Act nr. 27 of 13 th August 1998;
- wetlands protected by the Ramsar Convention, enforceable by Decree of the President of the Republic nr. 448 of 13 th March 1976.

Besides the OWF project in the central part of the Adriatic Sea (Figure 4-72) which ” is in a phase of “Concept/early planning definition” (http://www.4coffshore.com/windfarms/adriatico-croatia-hr02.html, last visit: 7/10/2014), most of OWF projects are located in FA2 (Figure 4-73) along the Apulia Coast (San Michele, Chieuti, Foce Varano, Gargano Sud, Golfo di Manfredonia, Margherita di Savoia, Rodi Garganico, Offshore Brindisi, Cerrano and Taranto

projects) and around Corfu island (Diapontian Island, Corfu, Marthakiou, Othonoi, Mathraki, Ormos Kalidhonos) (Table 4-57).

Figure 4-72 Position of the OWF in phase of early planning for the central part of the Adriatic Sea, in the Region Split-Dalmatija (http://www.4coffshore.com/windfarms/adriatico-croatia-hr02.html, last visit 6/10/2014).

Planned Offshore Wind Farms	Lat. North	Long. East	Phase
Golfo di Trieste	45.602	13.451	Concept/early planning
Adriatico	43.003	15.297	Concept/early planning
Gargano Sud	41.594	16.207	Concept/early planning
Rodi Garganico	41.99	15.814	Concept/early planning
Margherita di Savoia	41.471	16.104	Concept/early planning
Foce Verano	42.002	15.749	Concept/early planning
Chieuti	41.975	15.21	Consent application submitted
Taranto	40.485	17.137	Consent authorized
San Michele	42.087	14.883	Consent authorized
Golfo di Manfredonia	41.48	16.131	Consent authorized
Corfu	39.763	19.565	Concept/early planning
Cerano	40.6	18.6	Concept/early planning
Diapontian Islands	39.844	19.533	Concept/early planning
Othonoi	39.882	19.439	Concept/early planning
Marthakiou	39.751	19.515	Concept/early planning
Mathraki	39.812	19.452	Concept/early planning
Ormos Kalidhonos	38.315	21.561	Concept/early planning

Table 4-57 List of project of OWF in the AIM (sources: http://www.4coffshore.com/windfarms/; http://www.thewindpower.net/country_maps_en; last visit: 7/10/2014).

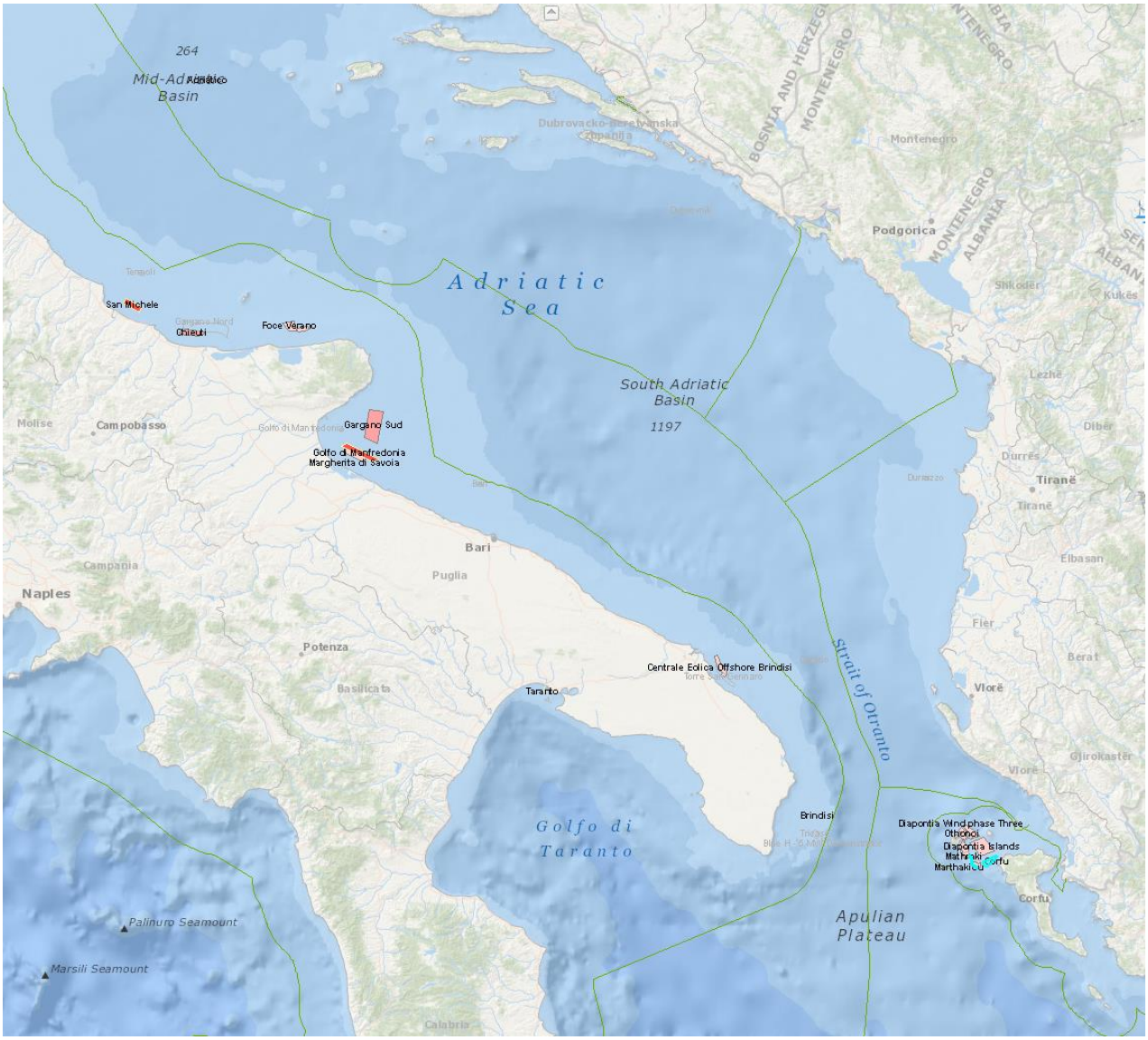


Figure 4-73 Position of the OWF in phase of early planning in FA2 (http://www.4coffshore.com/windfarms/dikella-greece-gr46.html; last visit 7/10/2014).

4.6 Oil & Gas

R. Mosetti, M. Lipizer, T. Papatheochari, S. Niavis, S. Fraschetti, G. Farella, F. De Leo, A. Kokkali, V. Vassilopoulou, S. Belošević

Adriatic sea is a long-established hydrocarbon province and in the past has been a successful exploration area with numerous large biogenic gas fields discovered in the shallow Pliocene and Tertiary section. Many of these fields—such as Ravenna, Porto Corsini and Porto Garibaldi in the northern Adriatic (Zone B) offshore Po Valley region—were put into production decades ago and have been steadily supplying Italy with a large portion of her domestic gas requirements. Some biogenic gas has also been discovered in the Tertiary section at Falco, but not to the levels found in the northern Adriatic. However, the southern Adriatic has been little explored to date compared with the northern Adriatic and is deserving of renewed exploration efforts.

Offshore gas is importat to satisfy internal demand (Table 4-58), so the Adriatic Sea offshore gas production is taking place through various projects.

In the framework of the Agreement between Italy and the former Yugoslavia, to ensure the exploitation of the gas field "Annamaria", located in between the Italian and Croatian continental shelf, a Technical Agreement was signed in July 2009 and updated in January 2013 between the Ministry of Economic Development of the Italian Republic (Directorate General for Energy and Mineral Resources) and the Ministry of Economy, Labour and Entrepreneurship of the Republic of Croatia (Directorate for Mining). Eni (Italian) and INA (Croatian) created a joint venture that started producing gas by platform Annamaria A in six wells in Croatian waters in 2009. The Annamaria B platform (located in Italian waters) started production in 2010.

The active trade and distribution of oil and gas in the Mediterranean Basin, both on land and at sea, involves an extensive network of crude oil pipelines and gas line systems, mainly in the countries of production, linking their oilfields to their refineries and port terminals or to other countries (Figure 4-74 and Figure 4-75).

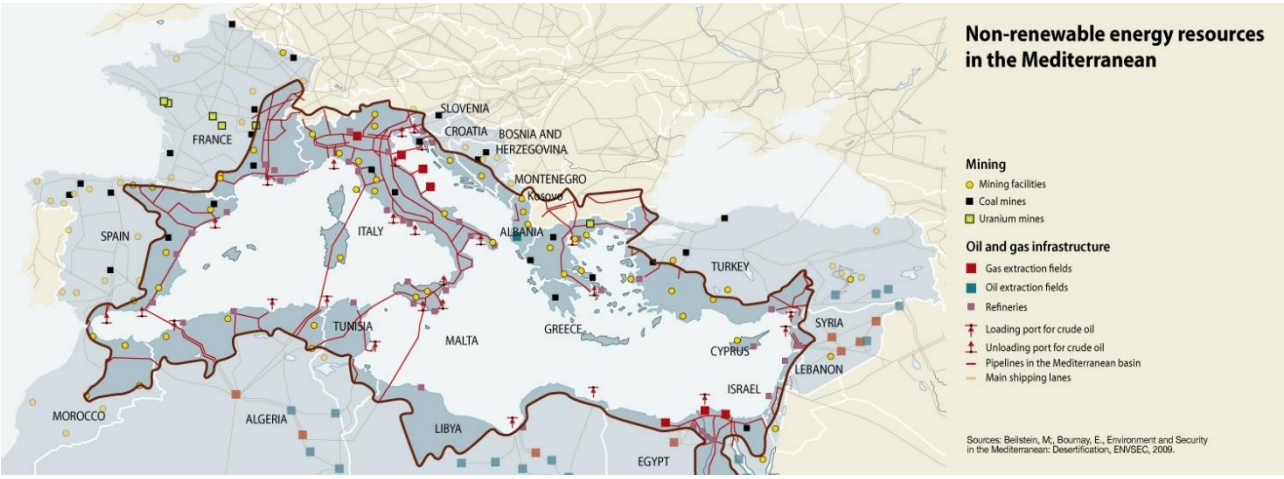


Figure 4-74 Map of non-renewable sources in the Mediterranean. ENVSEC, 2009

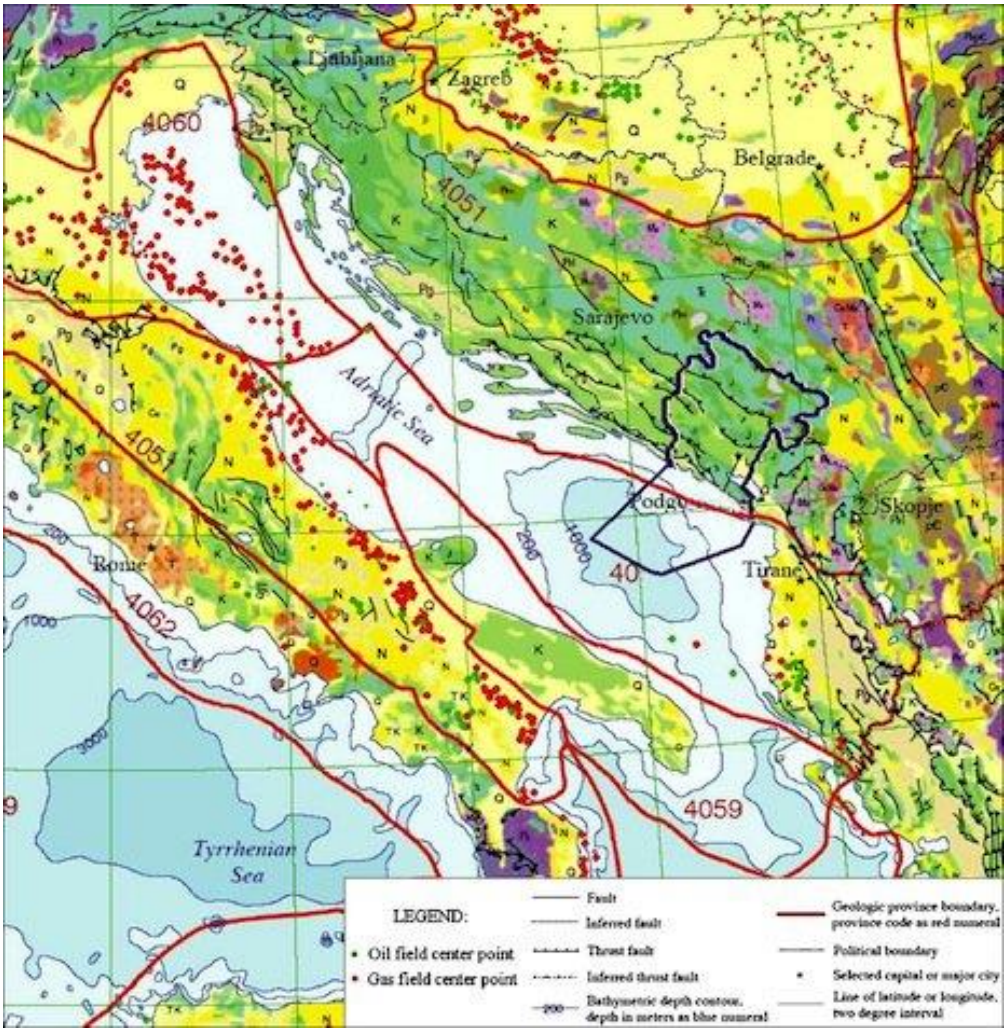


Figure 4-75 Geology, oil and gas fields and geological provinces of south-east Europe. Although commercial deposits of oil and gas have not been found yet off Montenegro, in parts of the Adriatic Basin belonging to neighbouring countries Italy, Albania and Croatia, oil and gas have been found and commercially exploited for years. Source: U.S. Department of the Interior, Open File Report 97-470.

REGION	INDUSTRIAL	THERMOELECTRIC	DISTRIBUTION	T O T A L
PIEMONTE	1,070.60	3,017.27	3,847.36	**7,935.23**
VALLE D'AOSTA	50.10	0.00	46.90	**97.00**
LOMBARDIA	2,512.03	5,139.16	9,218.24	**16,869.43**
TRENTINO ALTO ADIGE	277.04	56.86	663.06	**996.96**
VENETO	1,197.03	721.20	4,179.16	**6,097.39**
FRIULI VENEZIA GIULIA	635.50	944.70	873.80	**2,454.00**

LIGURIA	192.10	386.20	939.90	**1,518.20**
EMILIA ROMAGNA	2,614.10	3,335.30	4,537.50	**10,486.90**
TOSCANA	1,009.40	1,944.70	2,327.30	**5,281.40**
UMBRIA	283.00	217.80	540.20	**1,041.00**
MARCHE	352.70	34.30	925.68	**1,312.68**
LAZIO	634.82	1,012.81	2,237.72	**3,885.34**
ABRUZZO	315.23	501.08	729.67	**1,545.98**
MOLISE	18.01	184.30	133.98	**336.29**
CAMPANIA	461.30	1,207.60	1,085.88	**2,754.78**
PUGLIA	920.30	2,264.80	1,112.13	**4,297.23**
BASILICATA	105.70	116.50	206.75	**428.95**
CALABRIA	35.90	1,433.20	300.40	**1,769.50**
SICILIA	1,026.55	2,486.90	723.80	**4,237.25**
SARDEGNA	0.00	0.0	0.00	**0.00**
T O T A L	***13,711.41***	***25,004.68***	***34,629.43***	***73,345.52***

Table 4-58 Gas consumption per Region. Source: Italian Ministry of Economic development – Energy Department DGSAIE

In Italy, the Ministry of Economic Development (Directorate General for Energy and Mineral) is the Administration in charge for issuing research permit and extraction license.

Areas including extraction activities are classified by the Ministries according to Figure 4-76.

The current licence map (Figure 4-77) shows (in red) the large number of production licences in the northern Adriatic Zone B region, indicating the prolific nature of this shallow gas-play region. Many discoveries in this region are still producing large volumes of gas. This licence trend follows the coast southward to just north of the Gargano Peninsula where the Apennine thrust front trends back onshore. The map also shows that few licences are present in the southern Adriatic.

Figure 4-76 Zoning of areas of extraction activities along Italian coasts. Ministry of Economic Development, Directorate General for Energy and Mineral Resources http://unmig.sviluppoeconomico.gov.it

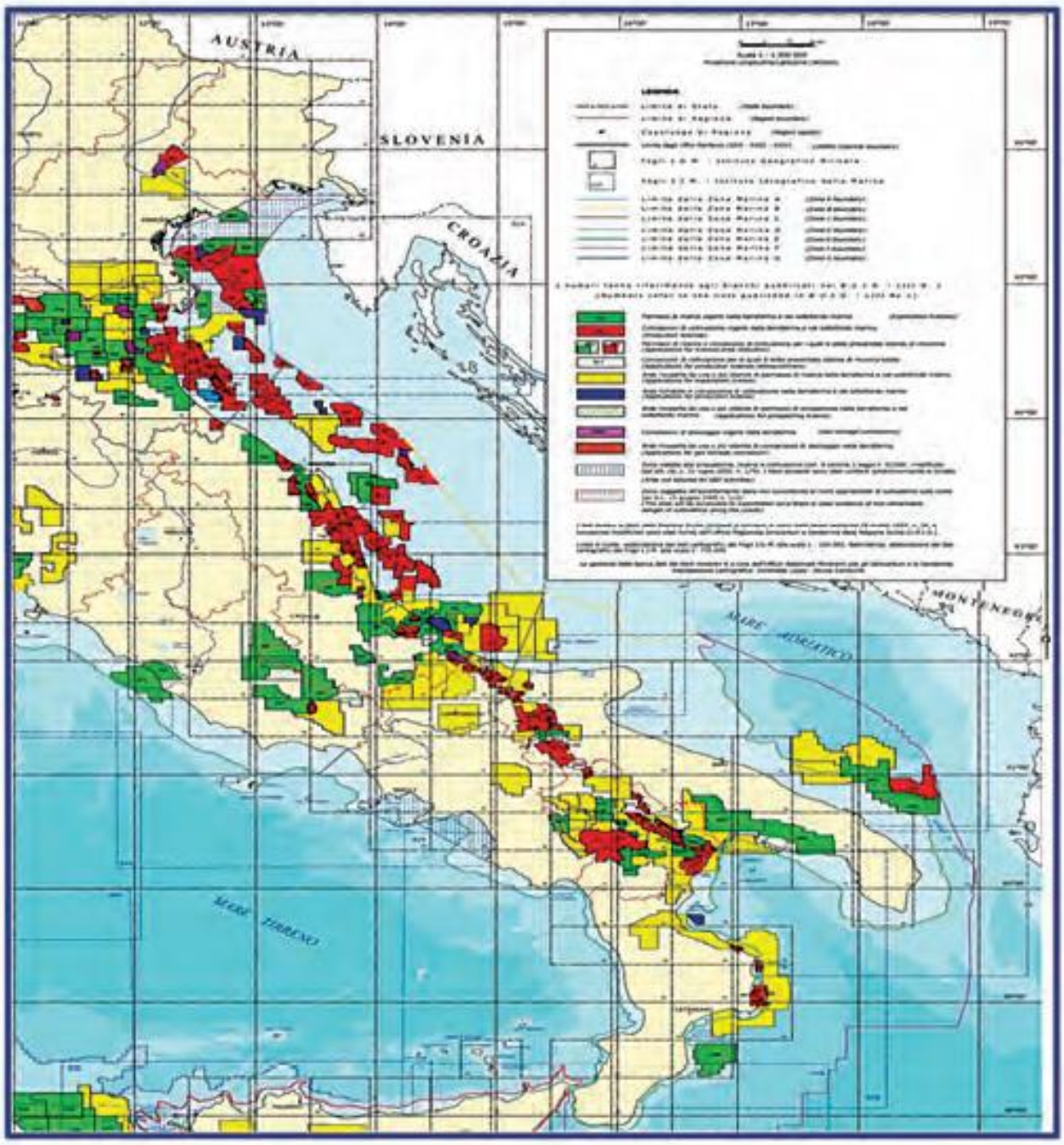


Figure 4-77 Map of current Italian licences. Ministry of Economic Development

Relevant detailed data and information about oil&gas deposit exploitation on the Coratian continental platform will be included at a further stage.

In Croatian waters gas Field, Pipelines and development/production areas are already been built/identified (Figure 4-78) but the issue is becoming one of the most relevant for the entire Adriatic-Ionian basin, since Croatian government has now officially opened the race for oil and gas in the Adriatic seabed. E.U. rules require Zagreb to open up the market, bringing an end to the monopoly held by Ina, the national oil company owned 44% by the State and 47% percent by Mol, a Hungarian company. Croatian government recently auctioned 29 sebed zones for the exploitation of oil & gas. A possible conflict with the Italian approach for the exploitation of the same deposits on the other side of the Italian-Croatian midline is in place: at present in Italy the acquisition of new research permits is now hampered for environmental issues raised by NGOs.

Figure 4-78 Gas Field, Pipelines and development/production areas for Croatia

Another important key issue is the building of rigassification (LNG) terminals in AIM (4-79).

A LNG Terminal is present off the Veneto coastline (see FA1 for details) and new potential LNG terminal sites on the Adriatic cost include Krk, Ormisalj, Ploce and several other possibilities being suggested by the Croatian government. At Krk initial feasibility and development studies are completed and many of the issues found in the previous work on this site are now overcome, since the earlier proposal failed due to environmental problems. At present, Krk project comes to final stages and the government is looking for investor for its realizazion.

There is also a potential site in Albania (Fieri District) where the Albanian government is interested in developing as an LNG terminal.

The presence of such terminals leads to competition with other maritime activities within AIM, with particular reference to fishing, togheter with the "standard" risk of strong pressure on the environment connected to the installation of offshore platform.

Figure 4-79 Principal pipelines and possible LNG terminal positions. ECA, SEE Regional Gasification Study, 2009

4.6.1 Focus Area 1

The Adriatic Sea represents Eni's main production area in Italy, accounting for 48% of Eni's domestic production in 2008. Main operated fields are Barbara (124 mmCF/d net to Eni), Angela-Angelina (57 mmCF/d), Porto Garibaldi (49 mmCF/d), Cervia (39 mmCF/d) and Tea-Arnica-Lavanda (42 mmCF/d). The areas of permissions for exploration and for exploitation in the Italian waters are indicated in Figure 4-82.

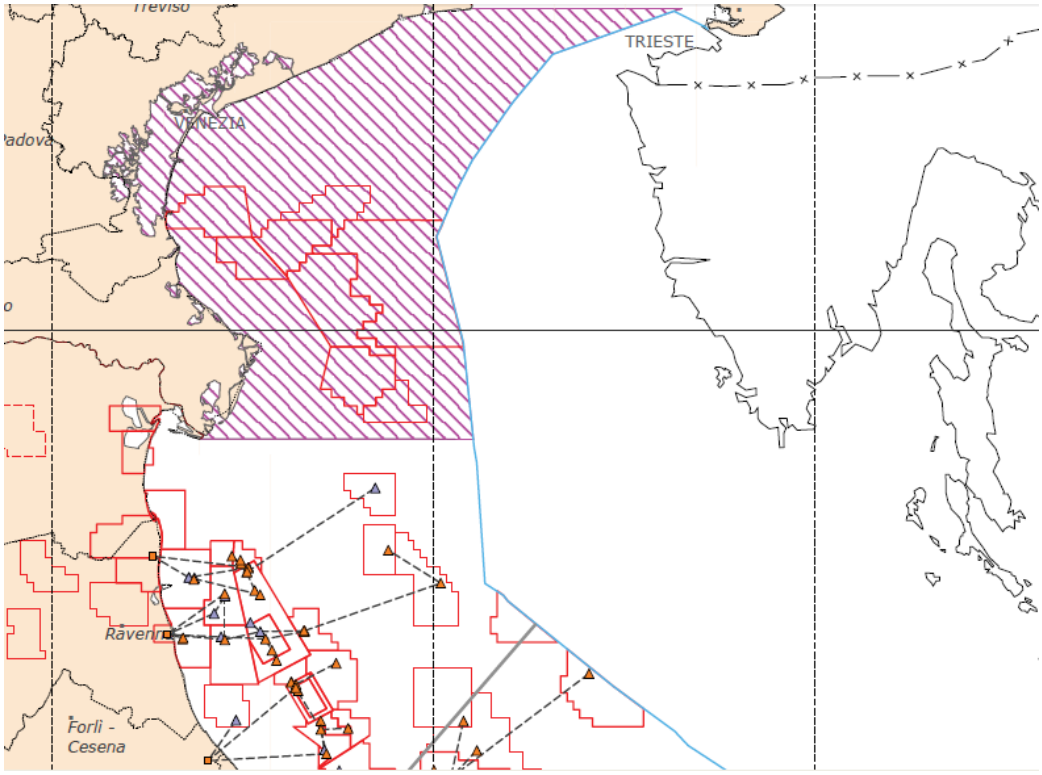


Figure 4-80 Oil platform distribution in Adriatic sea (Italian territory). Ministry of Economic Development Directorate General for Energy and Mineral Resources http://unmig.sviluppoeconomico.gov.it/unmig/cartografia/tavole/impianti/impianti.pdf

A relevant number of offshore platforms (approximately 100) is located off the coast of Emilia-Romagna (Figure 4-81).

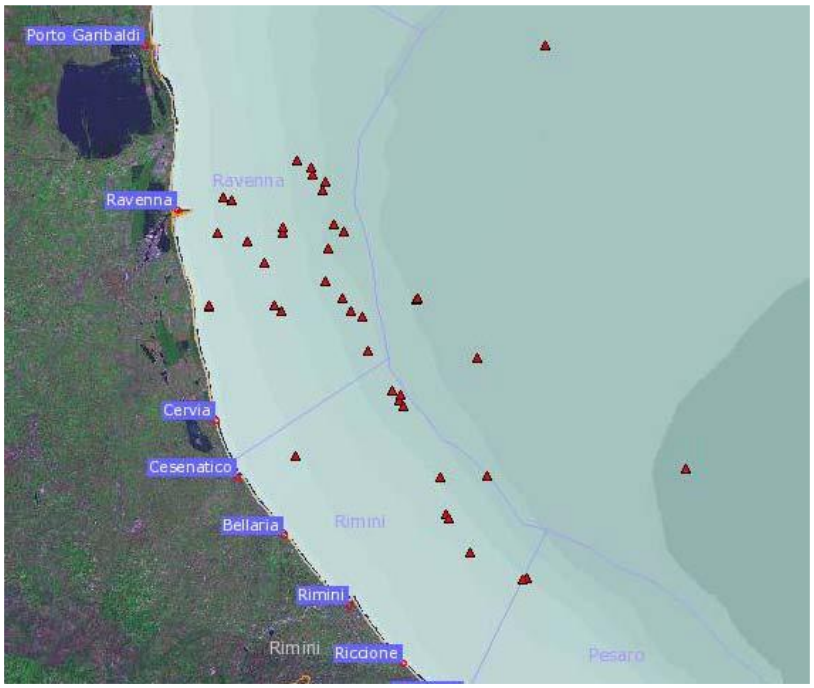


Figure 4-81 Offshore platforms in Emilia Romagna region. SHAPE project, 2014

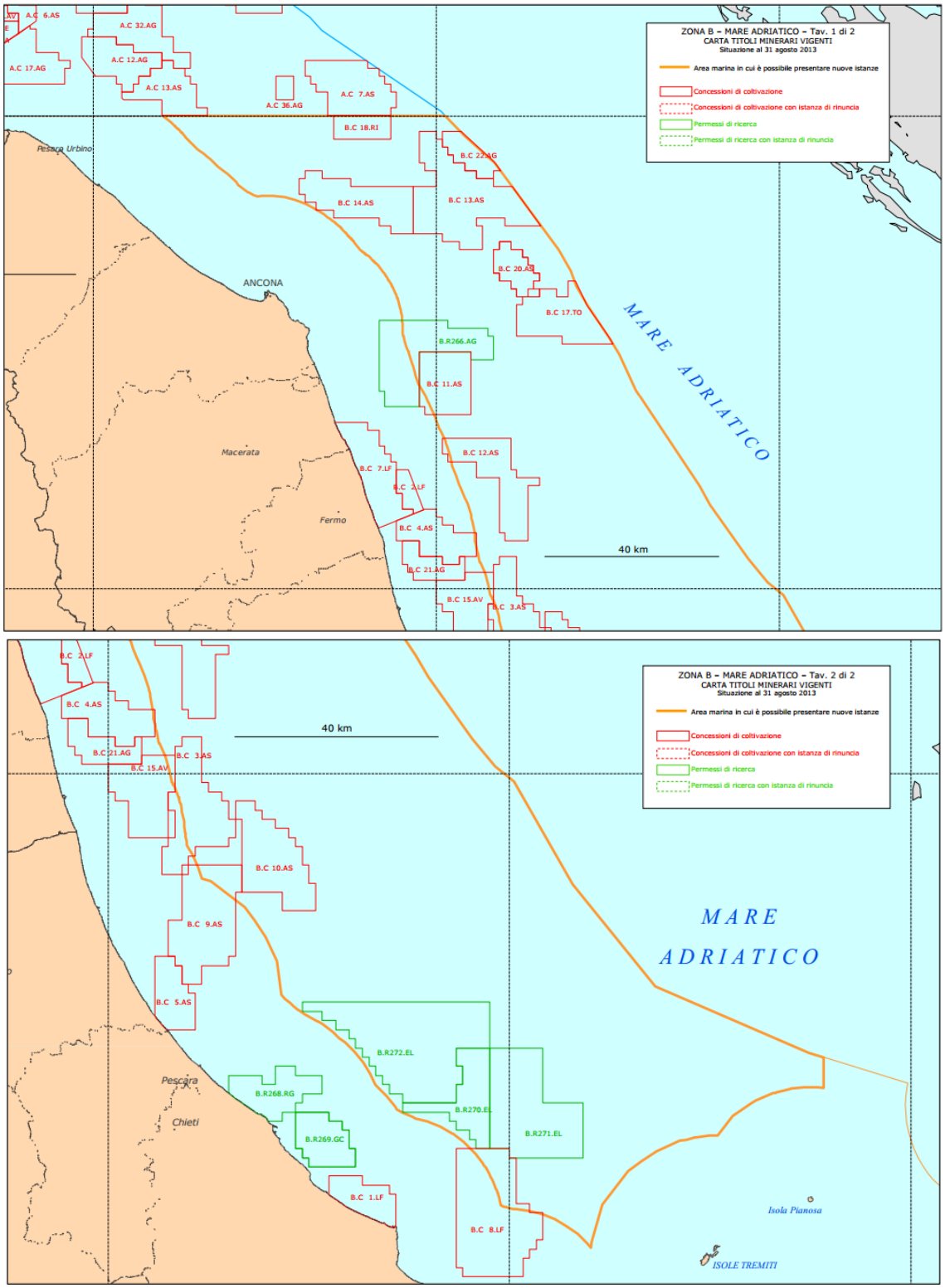


Figure 4-82 Central Adriatic: Permissions for exploitation (red) and exploration (green) (source: MISE, Ministero Sviluppo Economica, Italy).

The first offshore LNG terminal in the world has been built in the Northern Adriatic in the proximity of Porto Levante (province of Rovigo, Veneto). It went into operation in 2009.

It is the first ever offshore Gravity Based Structure (GBS) for unloading, storing and regasifying Liquefied Natural Gas (LNG). The facility is located about 15 kilometers off the

Veneto coastline and it is based on the sea floor. It has been connected to the national network of gas distribution by a new pipeline. Overall, the offshore Terminal is designed around a large concrete structure, which houses two LNG tanks and includes a regasification plant and facilities for mooring and unloading LNG vessels. It is overall 375 m long, 115 m wide and the main deck is 18 m above sea level, with the top of the flare tower rising 87 m. above sea level. The Terminal has a regasification capacity of 8 billion cubic meters of natural gas per year (775 million cubic feet per day), or approximately 10 percent of Italy's current natural gas requirements. Eighty percent of the Terminal capacity will be utilized by Edison for a period of 25 years, to regasify LNG imported from Qatar's North Field, as part of a supply agreement with RasGas II. The remaining 20% is open for third party access, out of which 12% has already been allocated according to the procedures defined by the Italian Ministry of Economic Development and the Regulatory Authority for Electricity and Gas.

The Terminal's regasification plant is located on the top of the GBS. It consists of four LNG Open-Rack vaporizers that operate using the natural heat of sea water, an energy recovery LNG vaporizer that reutilizes heat from the gas turbines, two cryogenic compressors, four pumps used to lift the LNG from the tanks, and five send-out pumps that send the gas through the vaporizers and into the external pipeline. The plant also includes a number of auxiliary facilities, such as gas turbine-powered electricity generators and the electrical control center.

There is a possible identified conflict with fisheries activities of Emilia Romagna Region: fishermen and a part of the scientific community claims that the decline in catches over the last 2 years can be attributed to the rise of temperature and loss of salinity connected to the use of marine water in the open loop cicle in the LNG plant. A study of the Ministry of Environment in 2012 excludes this hypothesis.

Morevoer, Italian government is looking for new locations for LNG terminals, as the priority is to have one more in northern Adriatic. One possible location is in the port of Trieste, but the project is complicated by environmental and maritime traffic issues. Anothrer possible location for a smaller plant is Monfalcone.

Croatia

The first oil refinery in Croatia, as one of the first in Europe, was built in 1883 in Rijeka, near the port, which was a benefit for the transport of raw materials by sea, and its products by sea and rail. Refinery in Rijeka, then settled third of the Austro-Hungarian empire needs for petroleum products, primarily for kerosene, paraffin, org. solvents and tar. In year 1885 has been processed 30 000 tons of crude oil, mainly in the refined petroleum. Year 1927 was built the oil refineries in Sisak. Oil and condensate are produced from reservoirs in the Pannonian basin, while the gas began in late 1999th and produce on the Adriatic. In Croatia gaining domestic oil and gas until half of the 1990s is covered more than 40% of total primary energy consumption, which is currently reduced to approximately 30%. Today, the largest refiners in Croatia are the refineries in Rijeka and Sisak, with a total annual capacity of processing about 8.5 Mt.

INA is a medium-sized European oil company with a leading role in Croatian oil business and a strong position in the region in the oil and gas exploration and production, oil processing, and oil and oil products distribution activities. There is a long tradition of this important economic activity in our region and from the very beginning it was related to INA. Until now, they have been involved in exploration and production operations in Croatia (Pannonian basin, Adriatic offshore). In 2012 in onshore Croatia, INA is continuing with successful exploration activities, two new discoveries nearby existing oil fields were made in the second half of the year. Near oil field Žutica, Hrastilnica-3, obtained maximum ever tested oil flow rate in Croatia, approximately 2400 bbls/day and Đeletovci-1z tested approximately 600 bbls/day of oil. New oil discoveries are going to be further developed and connected to INA's infrastructure. Exploration activities in the North Adriatic are carried out through cooperation between INA,d.d. and its Italian partners. The Izabela Contract Area has been explored together with EDISON GAS through a joint operating company EDINA. In 2012, total Croatian onshore production amounted to 8.8 mboepd of crude oil, 2.5 mboepd of condensate and 15 mboepd of gas. In 2012, total Croatian offshore production amounted to 15.8 mboepd natural gas.

EOR (Enhanced Oil Recovery) is one of the INA's most important investment project in the continental Croatia. The project objective is the extraction of additional hydrocarbon on the Žutica and Ivanić oil field, on register units Ivanić Grad, Šarampov, Posavski Bregi, Topolje and Hrastilnica. The project involves the application of the one of the so-called tertiary methods of enhanced oil recovery: alternating injection of carbon dioxide and water in partially depleted oil reservoirs, which will increase the pressure in the reservoir. Planned project envisages the construction of system of gas pipelines, power line and signal cables for underground injection of CO2 in the soil layers on the existing production wells. Within the project, apart from the existing 85 kilometres long pipeline from the INA Molve fields to the Ivanić and Žutica INA's fields, , another 56 kilometres of new pipeline as well as two compressor stations will be built.

Exploration and exploitation of oil and gas in the Croatian Adriatic has been a priority of the government since it took office. To prepare the grounds for the tenders, the relevant legal framework was passed. Norwegian company Spectrum Geo was then contracted to acquire 2D seismic data off the coast of Croatia. Seismic shooting started in September 2013 and was successfully completed on January 20 2014. The new seismic survey provides approximately 15,000 kilometres of modern long-offset data. In the meantime, the government selected IHS Global Limited, UK as consultants in the preparation and implementation of the public tender procedure. The Hydrocarbons Agency was established and its main purpose is to provide operational support to competent bodies participating in the exploration and exploitation of hydrocarbons. The agency should organise presentations to potential investors and provide all necessary support to investors participating in hydrocarbon exploration and exploitation. Croatia will offer 29 blocks in total, eight located in the northern Adriatic and 21 in the middle and southern Adriatic. Each block will be between 1,000 and 1,600 square kilometres. The government also presented the financial model, which includes payment of fees and product sharing. Pursuant to this model, the state's share should be 60% of gas and 54% of oil. The next step is to pass the Ordinance on the Fee for the Exploration and Exploitation of Hydrocarbons, which is expected soon.

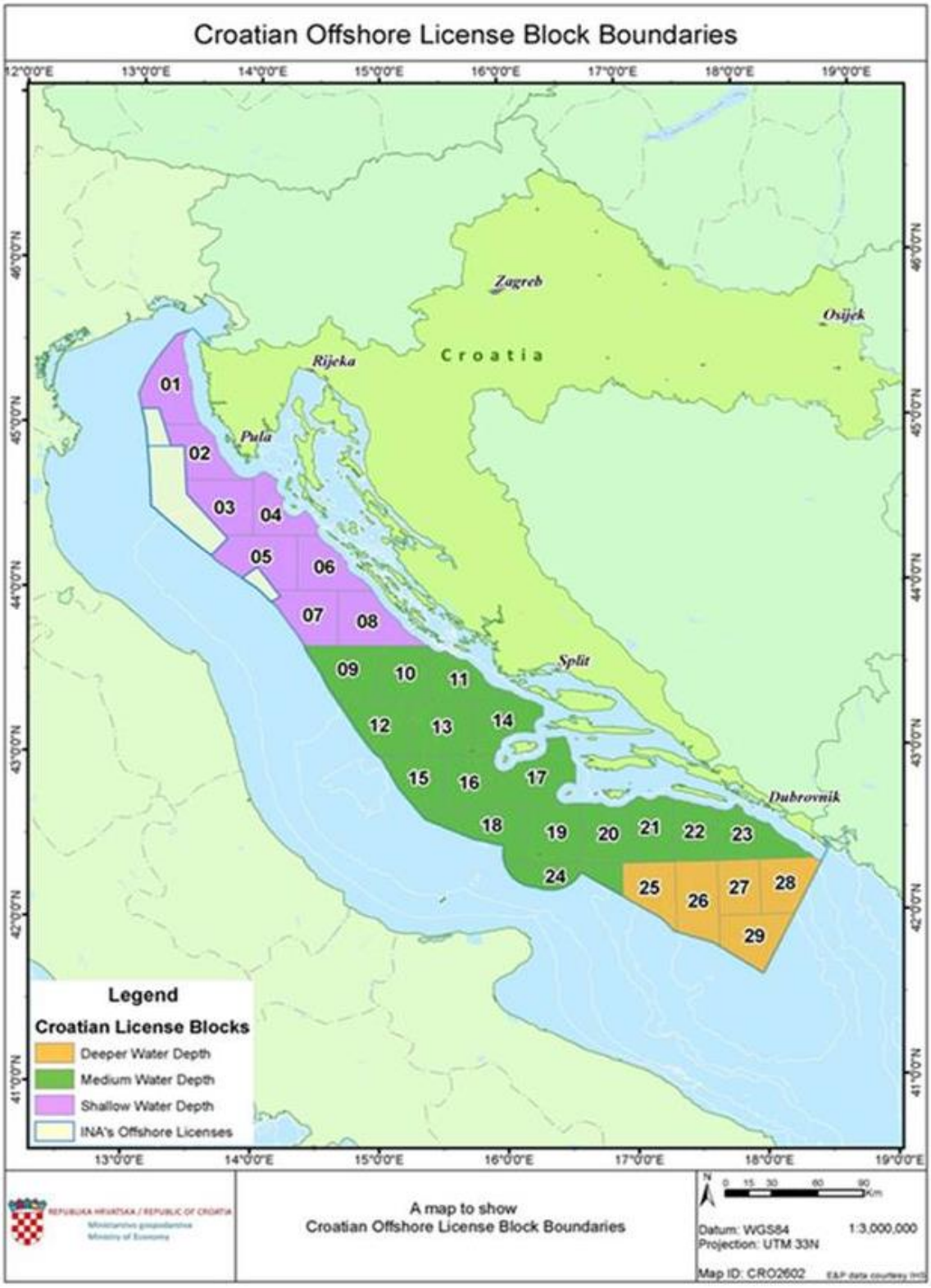


Figure 4-83 Croatian Offshore License Block Boundaries: 29 blocks for hydrocarbon exploitation have been defined. Source: Republik of Croatia.

On October 25 2013 the Croatian Parliament enacted the Strategic Investments Act. The goal of the new legislation is to give preferential treatment to investment projects of national interest. Strategic projects can be private, public or public-private partnerships that secure employment, improve standards of production and service, develop new technologies, ensure

added value, increase competition and have a positive effect on the economy. Energy projects are particularly eligible for strategic project status.

The Republic of Croatia launched the First International Offshore Bid round on 2 April 2014. The round will offer 29 blocks located in the eastern Adriatic Sea covering a total of 36,822 square kilometres. The majority of the blocks fall within the Dinaric Basin, however the most northerly blocks offered span part of the Po Basin, whilst the western parts of the shallow and medium water blocks enter the Northern Apennine Basin.

Jadranski naftovod, a joint stock company (JANAF dd) based in Zagreb, Croatia, operated oil pipeline system was designed and built in the period from 1974th to 1979th as a modern, efficient and economical transportation system of oil for domestic and overseas customers. With oil transport, significant activity of JANAF are storing oil and petroleum products and transhipment of liquid cargo. The system of JANAF was built as an international system of oil transportation from Luka and Omišalj terminal to domestic and foreign refineries in eastern and central Europe. The designed capacity of the pipeline is 34 million tons of oil annually (MTG), and installed 20 MTG.

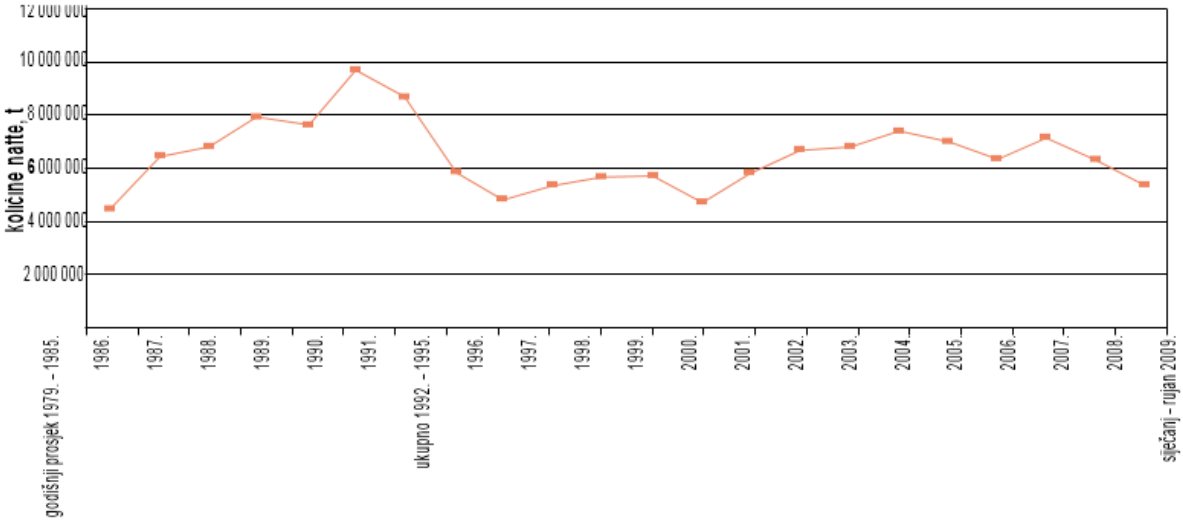


Figure 4-84 JANAF, Total oil transport in the period from 1979th until September 2009. Source: JANAF, JANAF THROUGH 30 YEARS OF WORK, 2009.

During 2013, the gross profit was realized in the amount of HRK 113,5 mil., thus being for 10,7% higher than the profit realized in the same period last year. The declared net profit, in the amount of HRK 104,7 mil., was raised by 9,2% compared to the previous year. The revenues obtained from crude oil transport, in the amount of HRK 287,4 mil., account for 68,2% of the revenues realized from the company core business operation, of which 82,3% was realized on the foreign market. During the year 2014, two investment projects whose value reaches almost HRK 380 mil. are to be completed on the Omišalj and Žitnjak Terminals. The projects relate to storage of crude oil and oil products and shall be commissioned in March and May of this year.

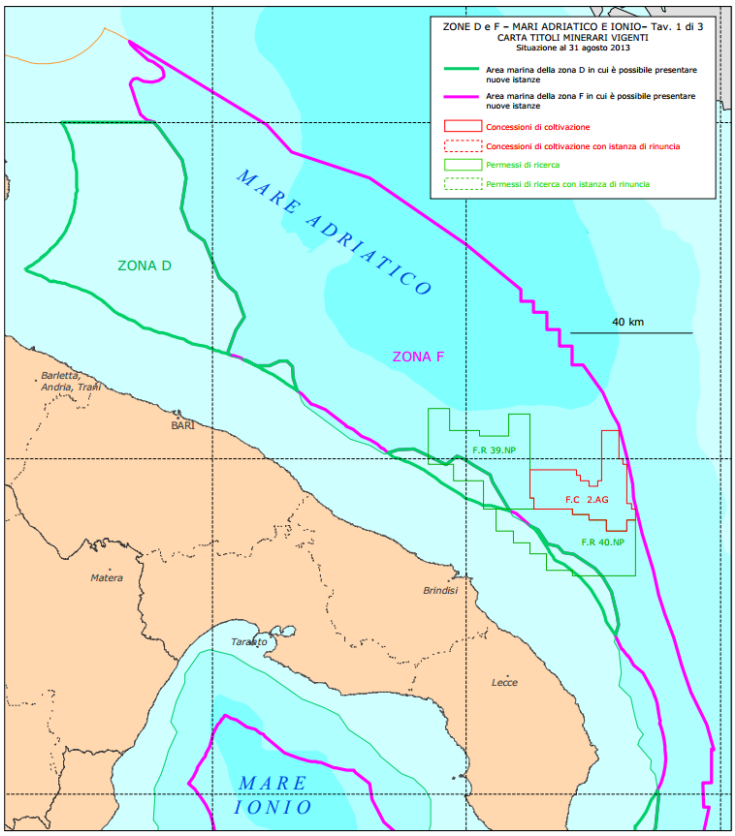
Natural gas is a natural resource of any country and for him to say that was a gift from the past to meet present and future needs of humanity. By analyzing the gas as an energy source should certainly point out its advantages and disadvantages. While, on the one hand, natural gas because of the large amount of energy (energy of high purity), on the other hand, the transmission of gas, the sites to consumer requests to appropriate technological procedures and legal safety standards in the function of preventing environmental risks. LNG terminals appear as transportation and technology hubs that support the safe, reliable and economically and environmentally sustainable transport natural gas over long distances, that is when the

construction of the pipeline is not economically justified and technologically almost impossible. LNG receiving terminal for import and transit of natural gas for the neads of Croatian and Central Europe, which should be located in the northern Adriatic, it gives to Croatia the role of strategic energy partner to a larger number of European Union countries as well as countries that export natural gas. The construction of the LNG terminal, at the area of Omišalj, enables many synergies which, according to their function and significance for the national economy, significantly exceed the level of its direct effects. Value-added effects of an LNG terminal on the Croatian territory are: energy independence and strategic energy partnership with the Croatia and a larger number of countries in Central Europe, but also countries exporters of LNG.

4.6.2 Focus Area 2

In the southern Adriatic, south of the Gargano Peninsula, the geology changes significantly and the deeper carbonate section has proven to contain some heavier oil plays. A few oil discoveries have been made which, with recent increases in the price of oil, can now be regarded as commercial. For the northern part of the Ionian sea, Apulia platform has been studied in Italy and Albania where significant deposits of liquid and gaseous hydrocarbons have been identified, associated with geological formations belonging either to the stratigraphic sequence of Mesozoic stratigraphic sequence either in the Miocene and Pliocene, creating the potential for liquid hydrocarbons.

The areas of permissions for exploration and for exploitation in the Italian waters of the FA2 are indicated in Figure 4-85.



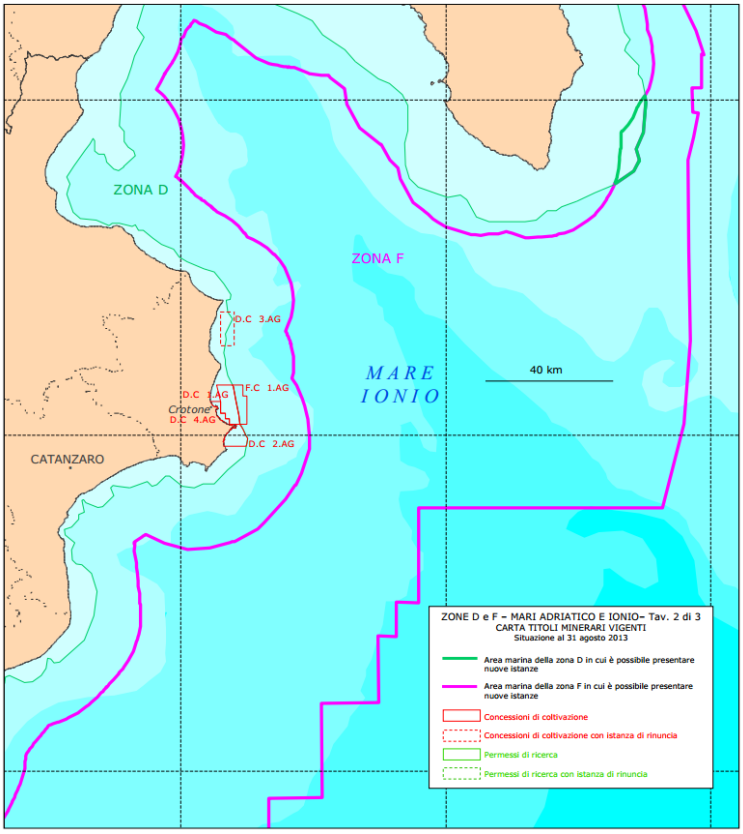


Figure 4-85 Southern Adriatic and Ionian Seas: Permissions for exploitation (red) and exploration (green) (source: MISE, Ministero Sviluppo Economica, Italy).

The geological structure of the narrow and wider area of the Ionian Islands contains strong evidence for the existence of hydrocarbon deposits. Planned studies in the sea area are expected to record the precise areas where these are located. According to current estimates for the Ionian Sea, it is expected that there is an 80% of possibility for such deposits in the Ionian Sea area. Neverthenless, the attention on environmental aspects is high in Italy: since part of these deposit lies on a relevant seabed slope, residents of Tremiti island and Gargano and environmental NGOs fear the environmental consequences for drilling on the Italian side of the Adriatic. While Italy has had to suspend exploitation plans off the Tremiti, one of the blocks auctioned from Zagreb is around the island of Palagruz, adjacent to the Tremiti. It was an Italian island that belonged to Yugoslavia (now Croatia) from '47. Today it is called Palagruz and it is just 30 kilometers from the superb cliffs of the Gargano.

For deposits around Corfu, called "Pyrros" and "Achilles", there are relevant estimates of comparative proportions of oil having been found in Apulia, the geological basin located in Appenine mountains of southern Italy, which extends to the Ionian Sea (Kefalonia & Zakynthos) and passes through the Gulf of Taranto. More specifically, according to available data in the Gulf of Patras, Ioannina, Katakolon and Corfu, it is almost proven that there are oil reserves of at least 300 to 500 million barrels. Also, in the southeastern part of the island of Zakynthos, traces of oil spurt has been observed in relatively small depth (200-500 m) with a variation rate of up to 1000 tonnes of oil per day. Specifically in Keri Lake, located in Zakynthos in the west of Laganas bay, which is dried during the summer months, a tar flow has been observed in certain places and time.

The 85 shows the areas that are part of Greece’s hydrocarbon resources (oil, natural gas).

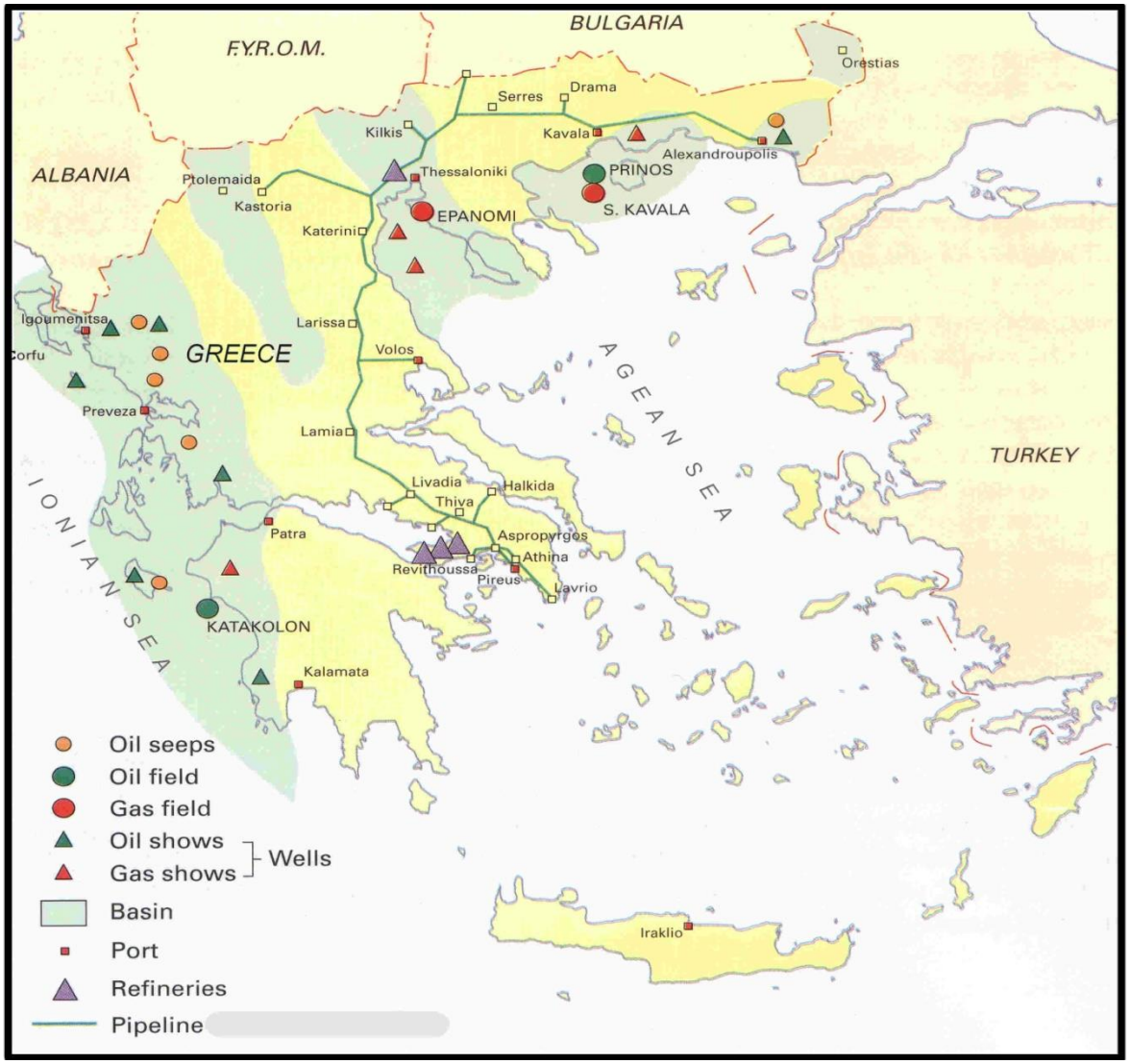


Figure 4-86 Map of areas with high probability of existence of hydrocarbons in Greece. MEECC (under review-a)

So far, previous drilling (not in depth) carried out in specific areas of the Ionian Islands (such as Zakynthos) have not indicated the existence of oil and gas hydrocarbons with prospect of economic potential. Clearly, more in depth investigations in combination with the results of new seismic surveys in appropriately selected areas will give a better picture on the economic exploitation of hydrocarbons that are located in the Ionian Sea.

In the Ionian Islands Region, the basic analysis for finding hydrocarbon potential has been focused in two areas with different geological evolution: a) in the northern part of Zakynthos to the small islands (Apulia platform) and b) in the southern and eastern part of the island of Zakynthos that extends to Cyprus.

Figure 4-87 shows the results of already conducted preliminary seismic surveys in order to find reserves of hydrocarbons (oil, natural gas) in Greece.

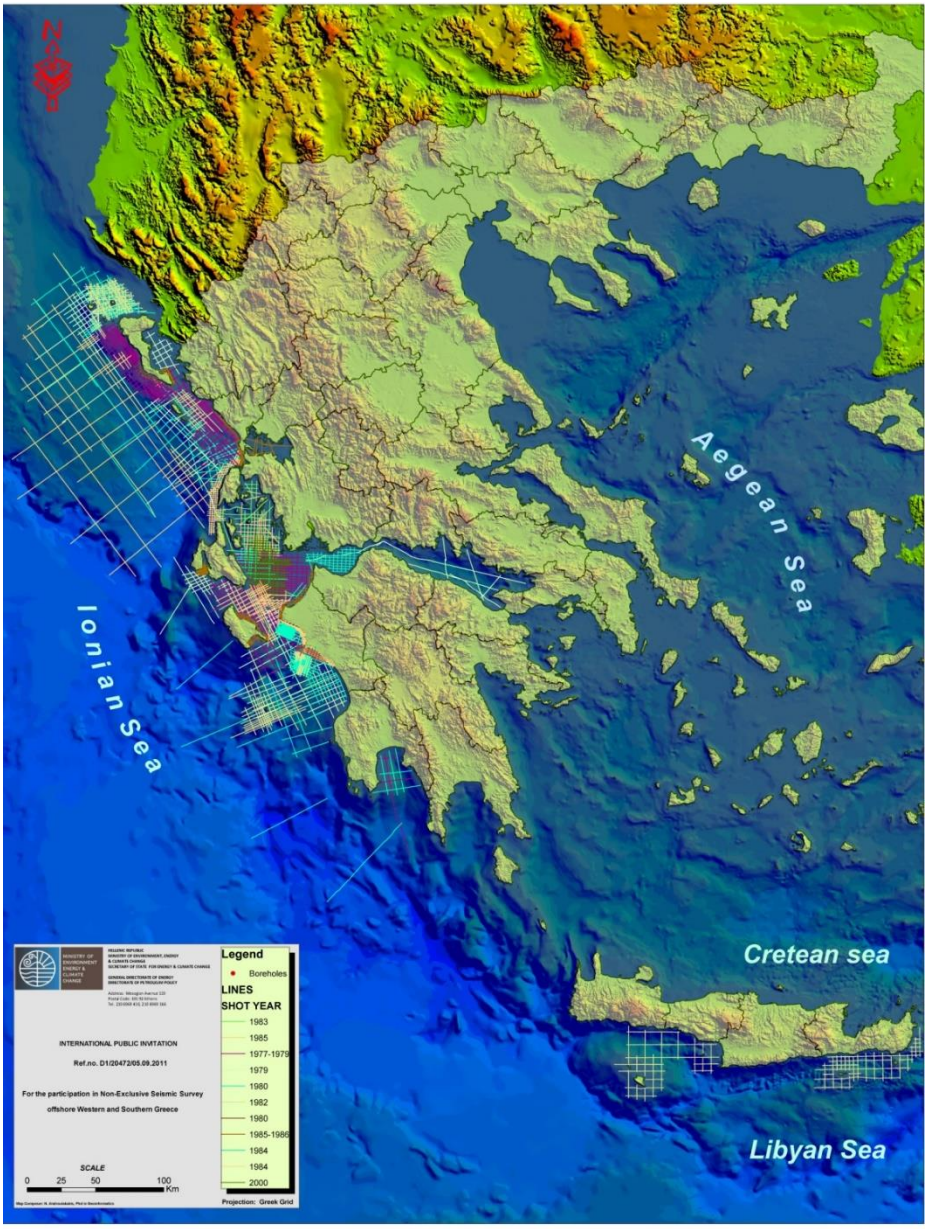


Figure 4-87 Preliminary seismic surveys conducted for reserves in hydrocarbons in Greece. MEECC (under review-a).

The geological structure of the narrow and wider area of the Ionian Islands contains strong evidence for the existence of hydrocarbon deposits. Planned studies in the sea area are expected to record the precise areas where these are located. According to current estimates for the Ionian Sea, it is expected that there is an 80% of possibility for such deposits in the Ionian Sea area.

For deposits around Corfu, called "Pyrros" and "Achilles", there are relevant estimates of comparative proportions of hydrocarbons of about 90km2 and 450 km2 respectively. “Pyrros” is on the boundary line between Greece and Italy and “Achilles” falls within the Greek continental self (source Corfu Press) (Figure 4-88).

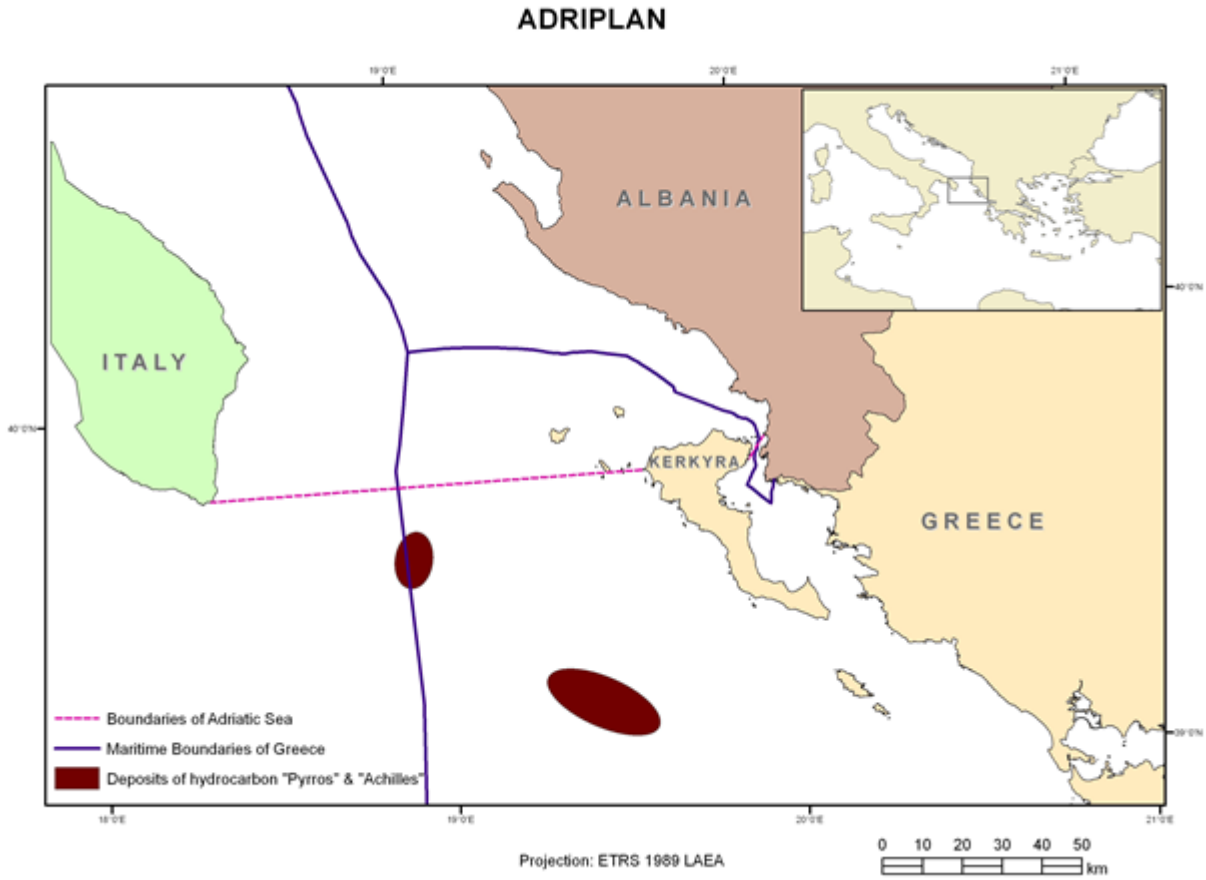


Figure 4-88 Deposits of oil (source: HCMR)

The possible identification and exploitation of hydrocarbons (oil and gas) will completely change the production structure of the Ionian Islands Region. These actions could contribute to the strengthening of the secondary sector. Taking this into consideration and with the fact that under the existing law 4001/2011 a regional tax of 5% is applied to mining companies, the national policy should be evaluated in relation to the issue of marine pollution which can be a burden for the already affected tourism industry, the marine ecosystems and the marine environment in general (MEECC-a).

4.7 MPA

S. Fraschetti, G. Farella, F. De Leo, M. Lipizer, D. Tagliapietra, P. Panayiotidis, V. Vassilopoulou, S. Mezek, T. Primožič, S. Belošević

According to the Marine Protected Areas in the Mediterranean Network (the MedPAN Network, http://www.medpan.org/en/home), the AIM hosts a relevant number of Marine Protected Areas (MPAs), established in Slovenian, Croatian, Italian, Albanian and Greek waters, while in Montenegro the currently existing protected areas have the status of Coastal Protected Areas (CPAs) (Figure 4-89, 4-90). The network's aim is to improve the management effectiveness of 9Marine Protected Areas (MPAs) in the Mediterranean.

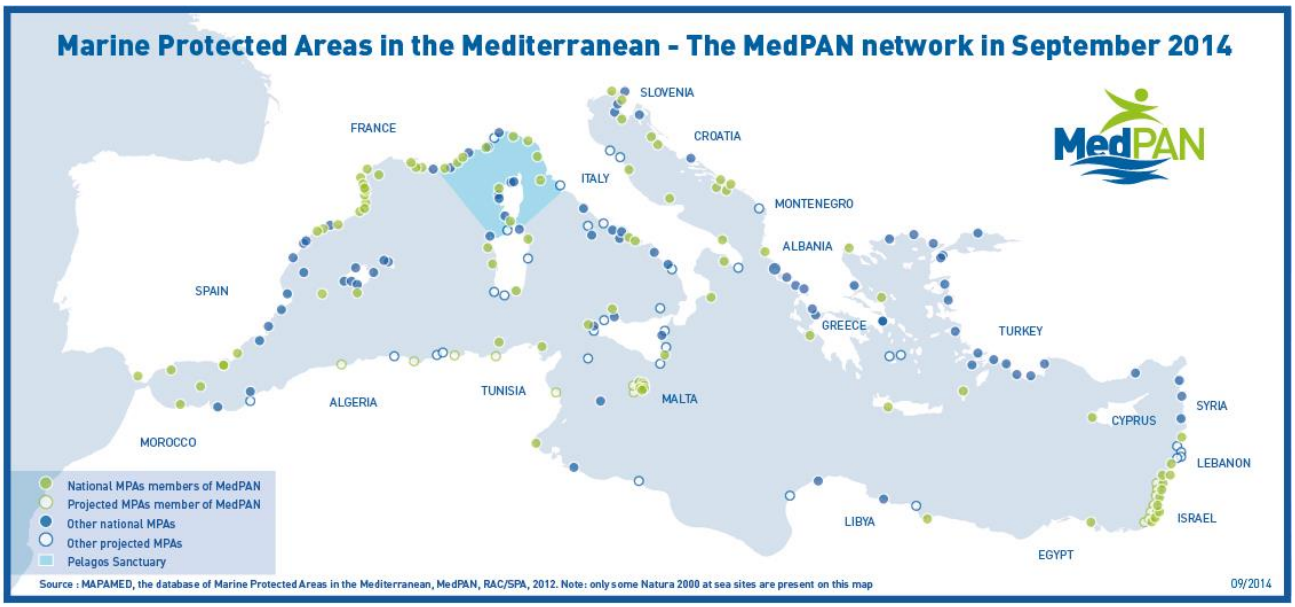


Figure 4-89 Marine Protected Areas in the Medeterranean Sea-The MedPAN network.

The need for effective coordination and cooperation between MPAs in the Adriatic led in 2008 to set up AdriaPAN, the Adriatic Protected Areas Network. The Adriatic Protected Areas Network (AdriaPAN, http://www.adriapan.org/index.php/en/), is a bottom-up initiative, started by two Italian marine protected areas but now including a list protected areas from Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Albania, as far as Greece. In the Adriatic Sea, there are 16 MPAs along the western coast (Table 4-59) and 22 along the eastern coast (Table 4-60) within the AdriaPAN network (Figure 4-90).

Name of protected area:	**TOTAL AREA**
Biological Protection Zone Tegnùe di Chioggia	
Marine Nature Reserve Torre Guaceto	2.227 ha
Marine Oasis of Caorle – Tegnùe di P.to Falconera	
Marine Protected Area Isole Tremiti	1466 ha
Marine Protected Area Torre del Cerrano	3.430 ha
Natural Reserve S.Giovanni in Venere	58 ha
Regional Natural Reserve Ripa Bianca di Jesi	310 ha
Regional Nature Reserve Lecceta Torino di Sangro	175 ha
Regional nature reserve Sentina	177,55 ha
Regional park Delta del Po Emilia Romagna	52.000 ha

Regional Park Delta del Po Veneto	12.592 ha
Regional Park Monte San Bartolo	1600 ha
Regional Park of Conero	6011 ha
State Natural Reserve Le Cesine	348,6 ha

Table 4-59 List o MPAs in AdriaPAN along the Western Adriatic.

Name of protected area:	**TOTAL AREA**
Important Landscape Dugi otok Island	21.46 Km2
Important Landscape Lopar	
Javni zavod Krajinski park Strunjan	4,3 km2
Miramare Marine Protected Area	30 ha
National Park Brijuni	3395,00 ha
National Park Kornati	220 kmq
National Park Mljet	5.375 ha
Nature Park Lastovsko otočje	196 kmq
Nature Park Telašćica	70,50 km2
Significant Landsacape Sibenik Channell-Harbour	1,095.02 HA
Significant Landsacape Zut-Sit Archipelago	10,006.57 ha
Significant Landscape Badija Island	
Significant Landscape River Krka	3025.45 ha
Significant Landscape Saplunara Island	
Special Marine Reserve Mali Ston bay and Malo More	
Special Reserve Cres Island	1,450 ha
Special Reserve Island Mrkan, Bobana and Supetar	
Special Reserve Kolanjsko blato - Blato Rogoza	
Special Reserve Neretva River Delta	
Special Reserve Prvić	7,000ha
Special Reserve Veliko i Malo blato	2x1.2 km
Wetland Narta Lagoon	4000 ha

Table 4-60 List o MPAs in AdriaPAN along the Eastern Adriatic.

There are three protected areas in the Croatian part including a marine component: Mljet National Park, Malostonski Bay Special Reserve and Lastovo Park of Nature. Mljet National Park is managed mainly for ecosystem protection and recreation, with the original designation based on terrestrial aesthetics rather than biodiversity. At the time of designation, there was little available scientific data that would justify protective measures, and, it was only recently that the national park boundaries were extended to include surrounding marine areas (Benoviç *et al*., 1999). Mljet National Park is under pressure predominantly from tourism, with additional problems regarding illegal construction on the islands, localised pollution, uncontrolled access, and illegal fishing by visitors and the local community. Malostonski Bay was designated a Special Marine Reserve, officially managed mainly for scientific reasons. However, this site was designated for historical bivalve aquaculture areas that have been

protected with the aim of conserving present and future bivalve production (Benoviç *et al*., 1999). But recreational use of the bay continues, with increasing risk of pollution that could threaten the integrity of bivalve production. In 2006 the Lastovo archipelago, which represents the second largest protected marine area in the country (UNEP-MAP RAC/SPA, 2007) was established for both terrestrial and marine natural values, archaeological findings, and a rich cultural heritage. It has been designated on biological grounds, but with the concept of multiple-use as part of its rationale. However, despite consultations, initial local support for the designation appears to have declined (Frankic, 2004; WWF, 2006).

Additionally within the Neretva Delta there is a Ramsar site, Mediterranean Specially Protected Area, Ornithological Reserve, Zoological Reserve and Protected Landscape Area. The Delta, its associated salt marshes, saline lagoons, sand banks and wet meadows are of considerable importance for wintering and staging birds and for several species of breeding birds. Large parts of the area have been subject to drainage and agricultural development, increasing road construction, urbanization and hunting.

Marine conservation has lagged behind terrestrial conservation in Croatia, and less than 1% of the territorial sea is protected. Generally protected area management capacity and political will has been lacking (Frankic, 2004). Recently, EU tenders have started to focus on marine conservation, and the Marine Natura 2000 sites should be identified in the coming months.

In Italy, the Gargano National Park includes the MPA of Tremiti Islands and the Varano and Lesina lagoons along the coast. Tremiti Islands was instituted in 1989. Systematic mapping activities have shown that the Archipelago is characterized by critical habitats (coralligenous formations, submarine caves, seagrasses, rhodolite banks) deserving careful monitoring due to increasing threats from tourism (diving, bathing, shipping, anchoring). Protection is generally weak, and poaching is still very active (Guidetti *et al.*, 2008). Long term monitoring, carried out by the University of Salento, shows that the MPA has not been correctly zoned and that the no take no man zone (called Pianosa) is characterized by low biodiversity assemblages even after more than twenty years of protection, (Fraschetti *et al.*, 2011). Pianosa can be considered a de facto marine refuge (e.g., a remote reef that is inaccessible) requiring the input of new recruits from neighbouring unprotected areas. Considering the position of this MPA and the oceanographic features described above, large-scale regulation could be a profitable strategy to facilitate the recovery of this area.

In the middle of the Adriatic, the Jabuka - Pomo Biological Protected Zone (BPZ) jointly declared by Italy and Croatia is located outside national territorial boundaries. Other BPZs (for nurseries as main purpose) are located around Tremiti Islands (Area Tremiti) and off Bari (so named Zone C "al largo della Puglia").

In Montenegro, Ada Island, in the southern part of the Buna/Bojana delta is a Ramsar site, an international IBA (Important Bird Area) and IPA (Important Plant Area).

In the Albanian sector, there are several units with different protection status within the proposed area. In the southern part of Buna/Bojana mouth, the Velipoja Forest has the status of a Managed Natural Reserve with a core area, the Franz Joseph Island, which is strictly protected as a National Natural Monument. The Velipoja Reserve also has the status of a Ramsar site, IBA and IPA, together with Buna/Bojna River and Shkodra Lake in the Albanian part, as a whole unit. Further south, the Viluni lagoon – Baks Rjolli coast is a Managed Nature Reserve, with a core area, the peculiar sand dune "Blown sand" (Rana e hedhun), strictly protected as a National Natural Monument.

In Albania, despite the presence of protected areas, the implementation of environmental legislation is still weak. Damage to natural habitats, including that within protected areas, is due to uncontrolled human access and illegal activities, such as construction of tourist facilities, deforestation, and fishing and hunting. Some recent efforts through national and international projects on protected areas in Albania aim to strengthen the national network of Coastal Protected Areas and encourage the proclamation of new MPAs. This should have positive impacts on marine ecosystem conservation in the country.

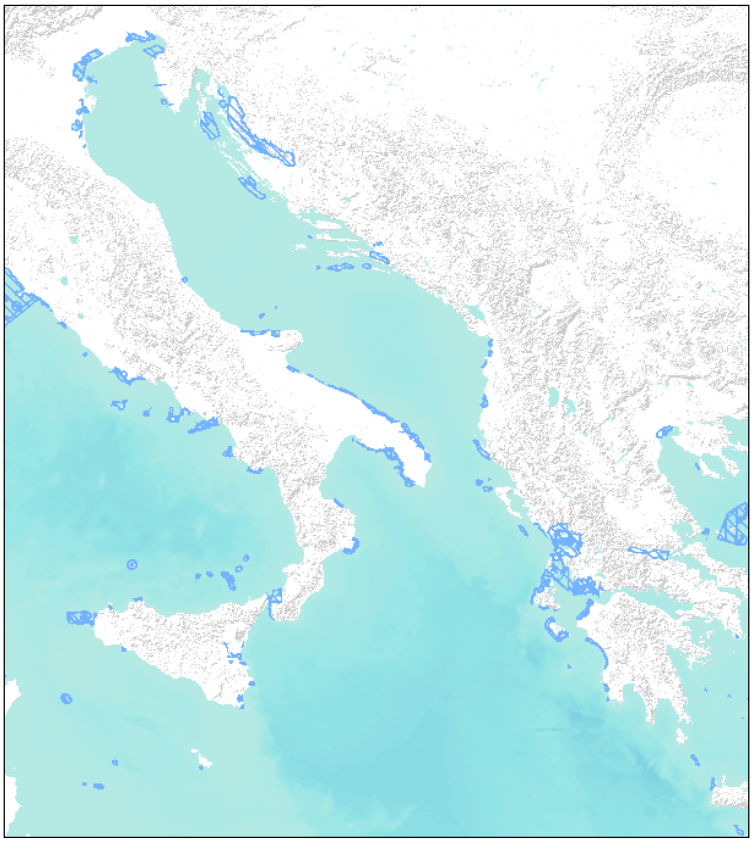


Figure 4-90 Marine protected areas in the Adriatic – Greek Ionian Seas. European Atlas of the Sea, http://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas/#lang=EN;bkgd=5:1;mode=1;pos=15.973:41.08:6;theme=80:1:1;time=2013; last visit 11.04.2014)

Figure 4-91 ADRIAPAN network of Protected Areas in the Adriatic. http://www.adriapan.org/index.php/en/network-it, last visti: 11.04.2014). ADRIAPAN – Adriatic Protected Areas network

4.7.1 Focus Area 1

FA1 hosts 3 sites of the italian Long Term Ecological Research Network (LTER Italia, http://www.lteritalia.it/defaultuk.php) part of the International LTER Network (ILTER), where ecological research is active. The sites are the Po River Delta (IT07), the Lagoon of Venice (IT16) and the Upper Adriatic (IT12).

FA1 hosts also the first Italian MPAs to be officially established, the "Riserva Naturale Marina di Miramare" near Triest that is also a UNESCO-MAB Biosphere Reserve.

NAS MPAs in the AdriaPAN are: Miramare Marine Protected Area, Trieste; Delta del Po Veneto Region Nature Park, Rovigo; Delta del Po Emilia Romagna Region Nature Park, Ferrara; Tegnue di Chioggia ZTB = Zona di Tutela Biologica (Area of Biological Protection) Venice; Oasi Marina di Caorle–Tegnùe di P.to Falconera Oasis ZTB (Venice); Regional Park Monte San Bartolo (Pesaro); Regional Park of Conero (Ancona); Javni zavod Krajinski park Strunjan (Slo); National Park Brijuni (Cro) (http://www.adriapan.org/index.php/en/network-it).

The Northern Adriatic Sea is characterised by a rather monotonous seabed, mostly moulded in mobile, silty-sandy sediments, nevertheless its waters hide some peculiar outcrops, called "tegnue"submarine rocky substrates of biogenic concretions, irregularly scattered in the sandy or muddy seabed and, rather like oases in a desert, contain extraordinary zoobenthic biocenoses of particular environmental concern. The ecological role played by the tegnue in the

northern Adriatic is extraordinary: as well as being true oases of biodiversity, they are areas, which are naturally protected against trawl fishing. This is because, on a local scale, their irregular profiles limit the use of highly profitable but destructive systems of fishing, like the rapid (large metal racks which furrow the seabed) or the hydraulic dredges, which plough the sea bottom with the aid of high-pressure jets of water. The tegnue thus provide shelter for a large variety of marine invertebrates and act as a natural nursery for many species of fishes, which find food, protection and, above all, suitable places for reproduction (Casellato et al., 2007)

In the following Figures more detailed mapping of the protected areas in FA1 are presented.

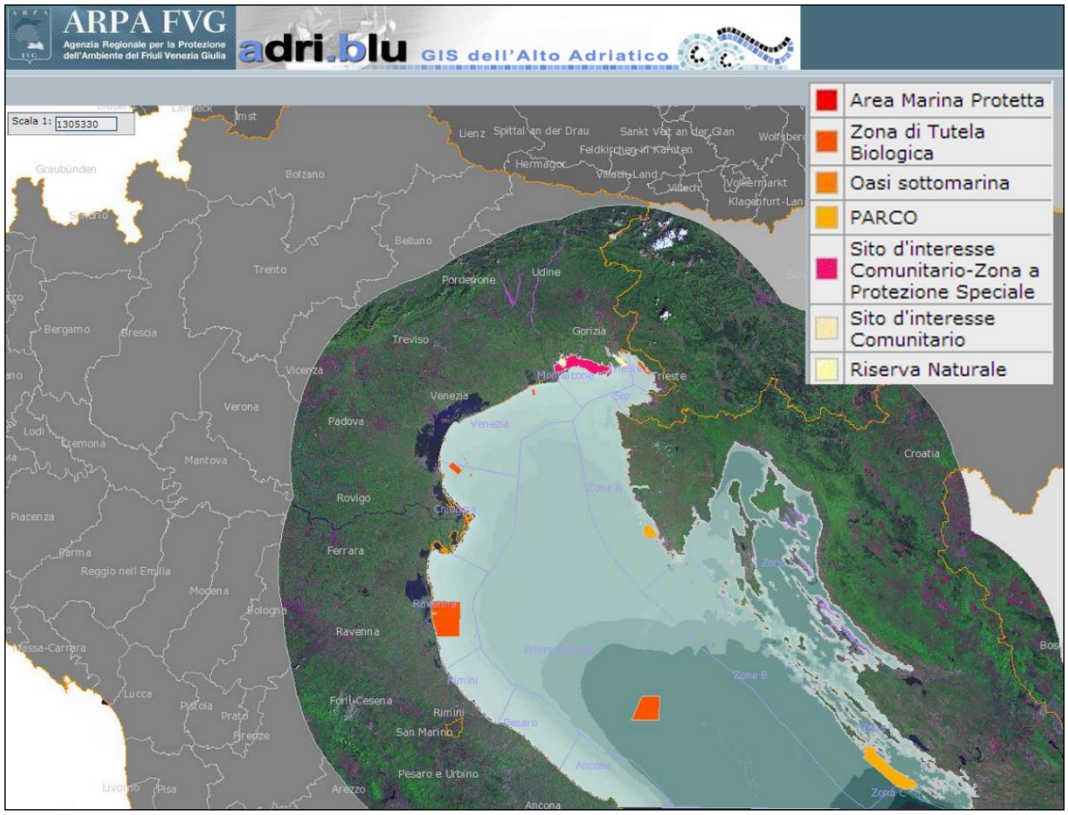


Figure 4-92 Protected areas in FA 1 (source: adri.blu ARPA FVG, http://mapserver.arpa.fvg.it/adriblu/map.phtml, last visit: 11/04/2014).

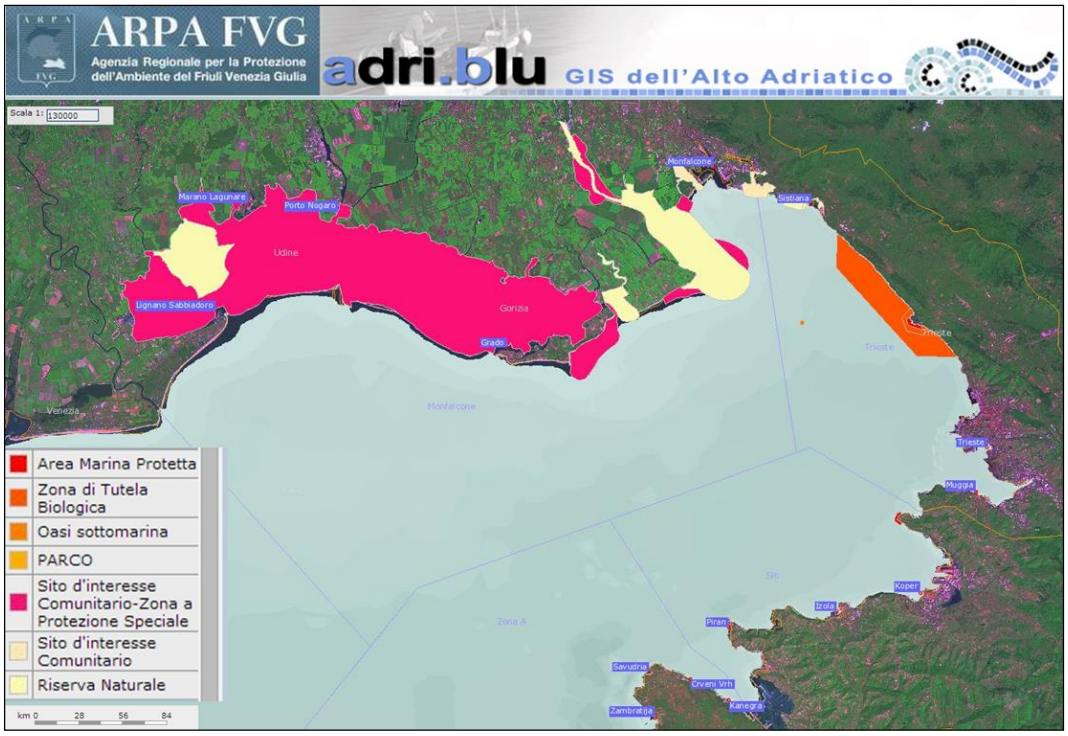


Figure 4-93 Details of the protected areas in Friuli Venezia Giulia Region and Slovenia (adri.blu ARPA FVG, http://mapserver.arpa.fvg.it/adriblu/map.phtml, last visit: 11/04/2014).

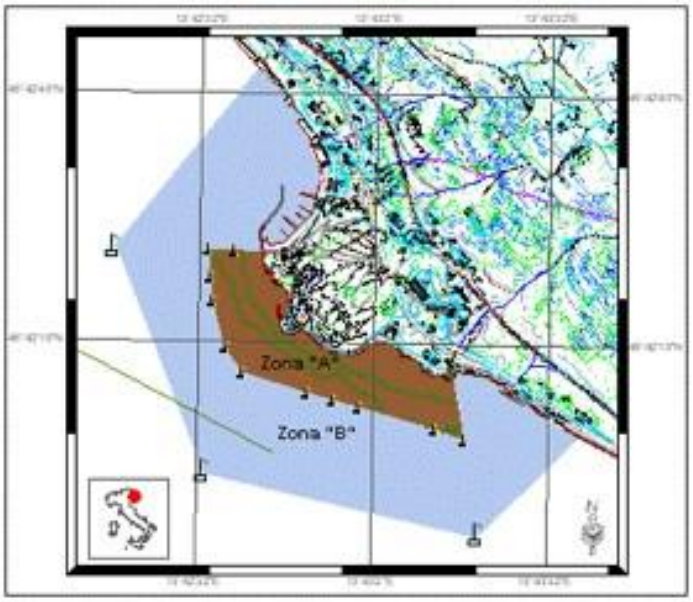


Figure 4-94 Miramare Marine Protected Area (www.riservamarinamiramare.it)

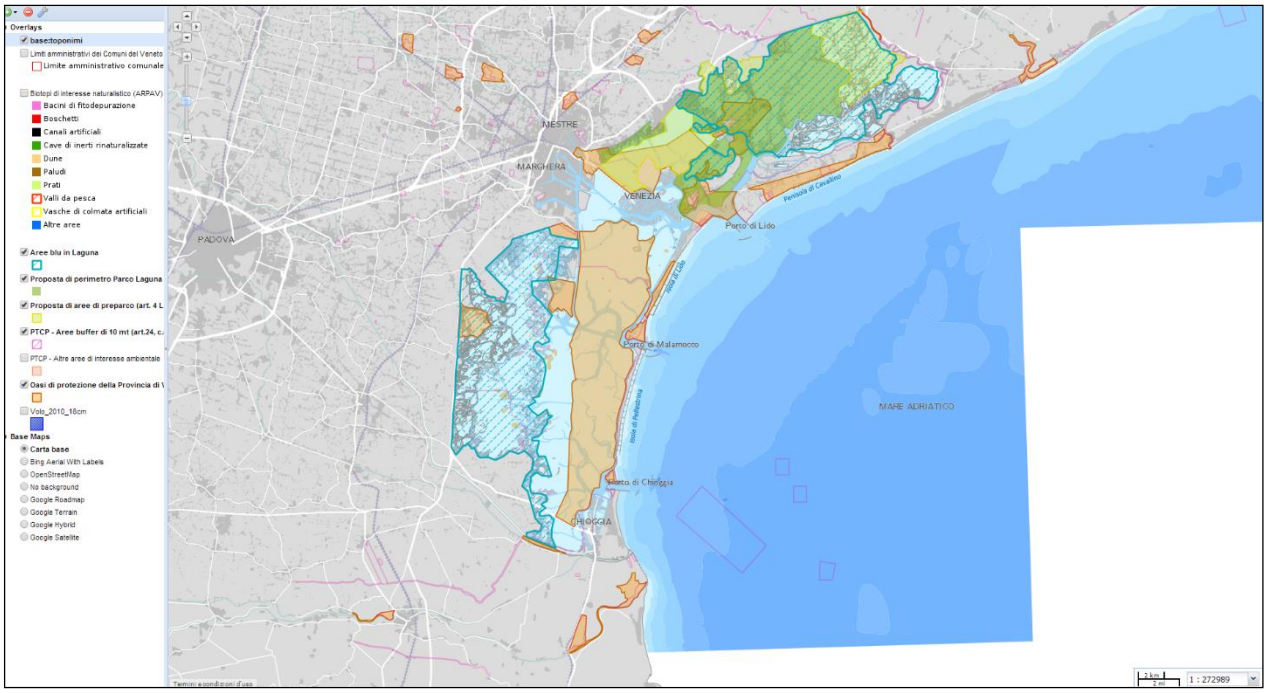


Figure 4-95 "Blue" areas, oasis and proposed protected areas in the Venice lagoon (http://cigno.atlantedellalaguna.it/maps/32/embed; last visit 30/4/2014)

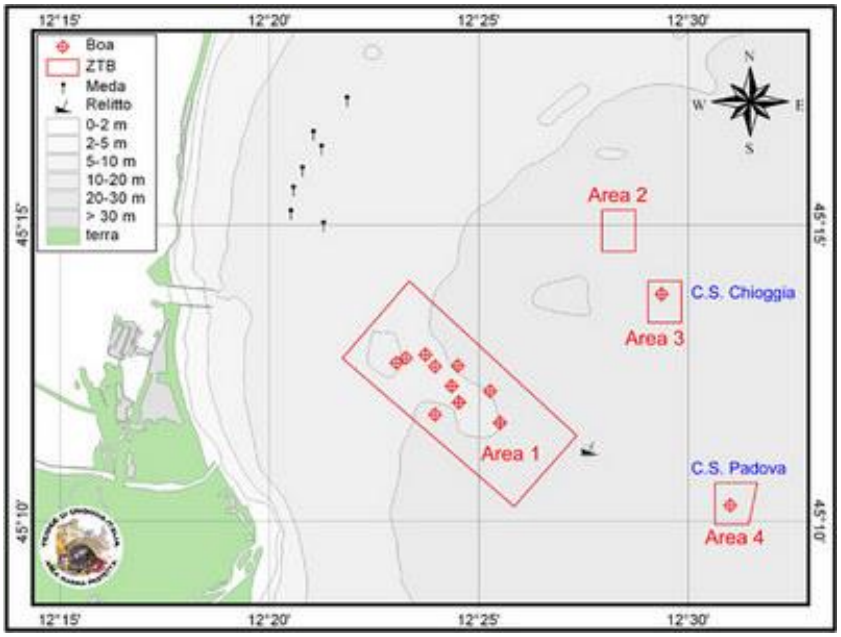


Figure 4-96 Tegnue di Chioggia ZTB = Zona di Tutela Biologica (Area of Biological Protection) Venice http://www.tegnue.it/

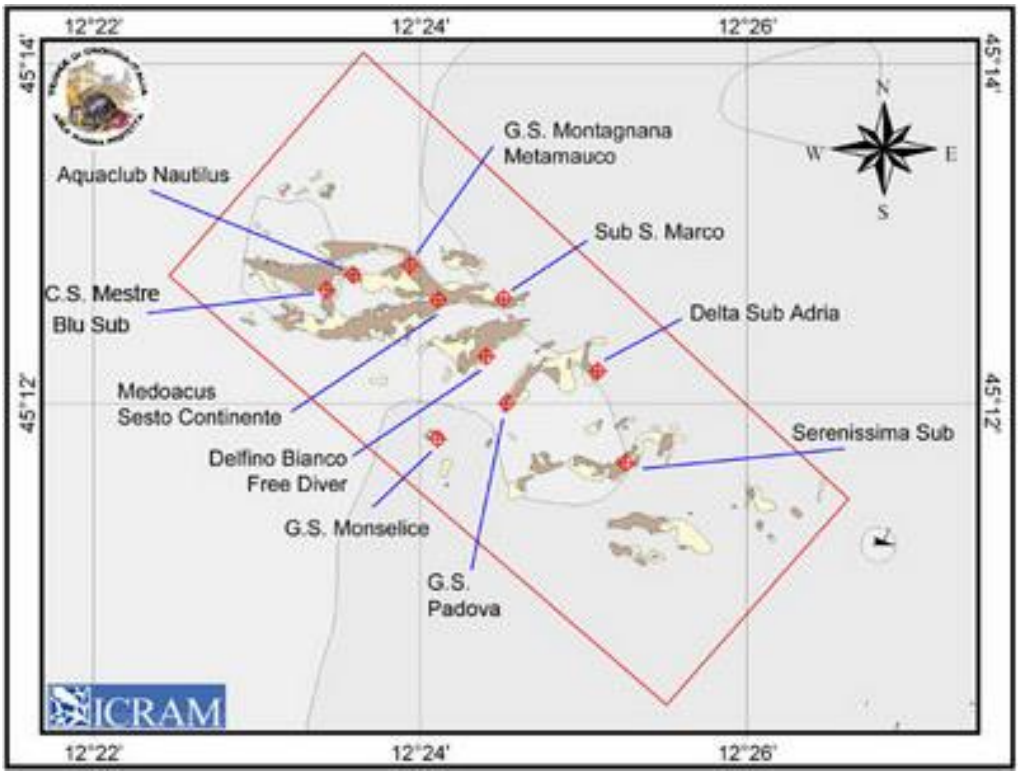


Figure 4-97 Tegnue of Chioggia http://www.progettomac.it/st_chioggia.asp

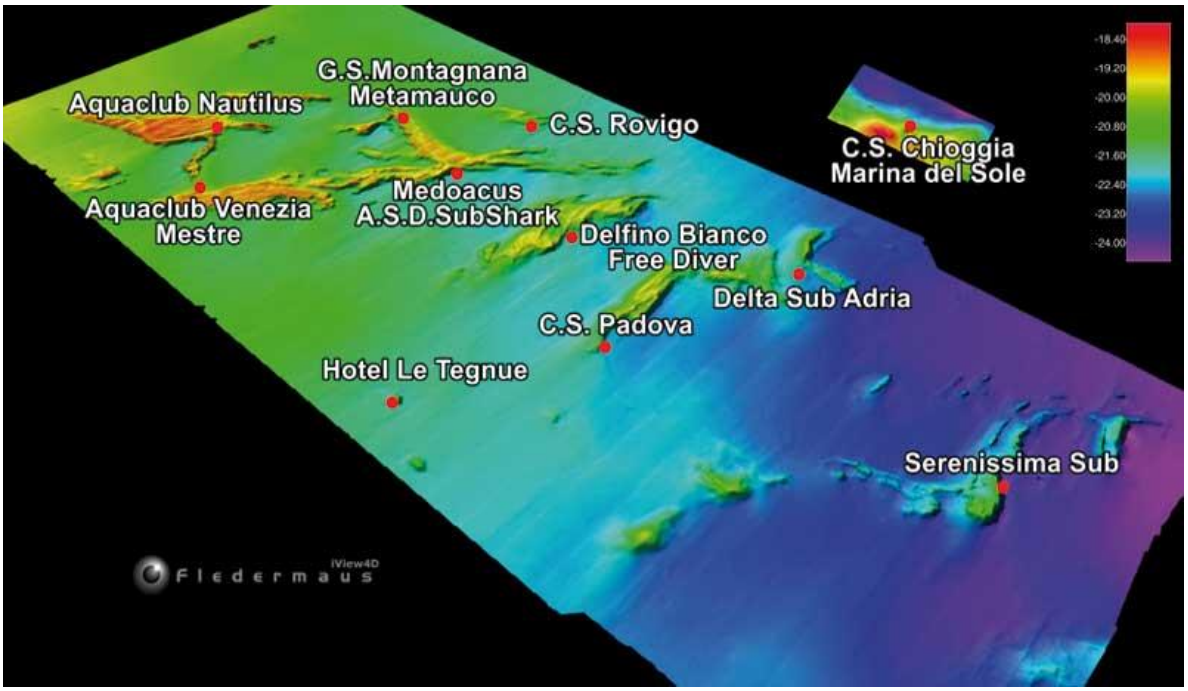


Figure 4-98 3D Map of Tegnue of Chioggia. Source: http://www.tegnue.it/cartografia.asp (last access 15.05.2014)

Figure 4-99 Tegnue di porto Falconera - oasi marina http://www.caorlotti.it/oasi-marina.html

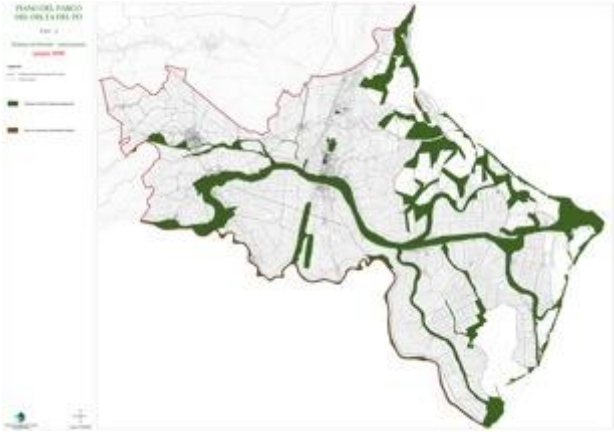


Figure 4-100 Regional Park Delta del Po Veneto

Figure 4-101 Regional park Delta del Po Emilia Romagna

Figure 4-102 National Park Brijuni

Protected areas in the Primorje- Gorski Kotar County

Islands and Coastal Region

The County of Primorje and Gorski Kotar is located in the western part of the Republic of Croatia and covers an area of 7,991 km2. The County's highly diversified area can be divided into three geographical regions: the island region, the coastal region and the highland region, each possessing its own particular features and points of interest. The marine area encompasses the greater part of the Kvarner Bay together with the Rijeka Bay, the Velebit Channel, the Vinodol Channel, and the Kvarnerić Bay, which separate the four major island groups of Krk, Rab, Cres and Lošinj. In addition to these four large islands (Cres 405.78 km2, Krk 405.78 km2, Rab 90.84 km2, Lošinj 74.68 km2), there are also several other smaller islands, as well as islets, crags and reefs. The County has a total of 55 islands, while the number of crags and reefs is harder to identify. The number of crags is estimated at more than 60 and the number of reefs, at more than ten. Each is, in itself, a separate world and eco-system.

The bountiful natural assets of the County's coastal and island regions are intertwined with the cultural heritage assets left behind by the people who populated this area in the past. These people and their turbulent histories have left a lasting impression on the landscape of the Kvarner islands and shores. Deforested and almost barren, rocky areas can be found, in particular, on the islands of Krk, Cres and Rab, and in the eastern parts of the coastal region. Parts of the Kvarner islands and shores that were once vibrant with life are today completely deforested and abandoned. The savage beauty of such landscapes can be seen in the barren karst plateau above the Baščanska Hollow in the southern part of Krk Island, as well as in the Kamenjak peaks on Rab Island, and in some wide areas of the Cres Island.

In the past, livestock was much more abundant in these regions than it is today. Small isolated villages and numerous shelters for herders are now abandoned, in poor condition or in such ruin that it is barely possible to tell where they were once located. In some areas, there still exists a dense network of terraces and small dales surrounded by dry-stone walls. This is evidence that once grapes and other crops were grown here, and that this was the site of a constant struggle with the forces of nature. Painstakingly and literally on their backs, peasants carried fertile soil to the terraces and dales, adapting them to natural forces, surrounding them with stone walls, and endlessly struggling against erosion, strong winds and drought. Recent

years, however, have seen the gradual reconstruction of these terraces; such is the case of the well-known terraces of Bakar.

Water - the provider of life on the karst of islands and the coast - quickly sinks underground, leaving on the surface only sparse oases such as karst ponds. Meanwhile, in the karst underground flourishes a special, soundless and peculiar living world abounding in endemic species and subspecies.

Traditional farming in which sheep-farming prevails is still practised on the Kvarner islands, and it is vital in maintaining the last population of griffon vultures, one of the most threatened birds in Europe. The Kvarner griffons are specific in that they build their nest on cliffs that rise up above the sea. The cliffs and rugged rocky regions of the Kvarner islands provide shelter to endemic flora and fauna, such as the stenoendemic Degenia velebitica, the Istrian bluebell, the thorny Jacquin's drypis, rare ferns such as the Kvarner spleenwort, plants specific to cliffs such as the Dalmatian knapweed, endemic insects and snails…

Other parts of the Kvarner islands and coast show a different, greener side. This makes the Dundo forest, a special reserve on the island of Rab and one of the most beautiful and well-preserved natural evergreen forests of holm-oak in the Mediterranean, all the more interesting to visit. Some areas have been heavily marked by human activities; although landscapes have not been destroyed, they have over the centuries been transformed into remarkable looking regions that are, to a greater or lesser extent, suited to people, domestic animals and cultivated plants. Sometimes a hidden gem can be found in the immediate vicinity of settlements or within the urbanised fabric of towns (the protected town parks of Opatija).

To preserve the natural assets of the County of Primorje and Gorski Kotar for the future, some thirty valuable areas have been proclaimed protected areas. All categories of protection (strict reserve, national park, nature park, special reserve, natural monument, important landscapes and monuments of park architecture) are present, with the exception of the category of regional park, which has only recently been introduced in Croatian legislation.

Also located within the County, the Risnjak National Park and the Učka Nature Park are managed by their respective public institutions, while the Public Institution "Priroda" is responsible for the management of all other protected area. This institution's primary task is to protect, maintain and promote protected areas for the purpose of protecting the genuine features of nature, ensuring the undisturbed development of natural processes and enabling the sustainable use of natural resources.

Let us take you now on a short stroll through the protected areas of the island and coastal regions of the County of Primorje and Gorski Kotar and we invite you to become an active participant in their conservation and protection.

Glavine - Mala luka (Kuntrep)

Although this ornithological reserve does not present a fully satisfactory solution to the problem of the declining griffon vulture population on the island of Krk, its magnificent landscapes and many other natural values justify its existence. If it were to succeed in providing more effective protection not only to the griffon vultures but also to other rare species of birds, reptiles, amphibians, invertebrates and to endemic plants and plant communities, as well as in providing genuine protection and care for its landscapes of unparalleled beauty, this special reserve could be capable of preserving priceless natural and scientific values for future generations.

Island of Prvić

This uninhabited island was declared a special reserve for its many special natural features, in particular, its rare flora and fauna that can be found in no other location in the Adriatic, and its utterly extraordinary, almost unreal and seemingly barren rocky landscapes battered by gale-force bora winds and salty water. Some naturalists are even of the opinion that this island deserves the status of a national park in the Kvarner archipelago!

Ornithological reserves on the Cres Island

- The Northern Reserve: the area between the Fojiška Bay and the Bay of Pod Predošćica (Kruna)
- The Southern Reserve: the area between the Bay of Mali Bok and the Bay of Koromačna (Pod Okladi)

Griffon vultures are magnificent birds with a wingspan of 2.4 to 2.8 metres. Watching them fly in groups, above the island of Cres, as they "comb" the land in search of food is an unforgettable experience. The Cres griffons are a phenomenon, because they are the only griffon population of the Kvarner islands that has not decreased in number, but has even shown an increase in recent decades.

The Dundo Forest

The Dundo Forest can be listed among the most beautiful and well-preserved holm-oak forests of the Mediterranean. This area has probably the longest tradition in the protection and conservation of forests among the mostly deforested islands of the Adriatic. We hope this special reserve of forest vegetation will continue to be a site of study for many future generations of foresters and natural scientists, and a site where nature lovers can come to enjoy the primordial world of Mediterranean forests.

The Glavotok Holm-Oak Forest

Interestingly, there are two reserves of exceptionally valuable, evergreen forest vegetation on the island of Krk (Košljun and Glavotok). Also interesting is the fact that both are linked to Franciscan monasteries and their diligent tenants. One is the holm-oak forest of Glavotok, listed among protected natural assets as a special reserve of forest vegetation. This is rather unusual, because it is an artificially planted forest and, according to Croatia's current nature-protection regulations, the status of forest park would seem more appropriate.

The Old Oak Tree near Sv. Petar of the Island of Cres

A protected, individual tree specimen, the old oak tree near Sv. Petar is an icon. Numerous legends and tales have been spun around this tree. A storm in 2003 almost marked its demise, and to restore the tree's stability threatened by a fissure in its truck, the crown of the tree had to be trimmed and rid of old branches.

Old Oak Trees in Guljanov Dolac near Crikvenica

The oaks in Guljanov Dolac are probably the oldest specimens of their kind in the Crikvenica region. Although it is likely that other oak trees can be found in the broader area, the care and the efforts of the Society of the Crikvenica Townspeople have been saved from oblivion the Guljanov Dolac oaks, as well as the historically valuable area of Kotor above Crikvenica.

Lopar

The Lopar Peninsula has had a stormy geological past, especially in recent times, when the action of water and winds created intriguing sand pyramids on its surface. An array of Eocene fossils can be found, as well as artefacts remaining from Palaeolithic and Mesolithic hunters, such as spears, scrapers, axes and arrows. Made from a hard and rare type of rock that does not naturally occur on the island of Rab, these artefacts are evidence of the ancient migrations of groups of Stone Age hunters. Plans are underway for creating a geological garden on the Lopar Peninsula with geological educational trails, panoramic spots and geological points of interest, which would operate within the framework of a broader geo-park of Rab Island.

Komrčar

Adjacent to the ancient walls of the town of Rab is the Komrčar Park with its luxurious green crowns of Aleppo pines and other Mediterranean vegetation. This pearl of nature in the immediate vicinity of the town of Rab owes its existence to the vision and diligence of Pravdoje Belija, a forest superintendant.

Košljun

There are still on-going debates among natural scientists as to whether the holm-oak forest on the island of Košljun is a wild-growth or planted forest. Long-time guardians of the forest, the Franciscan monks have succeeded in preserving it for present generations. On this islet, the forest is growing at the limits of its natural incidence. Whatever the case, this should not prevent each visit to Košljun from being a first-rate natural and spiritual experience.

Čikat

Today, the island of Lošinj is mostly covered in forests. However, it has not always been like this. In the past, it was predominantly covered in deforested, rocky grasslands as elsewhere in the Cres-Lošinj archipelago. Through the activities of the Society for Forestation and Beautification of Mali Lošinj, this part of the island underwent considerable change. Since then, it boasts a lush Aleppo pine forest. The pines provide shade for tourists in search of relaxation and a clean sea, and their needles and the evaporation of their resin fragrance the air.

Pod Javori

Anyone vacationing in Veli Lošinj should try to spend at least a few hours in the Forest Park Pod Javori. During the summer, the best time to visit the park is in the early morning or early evening when the heat is bearable. Visits to the park are also interesting in the other seasons, with each visit being a new experience: the blossoming of maritime cyclamen in the early spring to the concerts of crickets and cicada in the height of summer. The deafening clicking of crickets greets us from high up in the trees, and to our surprise, we find many molted skins, discarded by cicada.

Angiolina Park in Opatija

The end of winter and the first days of early spring with draw out the beautiful camellia blossoms in the Angiolina Park. Visitors will also remember the lush groves of scented laurel and many of the other, 150 or so types of decorative vegetation. At the time they were created, the parks of Opatija were considerably richer in species, in particular, in exotic and vulnerable sup-tropic rarities brought back by seafarers from far away lands. Fortunately enough, even today we can still relish the horticultural diversity of Opatija's parks.

Margarita Park

Perhaps less known than the Angiolina Park, the Margarita Park draws it special charm from its preserved examples of indigenous forest flora - old downy oaks - that now mingle with exotic Californian incense cedars. A pleasant walk away from the Margarita Park is the Vrutki promenade and the Carmen Sylva promenade.

The Stone Pine in the Bay of Žalić on the Island of Lošinj

In the County of Primorje and Gorski Kotar, this densely branched, stone-pine tree is the only specimen of its kind to have the status of a monument of park architecture. It is located in the vicinity of the Forest Park.

The Dolphin Marine Reserve is a special reserve located in the Lošinj sea area (temporary protection).

The only dolphin reserve in the Mediterranean, it provides the population of bottlenose dolphins with a singular habitat. With a bit of luck and some patience, visitors can enjoy watching the always playful dolphins. Dolphins, however, are not the only natural value of this reserve; rare marine turtles can be found here, and the widespread underwater fields of Posidonia, a marine flowering plant, provide shelter to numerous fish and other sea creatures.

NAME OF PROTECTED NATURE AREA	IUCN CATEGORY OF PROTECTED NATURE AREA	SURFACE AREA IN HECTARES	YEAR OF PROCLAMATION	IN THE TERRITORY OF TOWN/MUNICIPALITY
STRICT RESERVE				
Bijele and	I	1 175	1985.	Novi Vinodolski,

Samarske stijene				Mrkopalj
SPECIAL ORNITHOLOGICAL RESERVE				
Glavine – Mala luka	I	1 000	1969.	Baška
Island of Prvić	I	7 000	1972.	Baška
Fojiška – Pod Predošćica	I	550	1986.	Cres
Mali bok – Koromačna	I	900	1986.	Cres
SPECIAL RESERVE OF FOREST VEGETATION				
Dundo Forest	I	106	1949.	Rab
Glavotok	I	1	1969.	Krk
SPECIAL MARINE RESERVE – PREVENTATIVE RESERVE				
Part of the Cres and Lošinj area	I	52 576	2006.	Mali Lošinj
FOREST PARK				
Komrčar	IV	10	1965.	Rab
Košljun	IV	6	1969.	Krk
Čikat	IV	236	1992.	Mali Lošinj
Pod Javori	IV	39	1993.	Mali Lošinj
IMPORTANT LANDSCAPE				
Lopar	V		1969.	Lopar
NATURAL MONUMENT				
NATURAL GEOMORPHOLOGICAL MONUMENT				
Zametska cave	III	…	1981.	Rijeka
NATURAL GEOLOGICAL – PALEONTOLOGICAL MONUMENT preventative reserve				
Jama Vrtare male	III	0.031	2009.	Crikvenica
INDIVIDUAL TREE SPECIMEN				
Sveti Petar, old aok tree	III	-	1997.	Cres
Old oak trees in Guljanov Dolac near Crikvenica	III	-	2002.	Crikvenica
MONUMENT OF PARK ARCHITECTURE				
PARK				
Town parks in Opatija Angiolina park Margarita park	-	5	1968.	Opatija

INDIVIDUAL TREE SPECIMEN				
Stone Pine in Bay of Žalić on the Island of Lošinj	-	-	1976.	Mali Lošinj

Table 4-61 List of protected nature areas managed by the Public Institution „Priroda" in the County of Primorje and Gorski Kotar

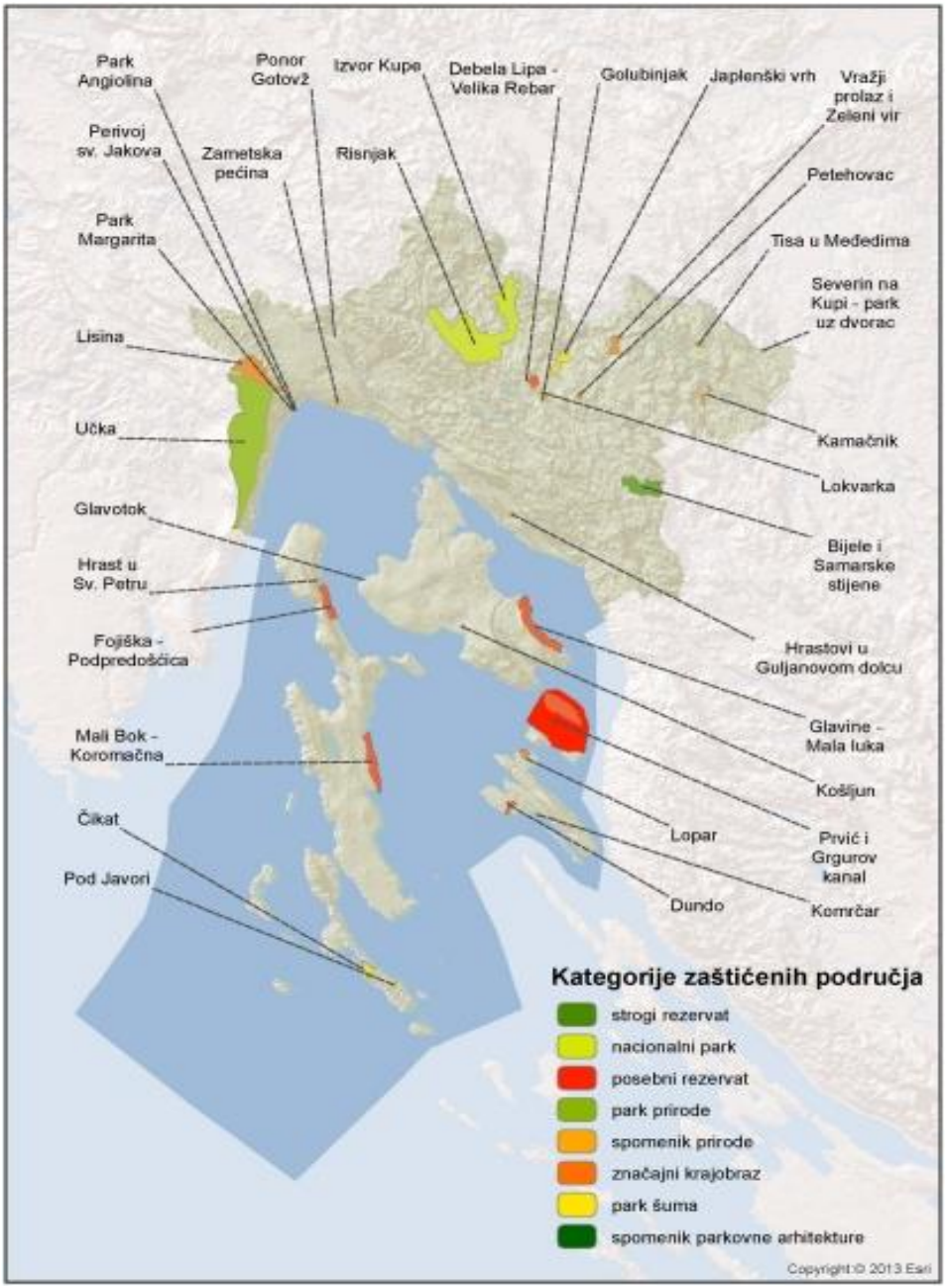


Figure 4- 103 Map of protected nature areas

4.7.2 Focus Area 2

According to the "habitat" Directive 92/43/EEC and the delimitation of the areas (sites) which would contribute to the European NATURA 2000 network, the total number of sites mapped for

the implementation of the Directive in Ionian Sea is 15 (Zenetos *et al*., 2010). The National Marine Park of Zakynthos and Strofades Isl. is the only marine area with an existing legal protection framework in the Greek Ionian Sea. Zakynthos is one of the most important sea turtle nesting areas in the Mediterranean. The area features a variety of habitats, including sand dunes and *Posidonia oceanica* beds. It is home to the critically endangered Sea daffodil (*Pancratium maritimum*), and submerged reefs as well as hundreds of species of flora and fauna, some of which are of great importance. A resident population of the critically endangered species the Mediterranean monk seal *Monachus monachus* is also present on the west coast of Zakynthos Although some coastal and marine areas of Kefalonia and Ithaca islands were *ad hoc* included in the Natura 2000 network in 2002, effective management and conservation actions are yet to be addressed.

Despite this regime, the area is still subject to numerous human-induced impacts that impose serious hinders to the successful reproduction of the endangered marine turtle *Caretta caretta*. Much effort is currently put into public awareness and costal management plans aiming to reduce the severe effects of the tourist development that is massively expanding along the sandy beach of Laganas, an area that is ranked among the most important Mediterranean nesting sites of *Caretta caretta*. In addition, waste disposal and illegal fishing are issues that have not yet been thoroughly resolved. The Inner Ionian Archipelagos - a Natura 2000 Site of Community Importance- used to be one of thelast places in the central Mediterranean Sea where abundant common dolphins would be found (Politi *et al*. 1999).

The Amvrakikos wetland located in Western Greece is one of the most ecologically important lagoon systems in the Mediterranean, covering about 250 km^2, including more than 20 coastal lagoons. Amvrakikos it is protected by the convention of Ramsar, included in the Natura 2000 network, and considered as Special Protection Area (SPA), Wildlife Refuge, and Important Bird Area. Amvrakikos complex is one of the largest wetland areas in the Mediterranean Europe, characterized by very diverse wetland habitat types and comprises critical habitats for at least 47 Annex I bird species, including the globally threatened *Pelecanus crispus*, *Phalacrocorax pygmaeus*, *Aquila clanga*, and *Numenious tenuirostris*. One of two breeding colonies of the globally threatened Pelecanus crispus is resident to Amvrakikos lagoons. The breeding population of this species in the lagoons represents about 20% of the respective total European populations and 3.5 % of the global one. Several commercial fish species (*Anguilla anguilla, Gobius niger, Sparus aurata, Dicentraurchus labrax*) are exploited traditionally in the lagoons.

The major anthropogenic pressures imposed on the lagoons of Amvrakikos concern mostly modification of the lagoon's hydrological regime (creation of hydroelectric dams, fresh water abstraction and dikes). Organic and chemical pollution water is not severe and arises mainly from agricultural and agrochemical activities. Fish farming and urban development have also degraded large parts of the lagoons.

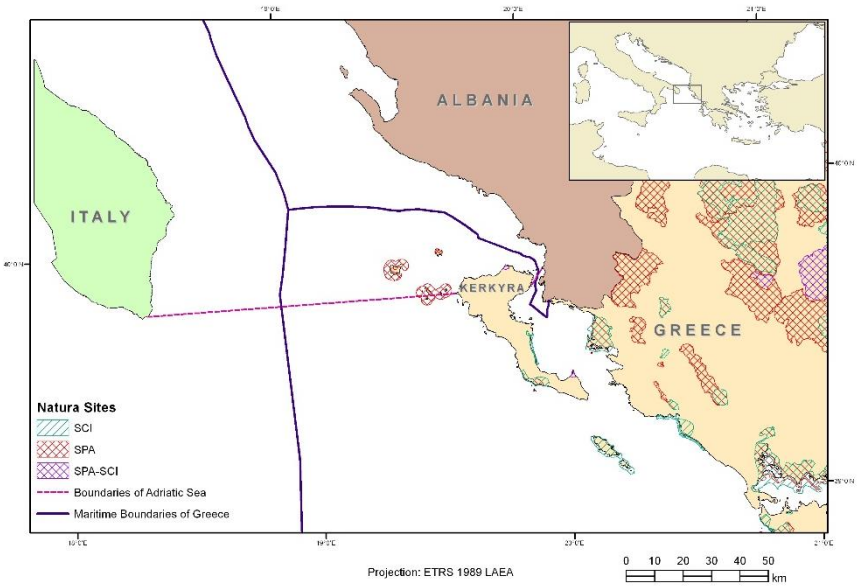
The island complex of Diapontia is located in the northwestern part of Ionian Sea and it is a marine Important Bird Area proposed also to be declared as SPA.

In the Epirus Region the Kalamas River delta is included in the Greek Natura network under the codes GR2120001 (SCI) and GR2120005 (SPA) (Table 4-62). In the Ionian Island Region three coastal lagoons and a marine coastal area in Corfu are included in the Greek Natura network under the codes GR21230001, GR21230002, GR21230003 and GR21230005 (Figure 4-103).The Diapontian Islands are also proposed as SPAs mainly for the protection of sea birds.

Name/Region	Natura code	coordinates	Surface and coastline length
Kalamas River Delta Epirus Region	GR2120001 GR2120005	39° 32' 20° 11'	Total surface (ha) 8541,93 Marine surface (ha) 1543,80

Status SCI/SPA			Coastline (Km) 35
Antinoti lagoon Status SCI/SPA	GR2230001	39º 49' 19º 52'	Total surface (ha) 187,95 Marine surface (ha) 23,31 Coastline (Km) 4
Korission lagoon Status SCI	GR2230002	39º 27' 19º 55'	Total surface (ha) 2292,38 Marine surface (ha) Coastline (Km) 15
Lefkimi lagoon Status SCI/SPA	GR2230003	39º 27' 20º 04'	Total surface (ha) 242,97 Marine surface (ha) 86,39 Coastline (Km) 6
Eastern coasts of Corfou (from Kanoni to Mesogi) Status SCI	GR2230003	39º 33' 19º 55'	Total surface (ha) 888 Marine surface (ha) 888 Coastline (Km) 21

Table 4-62 Natura network sites and their characteristics in the Greek part of focus area 2



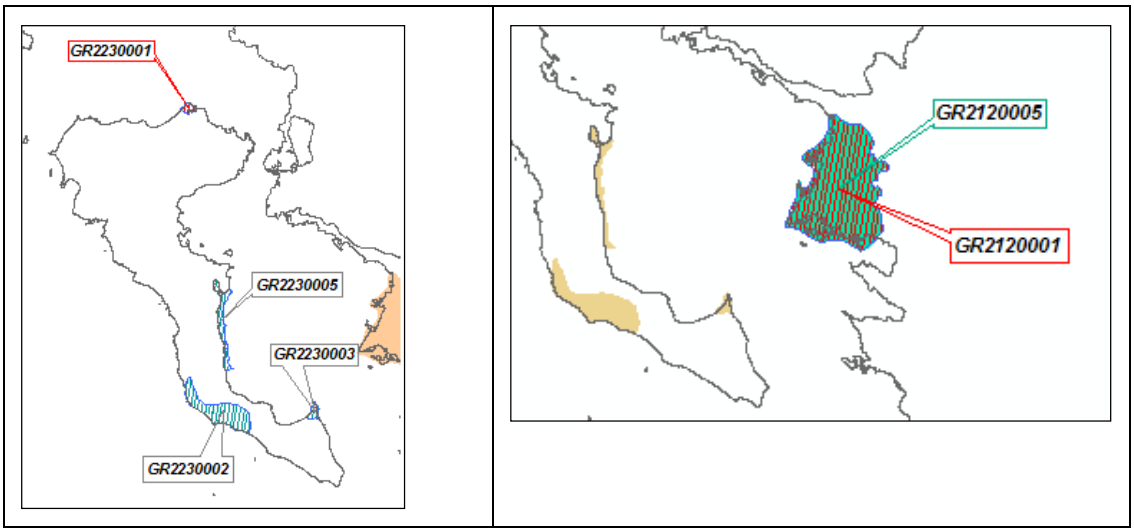


Figure 4-104 Marine Protected Areas of the Greek Natura network in FA2

In Albania, the Butrinti lagoon together with its surrounding wetland complex was designated as Ramsar site in 2003, as an internationally Important Plant Area (IPA), and an Important Bird Area (IBA). The Albanian part of this area, especially the Karaburuni Peninsula – Sazani Island, has also been identified as a priority area for marine biodiversity conservation by many recent national and international environmental reports. In January 2006 the General Fisheries Commission for the Mediterranean (GFCM) recommended prohibition of towed gears (dredges and trawl nets) in the deep-water coral banks of SML. To protect these deep areas, the GFCM has created the new legal category of "Deep-sea fisheries restricted area". The GFCM recommends members to notify the appropriate authorities to protect these particular habitats. The institutional process for a marine protected area beyond territorial waters in the northern Ionian Sea should be carried out in the context of the Barcelona Convention Protocol relative to Specially Protected Areas and Biological Diversity in the Mediterranean (SPA Protocol), asimplemented for the Ligurian Sea Cetacean Sanctuary in 1999 by France, Italy and Monaco on the Mediterranean High Seas (Mastrototaro et al., 2010). The Karaburun peninsula-Sazani Island is a MPA since April 2010 and has had a neighbouring terrestrial Managed Nature Reserve since 1968. The Tremiti Islands (N of the Gargano Peninsula), Torre Guaceto (N of Brindisi), the coast from Otranto to Santa Maria di Leuca (legislation underway), and Porto Cesareo (on the Ionian Sea). One MPAs has been designated on the Albanian Coast (Sazani Island - Karaburun Peninsula). Five additional areas along the Ionian coast of Albania have been proposed as potential MPAs by the National Biodiversity Strategy and Action Plan (NEA/AKM, 1999). In Greece, the MPA of Zakinthos was implemented by 1999.

It is important that detailed habitat maps are available for the three MPAs in Apulia and that of Zakinthos. In Albania, only a map of coastal habitats is available at the moment. Results show that in all cases zonation is never correctly designed and vulnerable habitats are systematically outside the zones under total protection. Fraschetti et al. (2009) used site selection algorithms along the Otranto and S. Maria di Leuca coast, and showed that despite widespread human influence, identification of parts of habitats to be protected from direct human disturbance as core no-take areas is still possible using the inclusion of 10 and 30% of low and high priority habitat within reserves, respectively, as a conservation target.

Implementation of MPAs with limited protection schemes that also include several small no-take areas may represent a feasible strategy for the conservation of Mediterranean coastal marine habitats. Moreover, MPAs could be combined with coastal zoning of activities as a means of further controlling effects over broader areas and allowing for recovery of degraded areas. MPAs of Apulia Region are listed in Table 4-63.

The MPA of Torre Guaceto (Brindisi), instituted in 1991 and embedded into a human-dominated landscape, is a rare example of well-managed MPA where adequate enforcement determined target fish recovery. This MPA is also SPAMI site. This MPA provides an excellent

opportunity to analyse the effects of protection on subtidal benthic assemblages, through the comparison of protected and unprotected locations. Clear differences between protected and unprotected assemblages have been revealed, with invertebrates and canopy forming algal species recovering within the MPA, whereas unprotected locations are still characterized by barren habitats. Lower temporal variability in protected assemblages than in controls has also been observed, demonstrating that, at least at a local scale, conservation can reverse the decline of marine biodiversity, and enhance community stability. Our results suggest that, even though marine benthic assemblages can be significantly affected by human activities, these trends are still reversible through effective ecosystem management. Here, fishing was completely banned in the entire MPA from 2001 to 2005. In 2005 fishing resumed within the buffer zone surrounding no-take zones. From 2005 to 2008, artisanal professional fishing was monitored and CPUE values (kg km-1 of net) within the buffer MPA compared with those obtained outside (where fishing grounds are fully open to professional and recreational fishing) (Guidetti et al., 2010). Catches were higher inside than outside the MPA. Overall assemblage structures were significantly different inside and outside the MPA, with the two most important commercial species, i.e. Mullus surmuletus and Scorpaena scrofa, accounting for about 40% of the catch inside and about 20% outside. Average CPUE outside the MPA was approximately 10 kg km- 1 of net and remained quite stable over the years. This study shows that the use of fishing co-management protocols within MPAs that properly involve local fishermen in the decision process is a promising approach to balance fishermen's and conservation needs. Also Porto Cesareo is a SPAMI site and the MPA of the Tremiti Islands are currently in the process to obtain the same acknowledgement. In both MPAs an increased effort by local managers is slowly changing local attitudes.

These, together with the SCIs, make that about the 70% of the Apulian coast results subjected to some forms of protection, although with very different management forms. In facts, Apulian marine SCIs are still without any form of management, making their role in protection very limited, and have been established mostly based on the presence of *Posidonia oceanic*a. Recently, the distribution of coralligenous assemblages along Apulian coasts is available for the Sites of Community Importance (SCIs) (Table 4-64) and information on the status of coralligenous outcrops has been gathered through the project BIOMAP, funded by the Apulian Region.

MPA Name	Surface (ha)	Zoning	WebSite
Isole Tremiti	1510,43	A,B1,B2,C	http://www.parcogargano.gov.it
Porto Cesareo	16741,42	A1,A2,B1,B2,C	http://www.ampportocesareo.it
Torre Guaceto	2210,65	A1,A2,B,C	http://www.riservaditorreguaceto.it

Table 4-63 Marine Protected Areas of the Apulia Region

SCI code	Name	Surface (HA)
IT9150011	Alimini	2308,82427
IT9150003	Aquatina di Frigole	3002,98791
IT9140001	Bosco Tramazzone	4280,55343

IT9130003	Duna di Campomarino	1693,69032
IT9110011	Isole Tremiti	30,0266
IT9150032	Le Cesine	1337,58046
IT9140002	Litorale brindisino	6832,41782
IT9150015	Litorale di Gallipoli e Isola S. Andrea	6605,52327
IT9150009	Litorale di Ugento	6046,04813
IT9150008	Montagna Spaccata e Rupi di San Mauro	1103,04946
IT9150013	Palude del Capitano	2135,58933
IT9150027	Palude del Conte Dune di Punta Prosciutto	4987,48561
IT9150028	Porto Cesareo	45,78693
IT9150034	Posidonieto Capo San Gregorio - Punta Ristola	270,57243
IT9130008	Posidonieto Isola di San Pietro - Torre Canneto	3147,73301
IT9120009	Posidonieto San Vito - Barletta	12458,75077
IT9150006	Rauccio	4886,25267
IT9140003	Stagni e saline di Punta della Contessa	2644,09951
IT9130001	Torre Colimena	1702,81735
IT9140005	Torre Guaceto e Macchia S. Giovanni	7658,86394
IT9150025	Torre Veneri	1358,22605

Table 4-64 SCI sites of the Apulia Region

4.8 Sand extraction

A. Correggiari, T. Papatheochari, S. Niavis, S. Belošević

Shorelines and coastal development will be more vulnerable to hazards in the future. Need for offshore sand for nourishment will increase but volumes for sustainable shore protection are uncertain for many regions.

Beach nourishment with sand derived from river or coastal borrow sites has been the preferred most common method of shoreline stabilization method in Italy for several decades. This practice has increased rapidly over the last period to the point that the search of alternative sources of sand became an issue. Better understanding of the shelf geology can aid our ability to plan for sustainable use of offshore sands.

At this stage sand deposit and extractions sites are mapped for the Italian continental shelf, while the set up of a complete picture for AIM is ongoing and will be included at a later stage.

On the Italian shelf the amount of marine dredge material in 17 years (18.1 milion of cubic metres, data from ISPRA 2012) is comparable to the dredged material of United Kingdom in a year or the half of the dredged material in the same period in Holland (data from ICES WGEXT REPORT 2007,2011) (Figure 4-104).

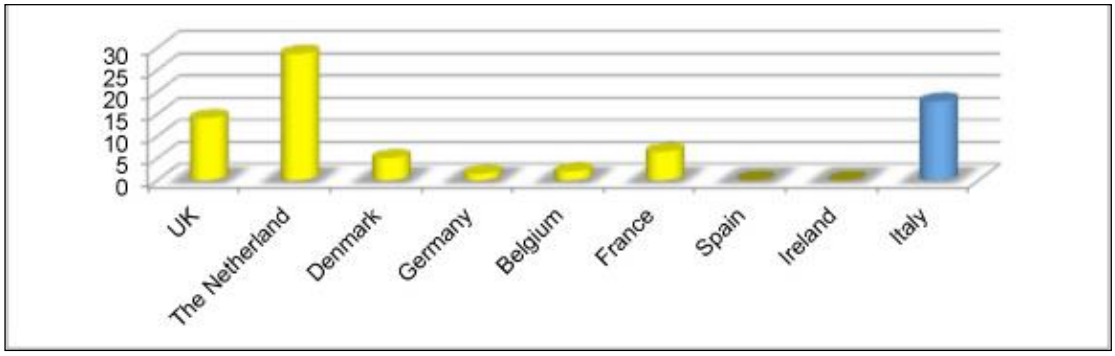


Figure 4-105 A summary of volume marine sediment extraction (m3x106) for the OSPAR Region in 2007 (ICES WGEXT REPORT 2007) compared to the amount extracted in Italy in 17 years, since 1996. Italian data from ISPRA Annuario dati Ambientali 2012.

The total amount of offshore sand dredged in Italy is reparted in Italian continental shelf according to Figure 4-106 and it has been used for beach nourishment in various locations, as reported in Table 4-65.

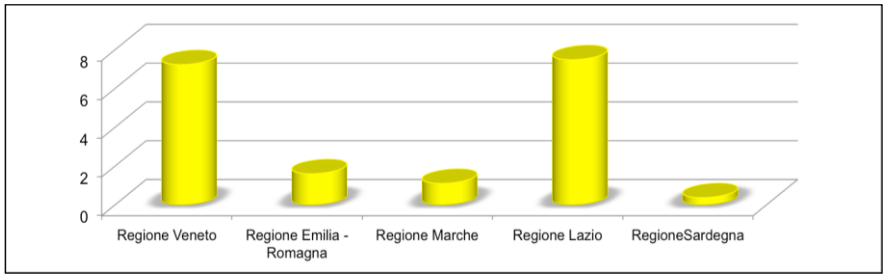


Figure 4-106 Total amount of offshore sand dredged from the Italian shelf for each region since 1996 (17 years) (m3x106). Data from Annuario dati Ambientali 2012 ISPRA.

In the Mediterranean shelves the research of offshore sand deposits and their exploitation are not of the same importance as those carried out in the North Sea and in the Atlantic European seas. The amount of sand available in mediterranean shelves is not well known yet and only where a coordinate program of surficial geologic mapping has been carried on is possible to quatify the sand resource. Compilation of the surficial marine geological maps, using high-

resolution seismic profiles, with the addition of new narrow grid detailed geophysical suveys and sediment vibracores in targeted locations, is an effective way to evaluate potential borrow sites on any continental shelf.

Offshore sand borrow site in the Adriatic sea(where /Name /administration)	**Year**	**Dredged amount**	**Nourishment beach sites**	**Volumes of sediment placed in each beach**
		m^3		**m^3**
Adriatic sea / offshore Tagliamento r. and Adige r. / Magistrato alle acque di Venezia	1995-1999	7.231.570	Litorale di Pellestrina (VE)	4.097.119
	1994-1999		Cavallino (VE)	1.921.604
	1999-2000		Jesolo (VE)	565.362
	1999-2003		Jesolo - Cortellazzo (VE)	351.000
	2004		Eraclea (VE)	296.485
	2012-2013		Caorle - Eraclea (VE)	300.000
Adriatic Sea / offshore Ravenna (C1 area) / Emilia-Romagna Region	2002	799.850	Misano Adriatico (RN)	165.300
			Riccione sud (RN)	253.750
			Igea Marina (RN)	65.200
			S. Mauro Pascoli - Savignano (FC)	27.000
			Gatteo a Mare (FC)	28.000
			Zadina (FC)	43.500
			Milano Marittima nord (RA)	176.100
			Lido di Classe - Foce Bevano (RA)	41.000
Adriatic sea / offshore Civitanova Marche (B1area) / Arenaria s.r.l. Abruzzo Region and Marche Region	2006	1.106.039	Pineto Silvi (TE)	64.245
			Martinsicuro (TE)	184.850
			Montesilvano (PE)	93.106
			Francavilla (CH)	159.325

			Casalbordino (CH)	85.162
			Civitanova Marche (MC)	52.670
			Fermo (FM)	65.375
			Pedaso (FM)	3.849
			Campofilone (FM)-Massignano (AP)	89.833
			Cupramarittima (AP)	58.098
			Grottammare (AP)	62.220
Adriatic sea/ offhore Ravenna (C1 and A areas) / Emilia-Romagna Region	2007	825.349	Punta Marina (RN)	189.869
			Misano Adriatico (RN)	149.000
			Riccione sud (RN)	105.065
			Igea Marina - Rimini nord (RN)	105.788
			Cesenatico nord (FC)	78.391
			Milano Marittima nord (RA)	90.108
			Lido di Dante (RA)	107.128

Table 4-65 Total amount of offshore sand dredged from the Adriatic Italian shelf (in 17 years) and volume of desplaced sand in each coastal site (data from Annuario dati Ambientali 2012 ISPRA).

Geologic factors control the location of offshore sand resources. Geophysical studies to locate potential borrow areas, identify sediment quantities, investigate sediment characteristics, and rank candidate sites are usually undertaken in multiple phases. The method draws together local geological information and data to generate the final sand search deliverables. The transgressive offshore sand bodies, which represent the remains of ancient beaches , are now one of the best resources for the coastal nourishment. In fact, the submerged sand deposits, progressively withdrawn from the coastal system during the phases of raising eustatic sea level, returning in the beach dynamic system allowing it to compensate, at least in part, the reduction of sediment input caused by human impact.

Since the ’80 the Italian Adriatic shelf has been studied to identify potential sand deposits available for extraction. During the last decades the increasing amount of data acquired by ISMAR CNR provides unique opportunities to summarize knowledge of geology and shelf geomorphology with existing geotechnical and geophysical data that facilitate identification of sand resources. Information about the geology of adriatic shelf regions, the characteristics of the seafloor and samples comprising the seafloor and subbottom have been aquired by ISMAR CNR as the result of several national and international projects included the Geological Adriatic Map (at the 1:250000 scale). This kind of understanding abbreviates the need to conduct random geophysical and sampling surveys over large sector of the seabed and is more efficient and economical because only potential deposits are targeted.

Pleistocene/Holocene relative sea level rise submerged a wide portion of the northern and central Adriatic paleoalluvial plain has been progressively drowned. For each step of the relative sea level rise a barrier lagoon system has been identifed and the amount of sand for the italian side of the orthern shelf has been quantified. The potentially sand resources are available to a confined area in the central portion of the basin, from 20 to 120 m water detph, not covered by the mud belt of the recent Adriatic prodelta wedge. Some types of offshore sites can be described as linear sand bodies, including remnant shoal features, ebb or flood tidal shoals, drowned barrier islands, oblique sand ridges, longshore bars, trough sand accumulations, and migratory sand spits attached or unattached to tidal inlets. The average grain size of the Adriatic sand resouce is fine sand, well to moderately well sorted.

4.8.1 Focus Area 1

The Adriatic available borrow sand deposits lays in patches inside paleo-barrier lagoon systems and comprise sediment classified as fine sand (D_{50}=0,160 mm) well to moderately well sorted. The mineralogical and chemical composition of Adriatic sand deposits classifies them as litharenites, with a variable mixture of cabonates, and silicates. Carbonates occurred in sediments as detrital granules of calcite or dolomite frequently associated with shell fragments.

Three example of of sand research results are shown in Figure 4-108, Figure 4-109, Figure 4-110, Figure 4-111. The first one comprise several patches of transfressive deposits with positive bathymetry at 80- 90 m water depth in central Adriatic (Figure 4-108). They represent a reworked complex coastal wedge with barriers lagoon environment dated around 14-16 calibrated kyr BP (Correggiari & Cattaneo, 2009). The second one is represented by another group of transgressive deposits offshore Emilia Romagna region already used as borrow sites for beaches nourishment (Figure 4-109) (Correggiari et al . 2011, Preti, 2002). Several outcrops of trangressive lithosomes, located from 36 m to 42 m water depth, has been dated between 8 to 12 calibrated kyrs BP. The third relict system of starved and reworked sand deposits is located offshore northern coast of the Adriatic basin and has been studied by a collaborative project by Regione del Veneto and ISMAR CNR Bologna with geophysical and geognostic surveys (Figure 4-110) (Correggiari et al 1996; Cecconi & Ardone, 2003).

It is important to note that while the majority of potential Adriatic borrow deposits identified consist of ridges and remnants of barrier lagoonal system, in the future it is likely that the range of deposit types will be expanded to include paleo-channels, paleo-deltas, and other buried sand deposits. The volume of the entire potental fine sand available reservoir outcropping in the italian portion of the adriatic shelf seafloor has been extimated in ca. 270 $x10^6$ cubic metres.

Most of the exploitable sand deposits in the Adriatic are patchy coastal lithosomes originated and reworked during the last sea level rise and their characteristics are :

1) Max thickness of sand deposit 3 m
2) Lithoarenites (silicates + carbonates, including shell debris)
3) Mean grain size: 0.160 mm (fine sand), well sorted

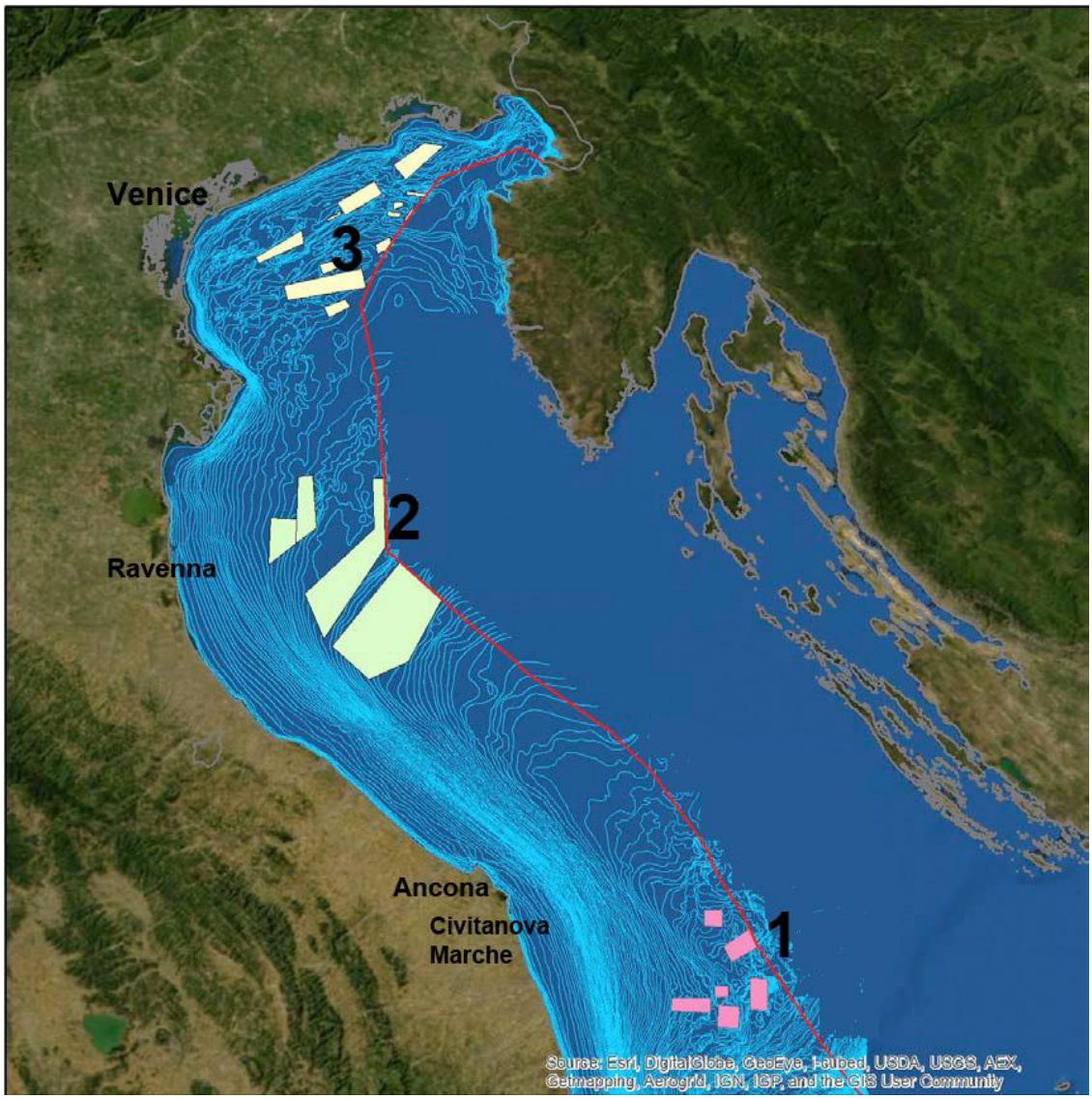


Figure 4-107 Location of sand deposit on the Adriatic italian shelf, only few od them have been dredged for coastal nourishment projets see Table 4-65.

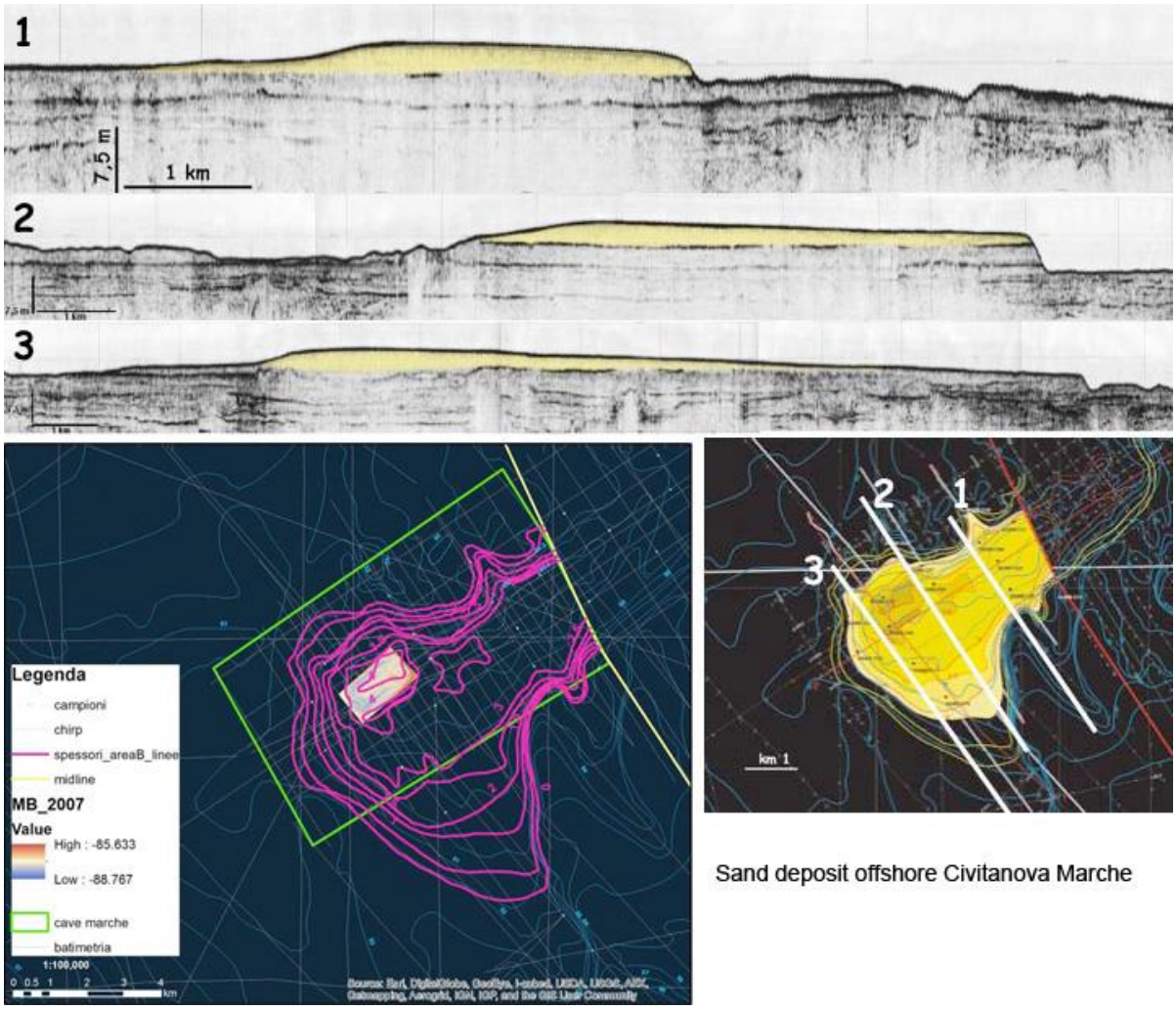


Figure 4-108 Example of a sand deposit offshore Civitanova Marche at 80- 90 m water depth in central Adriatic. During 2006 dredge operation 1.1 milion od cubic metres of sand have been delivered to the Abruzzo and Marche coast. (Arenara s.r.l) See Table 4-65, site 3.

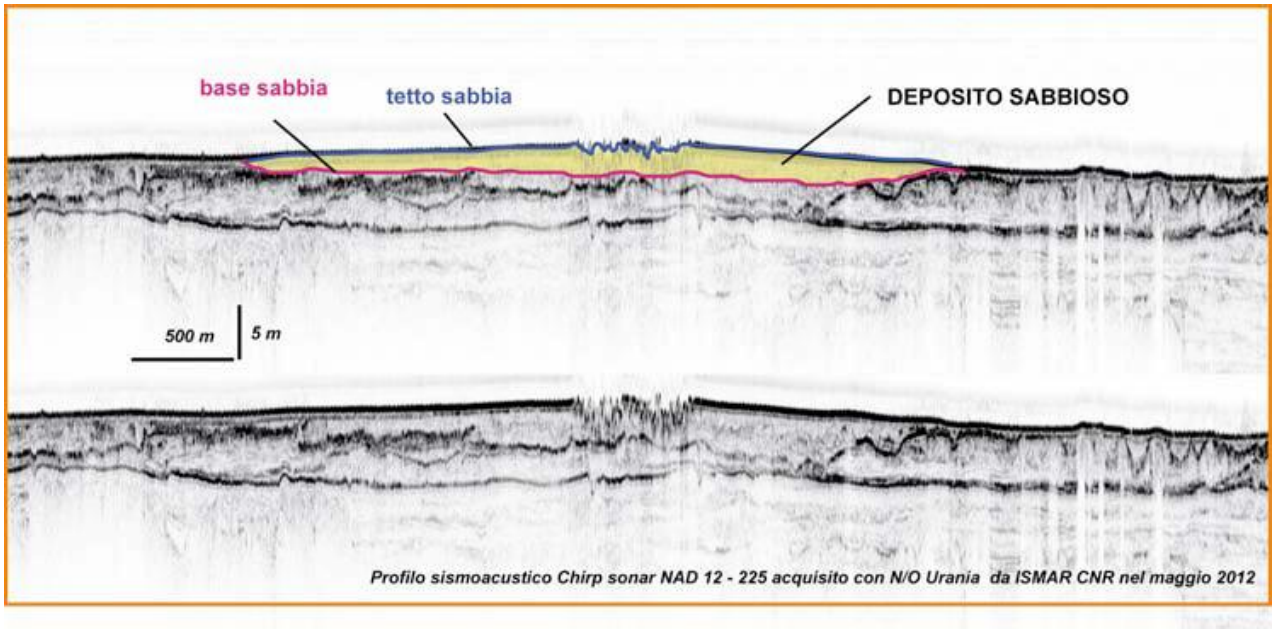


Figure 4-109 Example of a sand deposit offshore Ravenna at 37 m water depth in central Adriatic. the Chirp sonar profile shows the sea floor after the dredge operations. See Table 4-, site 2

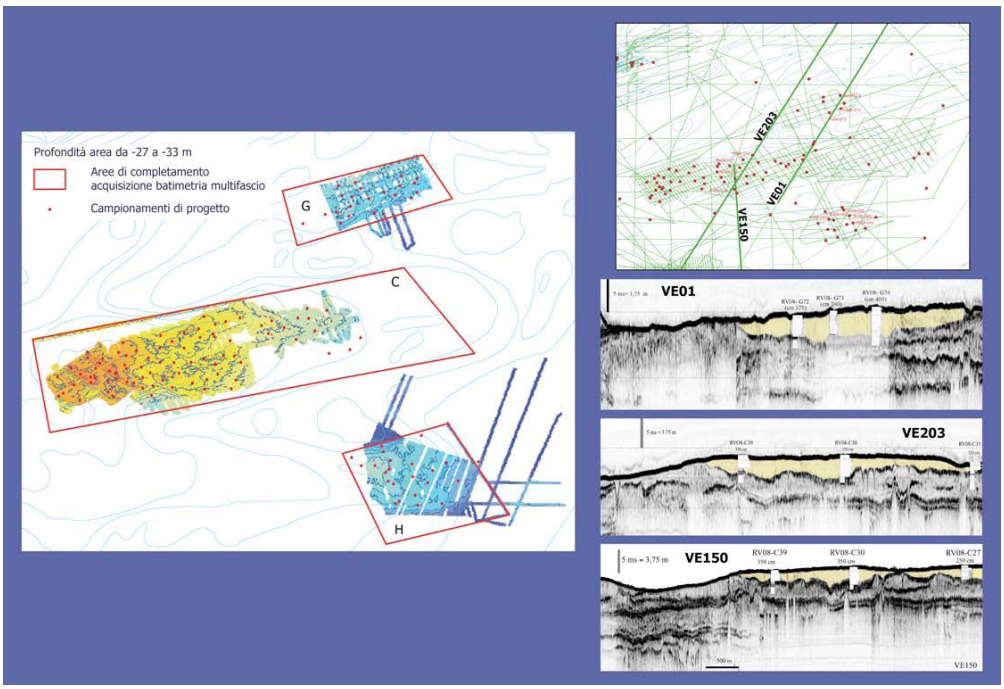


Figure 4-110 Example of a sand deposit offshore Chioggia at 27-33 m water depth in northAdriatic. During 2006 dredge operation 1.1 milion od cubic metres of sand have been delivered to the Abruzzo and Marche coast. (Arenara s.r.l)) See Table 4-65, site 1.

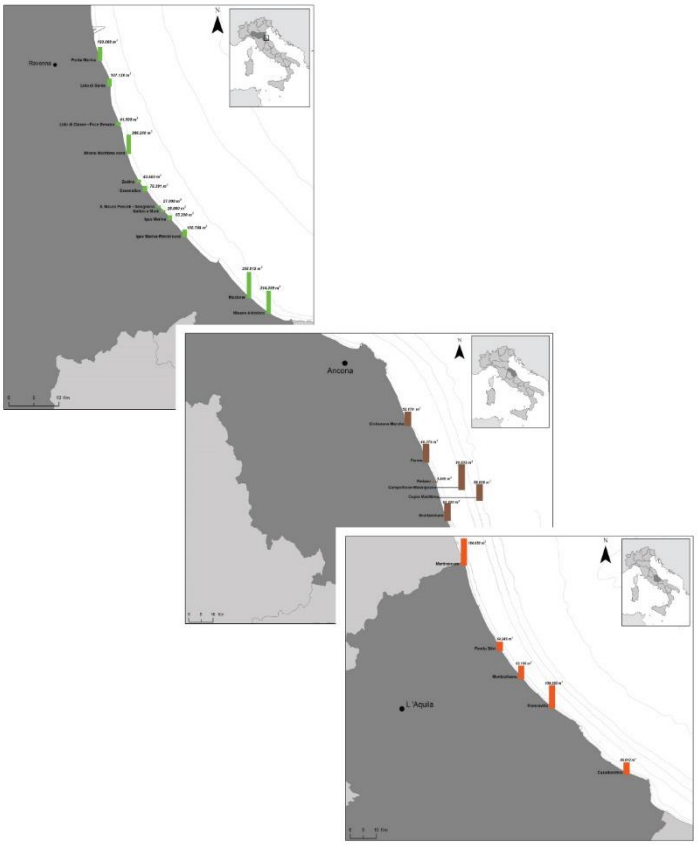


Figure 4-111 Coastal location of dredged offshore sands

In October 2009, the Geological, Seismic and Soil Survey (SGSS) of Emilia Romagna region igned an agreement with the ISMAR-CNR of Bologna, aimed at the creation of a tool for the management and analysis of data related to the offshore sand deposits, to be integrated to the information system of the Sea and the Coast (Figure 4-111).

The concept was focused on three priorities:

1. to produce a geodatabase containing geophysical, geognostic and cartographic data, which can be used for the characterization of the deposits and monitoring of interventions
2. to develop applications for the management of the resource, during the step of programming and planning the interventions, such as the one for the automatic calculation of the quantities of residual sands.
3. to establish guidelines for the optimal management of the sand deposits.

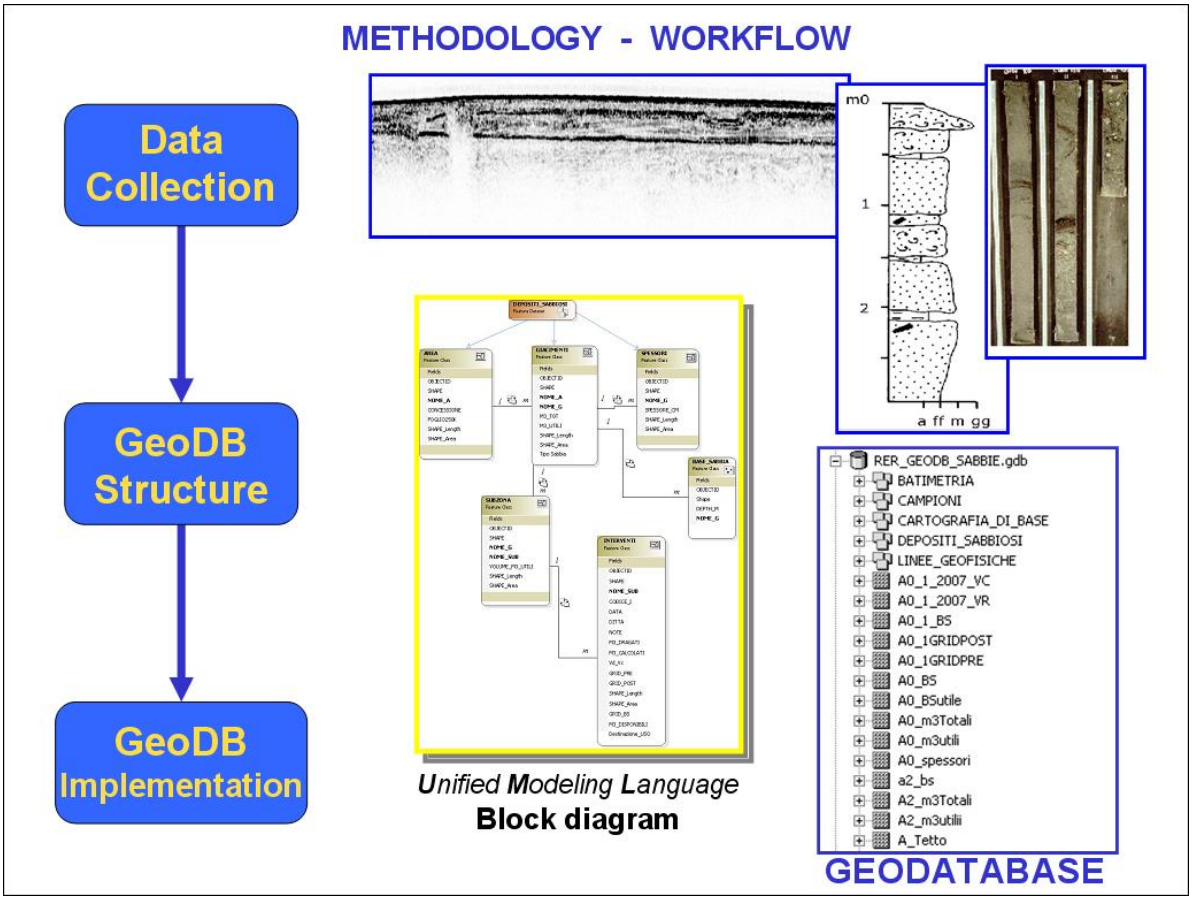


Figure 4-112 In_Sand database. It is a result of a collaboration between research institutes and regional geological offices. SHAPE project, Report 5.4.1, 2013

The Geodatabase in_Sand architecture has been designed to retrieve the data related to the total volume extracted from each sand reservoir, and consequently to asses the available amount of sand. The base of the sand deposits, interpreted from geophysical data, and the multibeam bathymetry acquired after dredging were compared with spatial analysis tools in order to highlight the areas where the dredging operations have lapped the base of the sand deposit.

The Geodatabase in_Sand is a tool for monitoring and update in real time the volume of sand deposits before and after dredging. It will be useful to control operations performed in each sand deposit by dredging company checking the volumes actually removed.

The geodatabase of the environmental data resulting of the monitoring programs related to the sand dredge operations (surficial sediment geochemistry, benthos, water column quality and fish resources, etc) is under construction result of a collaborative project between CNR ISMAR - ISPRA and Emilia Romagna and Veneto Region.

Concerning the Croatian Adriatic, according to Articles 3 and 4 of the Mining Act (Official Gazette 75/09), mineral wealth is owned by the Republic of Croatia. This includes all organic and inorganic mineral raw materials in solid, liquid or gaseous state, in the original beds, deposits, mine waste, slag or natural solutions.

CONSTRUCTION SAND AND GRAVEL
In the Primorje Gorski Kotar County there is just one sand exploatation field:
Exploitation field Lopar

The deposit is located in the northwestern part of the island of Rab, west of the village Lopar.

The quality is following:
- the mean compressive strength (MN/m2)
- dry 122,9
- Water saturated 123,5
- after freezing 127,3
- wear resistance – BOEHM (cm3/50cm2) 15,9
- water absorption (mas %) 0,201
- resistance to frost resistant
- spatial mass (t/m3) 2,687
- density (t/m3) 2,707
- densities 0,993
- porosity (vol. %) 0,74
- persistence method. solution Na2SO4: % (mas) 0,160

The rock mass is suitable for the production of:
- chippings to produce asphalt on roads 4 and 5 grades
- aggregates for concrete and reinforced concrete
- crushed stone masonry retaining walls and coastal defense
- crushed stone for road maintenance

Size deposits is 1.56 ha. Total reserves according to data from the 1999th year amounted to 79,800 m3.

4.8.2 Focus Area 2

In Greece sand (clay and gravel) are protected by law (L.1219/38) as public property for the purpose of public service.

In order to extract sand, stones etc. from a river, watercourse, coastal area, private property, it is necessary for the Commission of sand extraction to decide on the suitability of the site for sand extraction while in cases of public land a decision of Concession of Exploitation is being issued by the responsible Regional Director or directly by the government such as the minister of Finance or the Secretary General of the Decentralised Administration.

The services in charge to the aforementioned legislation on sand extraction and implementation are the Directorate of Public Property of the Ministry of Finance and the Public Service of Mortgage (Greek Mineral Wealth). Permissions for sand extraction are issued by those services in cooperation with the respective regional authority.

Sand extraction for Greek waters in FA2 lies under the jurisdiction of each regional unit in cooperation with the Directorate of Public Property of the Ministry of Finance and the Public Service of Mortgage (Greek Mineral Wealth). Permissions are only issued under the respective regional authorities under the law 1219/38. Unfortunately, the sand extraction areas at the Ionian Sea have not been recorded.

4.9 Dredging disposal areas

D. Scarcella, T.Papatheochari, S.Niavis

In Italy offshore dumping has been regulated by Dlgs 152/2006, art. 109. With the modifications of L. 35 of 2012, the competent authorities for authorizations are the Regional Administrations (with the exceptions of protected areas for which a decree of the Ministry of Environment is required).

In the disposal authorizations offshore dumping is a solution that is no longer favoured because many Port Authorities in Italy are trying to expand existing layouts and allocating (contaminated) sediments into confined disposal facilities that are used for different purposes once completed (i.e., handling or storage areas).

At the moment in AIM no existing conflict of use is identified and the relevant issue is the possible impact that dumping activities could generate on the seabed and on the water column.

Sediment disposal in open water may be more damaging to the benthic community than to any other part of the aquatic ecosystem because of the relative immobility of benthic organisms. The type and severity of the impact of sediment disposal on benthic ecosystems varies, depending upon several factors:

- chemical–physical characteristics and volume of sediment;
- water depth, surface, sedimentary and hydrological regime of the dumping site
- time of the year
- similarity of the sediment in dredged and
- disposal areas
- disposal method
- adaptation of organisms to the local sedimentary regime and structure a
- composition of benthic assemblages in the dumping site and nearby areas

Despite the number of studies concerning the impacts of sediment disposal activities, the high number of variables that may play a role in determining the effects of dredged-material deposition on the benthic community structure makes it difficult to draw general conclusions, so the evaluation must be done case-by-case.

Off-shore discharge appears a sustainable strategy for the management of uncontaminated dredged sediments from the Northern Adriatic Sea harbours (Simonini et al. 2005). In Italy, harbour- dredging guidelines, off-shore discharge practices and monitoring activities were established in 2002 by the Central Institute for Research Applied to the Sea (ICRAM) in accordance with the Italian legislation (D.M. 24/1/1996, D.Lgs 258/2000 art. 35). The discharge of dredged material in appropriate off-shore disposal sites is permitted only if there is no established technical or economical possibility for their reutilization or settlement in land dumps (APAT, ICRAM 2007). Recorded dumping/disposal site for dredging are reported in Figure 4-113.

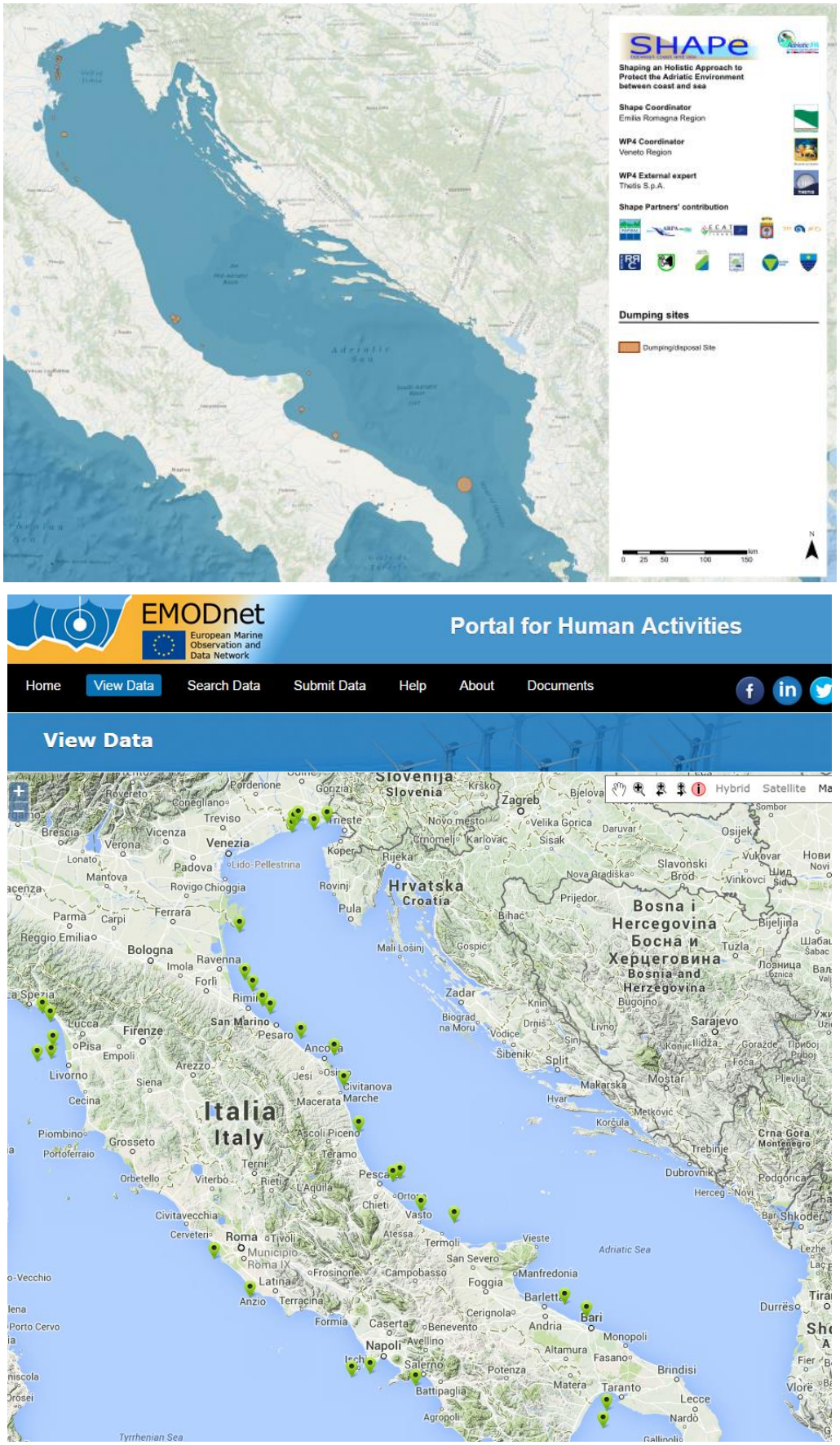


Figure 4-113 Dumping/Disposal site in AIM. SHAPE project, 2014 (top) and Dredge Spoil Dumping from EMODnet Human Activities (bottom) (last access: 6/10/2014).

4.9.1 Focus Area 1

Emilia Romagna Disposal site between Po river mouth and Gabicce

Between March 1999 and May 2003, sediments dredged from some regional harbors were dumped in four disposal areas in the Northern Adriatic Sea, near the shore of the Emilia-Romagna coast (Figure 4-114).

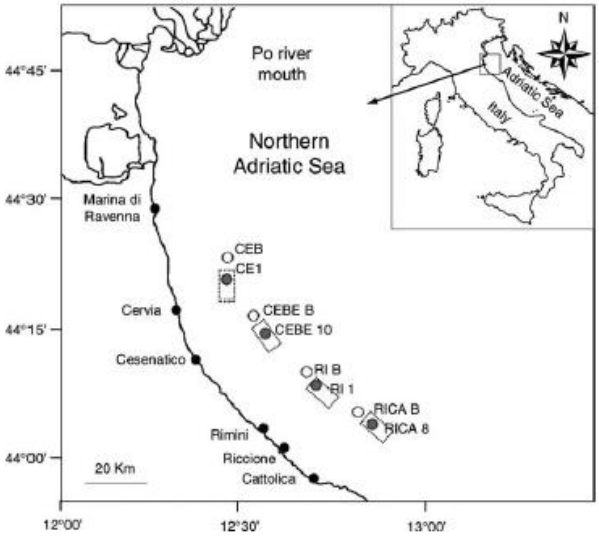


Figure 4-114 Location of the sampling station in the Emilia Romanga dumping areas. Simonini et al (2005).

A first monitoring campaign was carried out in 2003, finding that: (1) the communities of the dumping areas are well adapted to unstable environments; (2) the sediments were disposed gradually and homogeneously over relatively large areas; other factors that help to reduce the impact of sediment disposal are the low concentrations of contaminants in dredged materials and the similarity of sediment in the dredged and disposal areas.

By comparing data from the first monitoring campaign with data of the initial characterization of the five areas (1998), no significant impact on the seabed was found. So the dumping of dredged material has been permitted and another monitoring campaign has been carried out in 2009, with basically the same results of 2003. The five areas continue to be used as dumping areas for port dredged material, starting from the sub-areas still not used, up to a volume of 20.000 mc.

Veneto dumping sites in front of Venice lagoon

Areas of potential dumping of industrial waste occurred in the past (eighties of the 20th century). These areas have been identified on the basis of a number of authorisations granted by the Italian Corps of Port Captaincies – Coast Guard available at the Veneto Region archive (SHAPE. 2014). So they are areas of "potential" dumping, lacking a real on-site check about that (Figure 4-115).

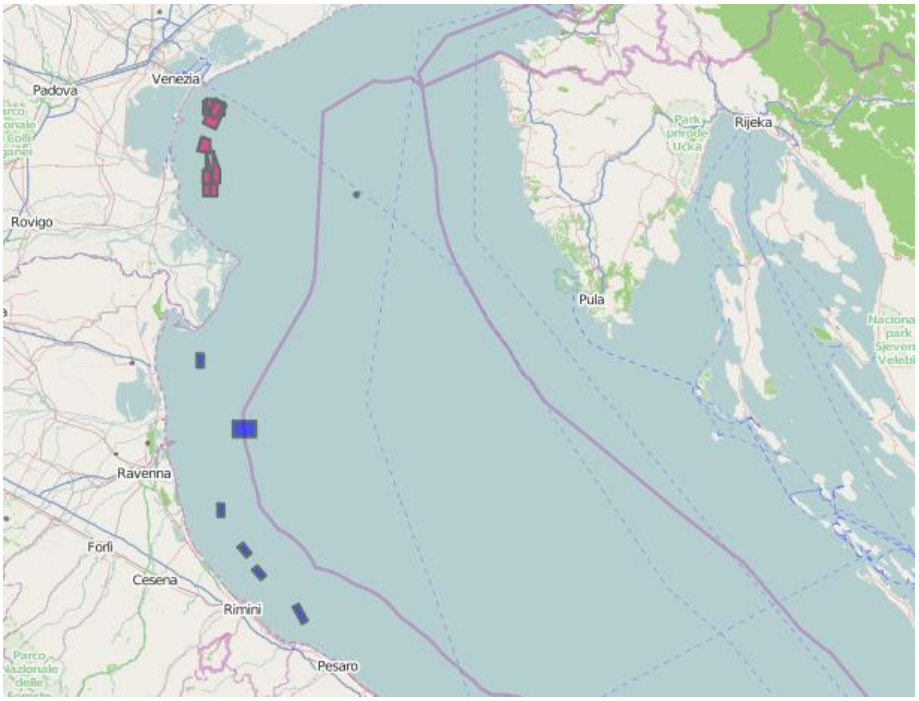


Figure 4-115 Location of dumping areas in Focus Area 1. Blue: Emilia Romagna Region, Pink: Veneto Region. SHAPE project, 2014

4.9.2 Focus Area 2

In Greece there is a great gap in planning and management of waste and wastewater disposal. In existing Greek legislation on the protection of the marine environment and rules related to the management of dredging materials are not yet included while there is a need for a revision due to the new worldwide data have occurred regarding the priority toxic substances that degrade the marine environment and for which there was no information at the time of the adoption of the Laws of 1966 to 1986. In the context of defining the strategy for the management of dredging materials according to their quality and the estimation of their impacts on the marine environment, Greece could incorporate such information in its legal framework in order to decrease the resulting dangers for the quality of coastal and marine environment (Papadas et al, 2008).

Dredging disposal areas can only be found in the respective ports according to the permit issued for its port. An example in the area is Keri which is close to the protected area of *Caretta caretta* seaturtle. As mentioned above a study for its improvement has been assigned including also dredging in order to prevent adverse environmental impacts.

4.10 Cultural and historic conservation areas

S. Fraschetti, G. Farella, F. De Leo, M. Lipizer, R. Mosetti, T. Papatheochari, S. Niavis, A. Kokkali, P. Drakopoulou, V. Vassilopoulou

Being the birthplace of several ancient civilizations as well as an important route for merchants and travelers of ancient times that allowed for trade and cultural exchange between emergent peoples of the region, the whole Mediterranean basin hosts a wealth of cultural and historical sites, several of them included in the UNESCO heritage sites. Those include in AIM are indicated in Figure 4-116.

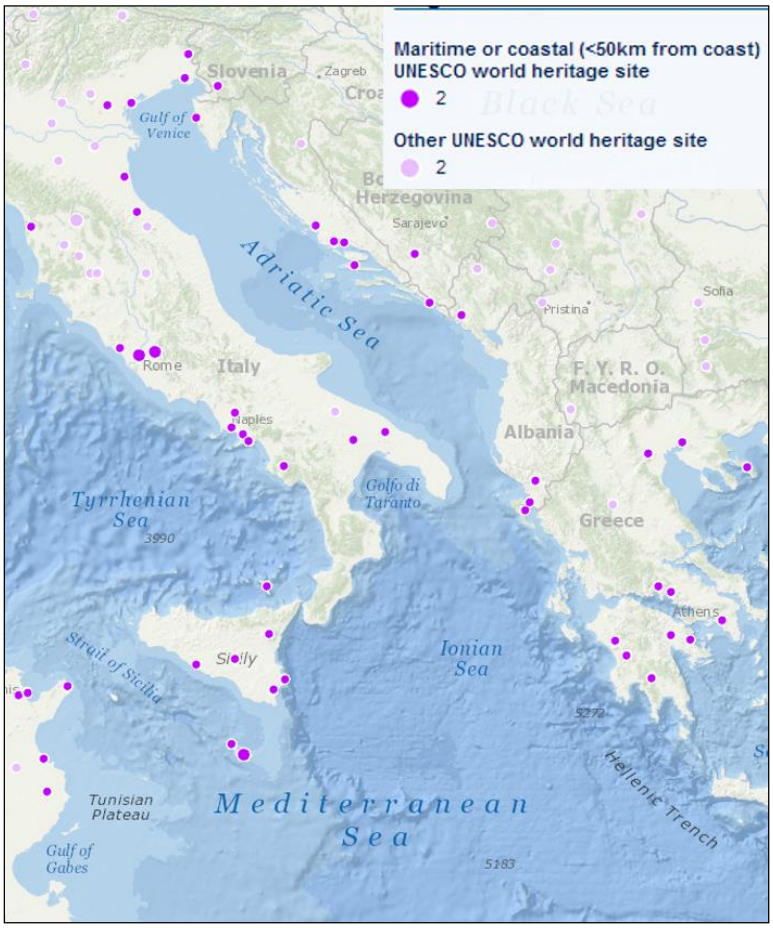


Figure 4-116 Map of UNESCO world heritage sites in the AIM. European Atlas of the Sea

Great attention is given to improve protection of the world's terrestrial heritage and, as fare as the Adriatic is concerned, the recent Adriatic IPA Project EX.PO AUS (EXtension of POtentiality of Adriatic UNESCO Sites; http://www.expoaus.org/project-5) has the general objective to set up a cooperative network between the UNESCO sites of the Adriatic sea (including some remarkable sites aspiring to get this recognition), which will be able to develop, in a cross-border context, and diffuse highly qualitative technical and managerial competences by the various public and private actors involved, with the aim of pursuing a joint strategy of long term to achieve a sustainable valorisation of these sites, based on high levels of managerial, technological and energy innovation.

4.10.1 Focus Area 1

FA1 hosts several UNESCO sites of high cultural and historical relevance, which make the area also highly attractive for tourists. The sites include the city of Venice (Veneto), the town of Aquileia (Friuli Venezia Giulia), the city of Ravenna (Emilia Romagna), the town of Piran (Slovenia) and the town of Poreč (Croatia).

Venice is a unique artistic achievement. The city is built on 118 small islands and seems to float on the waters of the lagoon. The influence of Venice on the development of architecture and monumental arts has been considerable. Venice possesses an incomparable series of architectural ensembles illustrating the age of its splendour. It presents a complete typology whose exemplary value goes hand-in-hand with the outstanding character of an urban setting which had to adapt to the special requirements of the site. The UNESCO World Heritage property comprises the city of Venice and its lagoon situated in the Veneto Region of Northeast Italy.

Aquileia was one of the largest cities in the Roman Empire, one of the liveliest communities of early Latin Christianity, one of the most important ancient ports of the Adriatic Sea, and the starting point of the main commercial, cultural and military routes towards North-Eastern Europe. The World Heritage Committee has recognised that Aquileia was one of the largest and wealthiest cities of the Roman Empire, and a most complete example of an ancient Roman city in the Mediterranean area, as it is largely intact and still buried, and that the complex of the patriarchal Basilica of Aquileia demonstrates its crucial role in spreading Christianity in Europe in the early Middle Ages.

The the town of Piran features an ancient city centre with a rich architectural heritage and a unique cultural landscape in the form of its salt-pans, which are still partly in use today with production based on traditional cultivation. The salt-pan areas in Strunjan and Sečovlje are also under special protection as nature parks, as they are inhabited by rare, endangered and characteristic wildlife species in a typical salt-pan ecosystem.

the ancient town of Parentium – currently known as Porec – founded by the Romans on an already sparsely inhabited peninsula; The small town featured a square grid layout of Cardo and Decumanus streets shaping the blocks of public and residential buildings. The Forum was situated on the tip of the peninsula, where on the north side in the 3rd century an early Christian complex was built which later, in the 4th century, was given the shape of a veritable public church. It was in the mid-6th century that Euphrasius, Bishop of Parentium, thoroughly refurbished the complex, furnishing the large basilica with rich wall mosaics.

The city of Ravenna (Emilia Romagna) which is a site is of outstanding universal value, being of remarkable significance by virtue of the supreme artistry of the mosaic art that the monuments contain, and also because of the crucial evidence that they provide of artistic and religious relationships and contacts at an important period of European cultural history.

Besides UNESCO sites, there are several other towns and areas of relevant historical and cultural importance such as the city of Trieste and the small fishing village of Muggia, with its typical Venetian architecture (Friuli Venezia Giulia), the city of Pula (Croatia), with its impressive ancient Roman buildings and amphitheatre, and the small coastal towns of Vrsar and Rovinj with their typical Venetian architecture (Croatia).

4.10.2 Focus Area 2

The Old Town of Corfu is the only site in the Ionian protected by the UNESCO. The site, on the Island of Corfu off the western coasts of Albania and Greece, is located in a strategic position at the entrance of the Adriatic Sea, and has its roots in the 8th century BC. The three forts of the town, designed by renowned Venetian engineers, were used for four centuries to defend the maritime trading interests of the Republic of Venice against the Ottoman Empire. In the course of time, the forts were repaired and partly rebuilt several times, more recently under British rule in the 19th century. The mainly neoclassical housing stock of the Old Town is partly from the Venetian period, partly of later construction, notably the 19th century. As a fortified Mediterranean port, Corfu's urban and port ensemble is notable for its high level of integrity and authenticity (UNESCO).

The responsibility for the protection is shared by several institutions and relevant decrees. These include the Ministry of Culture and Sports (ministerial decision of 1980), the Ministry of Environment, Energy and Climate Change (former Ministry of the Environment, Spatial Planning and Public Works-Presidential decree of 1980) and the Municipality of Corfu

(Presidential decree of 1981). Also relevant are the Greek law on the shoreline of towns and of islands in general; the law on the protection of antiquities and cultural heritage in general (n° 3028/2002) and the establishment of a new independent Superintendence for Byzantine and post-Byzantine antiquities, in 2006. A buffer zone has been established. The proactive policies of restoration and enhancement of the fortifications and of the citadel have resulted in a generally acceptable state of conservation. Many works however have still to be completed or started. A management plan has been prepared. An urban action plan, which is in line with the management plan of the nominated property, has just been adopted (2005) for the period 2006-2012 (UNESCO).

Apulia is one of the richest archaeological regions in Italy, hosting several evidences of prehistoric, Greek and Roman settlements. The Japigia (ancient Puglia), originally populated by both Illyrian and Greek populations, formerly included the territories of Daunia (northern Puglia), Peucezia (central Puglia) and Messapia (ancient Salento). The Daunians developed a peculiar culture, though not devoid of contacts with other neighboring populations, both Greek and indigenous. Among the most significant findings of this civilization certainly stand the Daunian stems, carved stone blocks dating from the sixth century BC, found in the plain south of Siponto, and now preserved in the National Museum of Manfredonia (Adriatic coast). The main centers were dauni Tiati (now San Paolo di Civitate), Casone (San Severo), Lucera, Merinum (Vieste), Herdonia (Ordona) , Ausculum (Ascoli Satriano), Ripalta (Cerignola) and Melfi.

The Peucetis inhabited the central part of Apulia, which corresponds more or less to the present province of Bari, hosting the thriving town of Canosa, Silvium (modern Gravina in Puglia), Bito, Azetium (today Rutigliano), Norba and Trani.

The Salento peninsula, once called by Ancient Greeks *Messapia* (ie "Land between two seas"), was inhabited by Messapians, population of Illyrian or Aegean-Anatolian origin. Major cities were: Alytia (Gallipoli), Ozan (Ugento), Brention/Brentesion (Brindisi), Hyretum/Veretum (Vereto), Hodrum/Idruntum (Otranto), Kailia (Ceglie), Manduria, Mesania (Mesa), Neriton (Nardo), Orra (Oria), Thuria Sallentina (Roca Vecchia) and, at the northern limits of the peninsula, the important city of Egnatia.

On the homonym gulf in the Ionian Sea, was founded Taranto (Taras), one of the most important ports of Magna Graecia. Its foundation is traditionally dated 706 BC, by Dorian immigrants as the only Spartan colony in peninsular Italy. Taras had important expansion ambitions, with a long rivalry between other Apulian populations. Nowadays, Taranto hosts one of the most important National Archaeological Museum, founded in 1887.

Apulia was too an important area for the ancient Romans, who conquered it after several wars against the Samnites and Pyrrhus in the 4th and 3rd centuries BC, but also suffered a crushing defeat here in the battle of Cannae against Hannibal. However, after the Carthaginians left the region, the Romans captured the ports of Brindisi and Taranto, and established dominion over the region. During the Imperial age Apulia was a flourishing area for production of grain and oil, becoming the most important exporter to the Eastern provinces. After the fall of Rome, Apulia was held successively by the Goths, the Lombards and, from the 6th century onwards, the Byzantines. From the 9th century, a Saracen presence was intermittent, but Apulia remained under the Byzantine authority, despite the region being mainly inhabited by Lombards until the 11th century, when the Normans conquered it with relative ease. From the late 12th to early 13th centuries, it was a favorite residence of the Hohenstaufen emperors, Frederick II. A number of castles were built in the area by Frederick, including Castel del Monte. Castel del Monte is, in fact, one of the three UNESCO World Heritage in the Apulian area. Located in the Communes of Andria and Corato (Bari Province), it was built by the Emperor Frederick II in the 13th century. First of all, Del Monte Castle is a perfectly preserved symbol of medieval military architecture.

The other two are the *Trulli* of Alberobello, prehistoric buildings characterized by circular plants, white dry stone walls, small windows and pinnacles, that create a whole urban area near Bari and, just out of the region, the Sassi of Matera (Basilicata Region). Meaning Stones of Matera, they are described as troglodyte settlement because they consist of a rock-cut

settlement. It was the hidden heart of ancient pastoral communities over more than two millennia.

Maritime archaeological sites

The maritime archaeological sites of the Ionian Islandare located at the areas described in Table 4-66.

In these sites fishing, anchoring and diving are not allowed unless authorized by the Ministry of Culture and Sports. It is possible that an area may be defined around the sites in which the activities described above are not allowed without any prior permission (Protection Area), issued by the Ministry of Culture and Sports (Hellenic Society for Law and Archaeology).

Regional unit	Maritime archaeological site
Corfu	Southwestern coast of Corfu (ΥΠΠΟ/ΓΔΑΠΚ/ΑΡΧ/Α1/Φ43/59538/3993/3-11-2003)
Kefalonia	Ancient port area of Loutro, Sami (YPPO/ARCH/A1/F43/36545/1887/8-8-1994 647/V/26-8-1994-Gazette)
	Northern site of the bay of Gagana (ΥΠΠΟ/ΓΔΑΠΚ/ΑΡΧ/Α1/Φ43/62769/4286/11-11-2003)
	Southern site of the bay of Fiskardo (ΥΠΠΟ/ΓΔΑΠΚ/ΑΡΧ/Α1/Φ43/62772/4285/11-11-2003)
Zakynthos	Shipwreck of Zakynthos(ΦΕΚ 1701/2003)

Table 4-66 List of maritime archaeological sites at the Ionian sea. MEECC (under review-a)

Apulia, with over 800km of coastline and a central position within the Mediterranean basin, conserves within its waters a vast underwater archaeological heritage, testimony of the fundamental role it has played at the crossroads of travel over the course of centuries. In order to get a thorough knowledge and mapping of maritime archaeological sites, the Ministry of Cultural Heritage, in accordance with the UNESCO Paris Convention, in 2004 started the Archeomar Project. The project aims to create a register of all the underwater archaeological sites along the coastlines of the regions of Italy.

Along the Apulian coasts 94 sites were surveyed: 52 shipwrecks, 7 facilities, 26 sets of artifacts and 9 artifacts. In some coastal areas the concentration of submerged archaeological sites is particularly high both for historical and geographical reasons: because they represented crossroads of passages, or more exposed to bad weather, because more densely populated or marine battlegrounds. Among the most interesting from this point of view, there are the Tremiti Islands, the Adriatic coast between Bari and Brindisi and between Otranto and Gallipoli and that of Taranto. (Source: www.archeomar.it).

4.11 Cables, pipelines, transmission lines

R. Mosetti, M. Lipizer, S. Fraschetti, G. Farella, F. De Leo, T. Papatheochari, S. Niavis

Most important pipelines are located offshore central Italy and connect offshore gas production platforms with coastal power plants; in Croatian waters, there is a relevant pipeline connecting gas platforms offshore Istria peninsula with mainland (Figure 4-117). Consequently, even if the analysis of this component on total physical loss is still in progress, first considerations suggest that the pressure of this component regards firstly Italy and then Croatia.

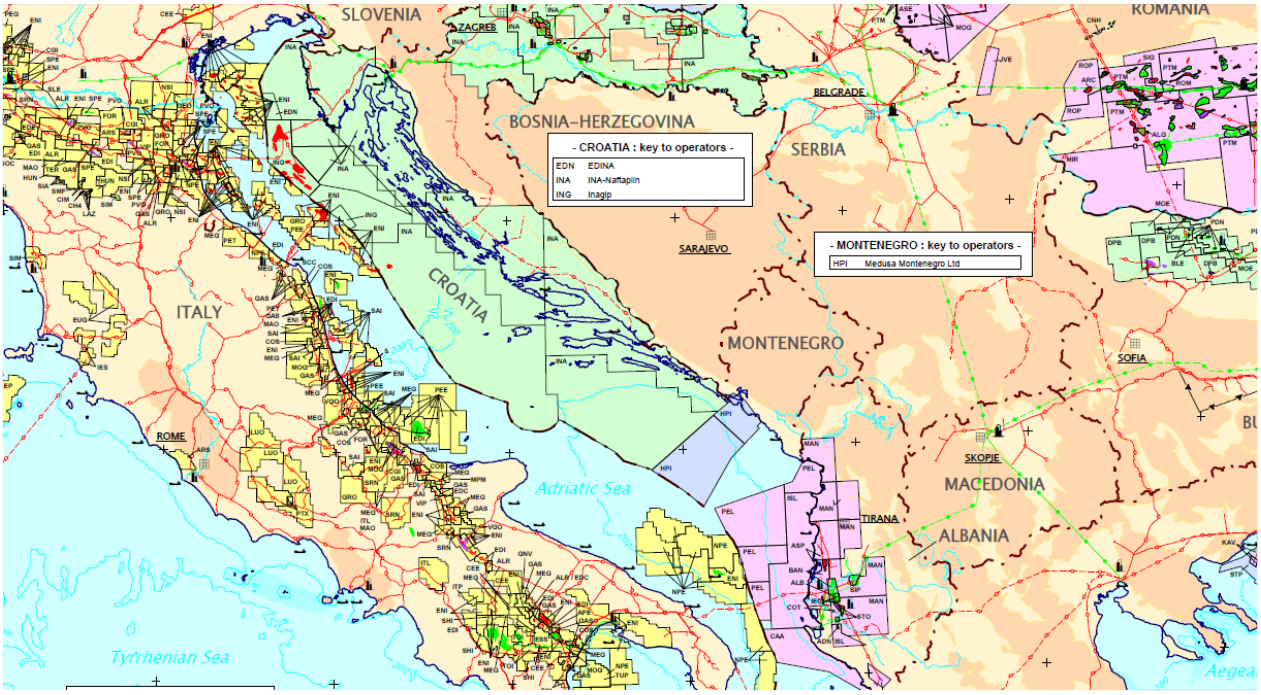


Figure 4-117 Underwater pipelines in the Adriatic sea. Italian Ministry of Economic Development Directorate General for Energy and Mineral Resources

In 2005, Croatia, Montenegro and Albania, togheter with Bosnia and Herzegovina, Bulgaria, Kosovo, Macedonia, Romania and Serbia, formed an Energy Community, with a Secretariat established in Vienna.

With the exception of Romania, it is recognised that the small size of these gas markets is such that it would be difficult to establish new bulk transmission lines to supply these markets alone. However, the fact that there are a number of proposals for major transmission lines which will cross the SEE region en route to supplying major markets in Western Europe opens the possibility for spur lines to augment existing supplies to the SEE countries so as to meet projected demand up to the year 2025.

A 2009 study from ECA (Economic consulting associates) estimates an average annual growth of gas demand of 2.6 % for the entire South East European region in 2010-2025. This incremental demand must be met by greater supply of gas. To this end, it is necessary to examine the spur lines, which originate from the major transmission systems.

The point of departure was the assessment of sources of gas supply from Russia, the Caspian region and other current potential producer countries through Turkey and other transit routes. As a next step, the study puts a price tag on the costs of gasification in nine gas markets in the region of South East Europe, SEE. These are Albania, Bosnia and Herzegovina, Bulgaria, Croatia, FYR of Macedonia, Montenegro, Romania, Serbia and Kosovo.

The connection of the spur lines results in the Energy Community Gas Ring concept. The concept connects the seven Contracting Parties via a ring and takes thereby the needs of the region with regard to the electricity sector, as well as the existing or planned regional pipelines, LNG terminals and storage facilities that could be connected to the Gas Ring into

account. Due to its ring form, the Gas Ring would require just enough upstream capacity to meet the anchor loads (Figure 4-118).

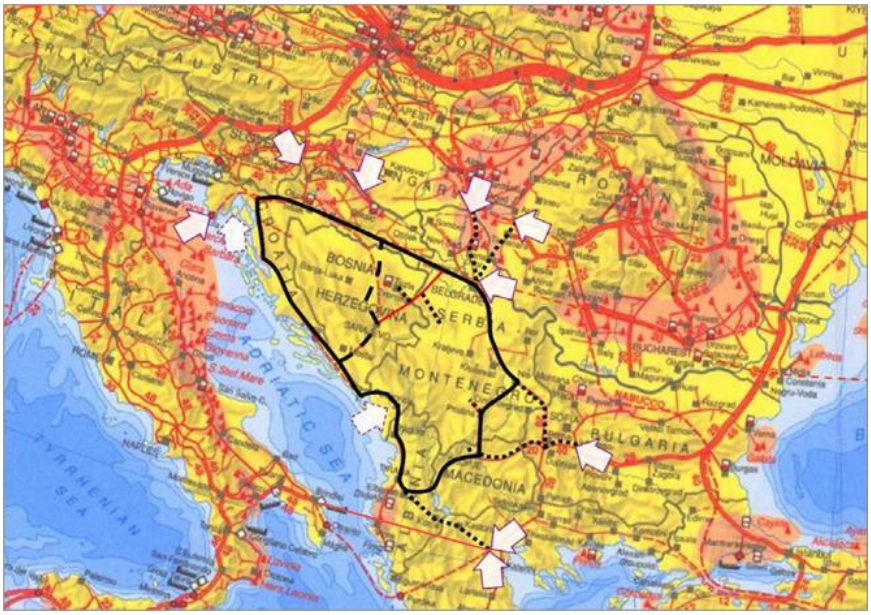


Figure 4-118 Energy Community Gas Ring concept, 2008. Energy Community portal (http://www.energy-community.org/ , last access 15.05.2014).

A map of submarine cables in the Adriatic and Ionian Seas is provided in figure 4-119. The Submarine Cable Map is based on authoritative Global Bandwidth research, and depicts active and planned submarine cable systems and their landing stations. On the website: http://www.submarinecablemap.com/#/ it is possible to select a cable on the map projection or from the submarine cable list to obtain access to the cable's profile, including the cable's name, ready-for-service (RFS) date, length, owners, website, and landing points.

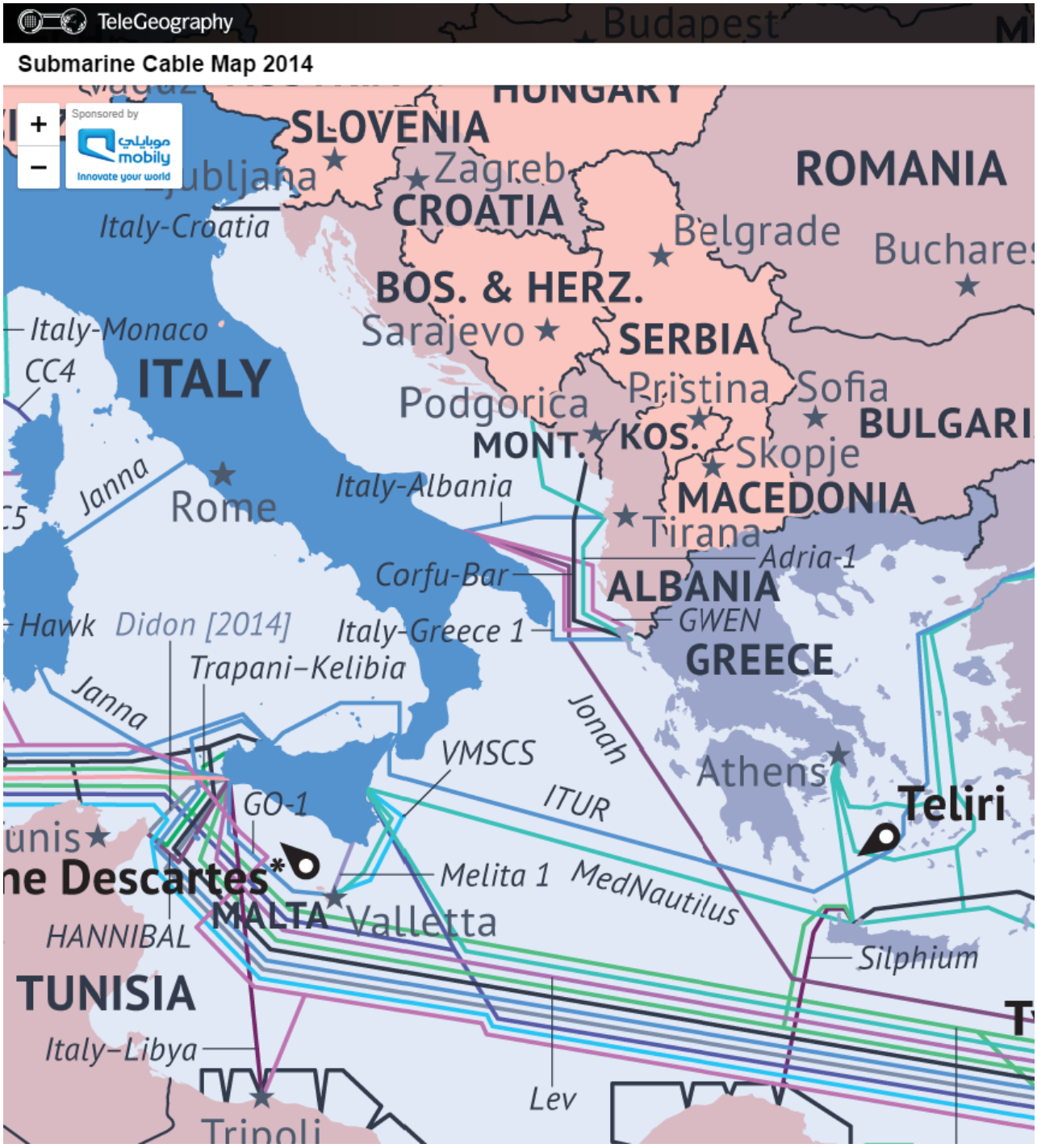
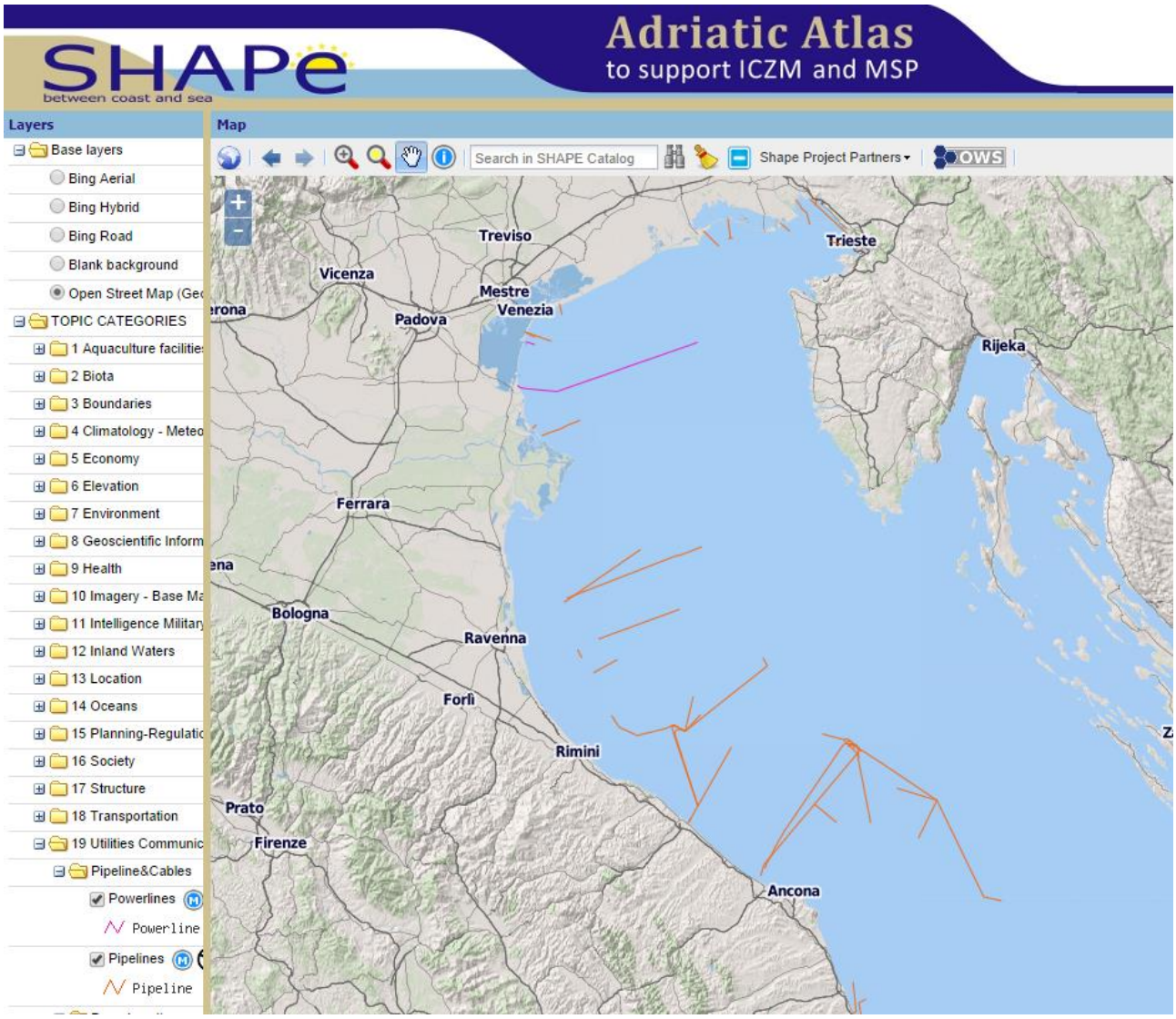


Figure 4-119 Submarine Cable Map from Global Bandwidth Research Service (http://submarine-cable-map-2014.telegeography.com/ last visit: 7/10/2014).

4.11.1 Focus Area 1

The FA1 is interested by the Italy-Croatia submarine cable owned by Telecom Italia Sparkle, T-Hrvatski Telekom, connecting Mestre (Venice, Italy) to Umag (Croatia), with a total length of 230 km (http://www.submarinecablemap.com/#/submarine-cable/italy-croatia; last visit: 8710/2014) (Figure 4-119).

A map of pipelines and transmission lines for FA1 and more detailed for Emila Romagna Region are presented in the SHAPE project (Figure 4-120).



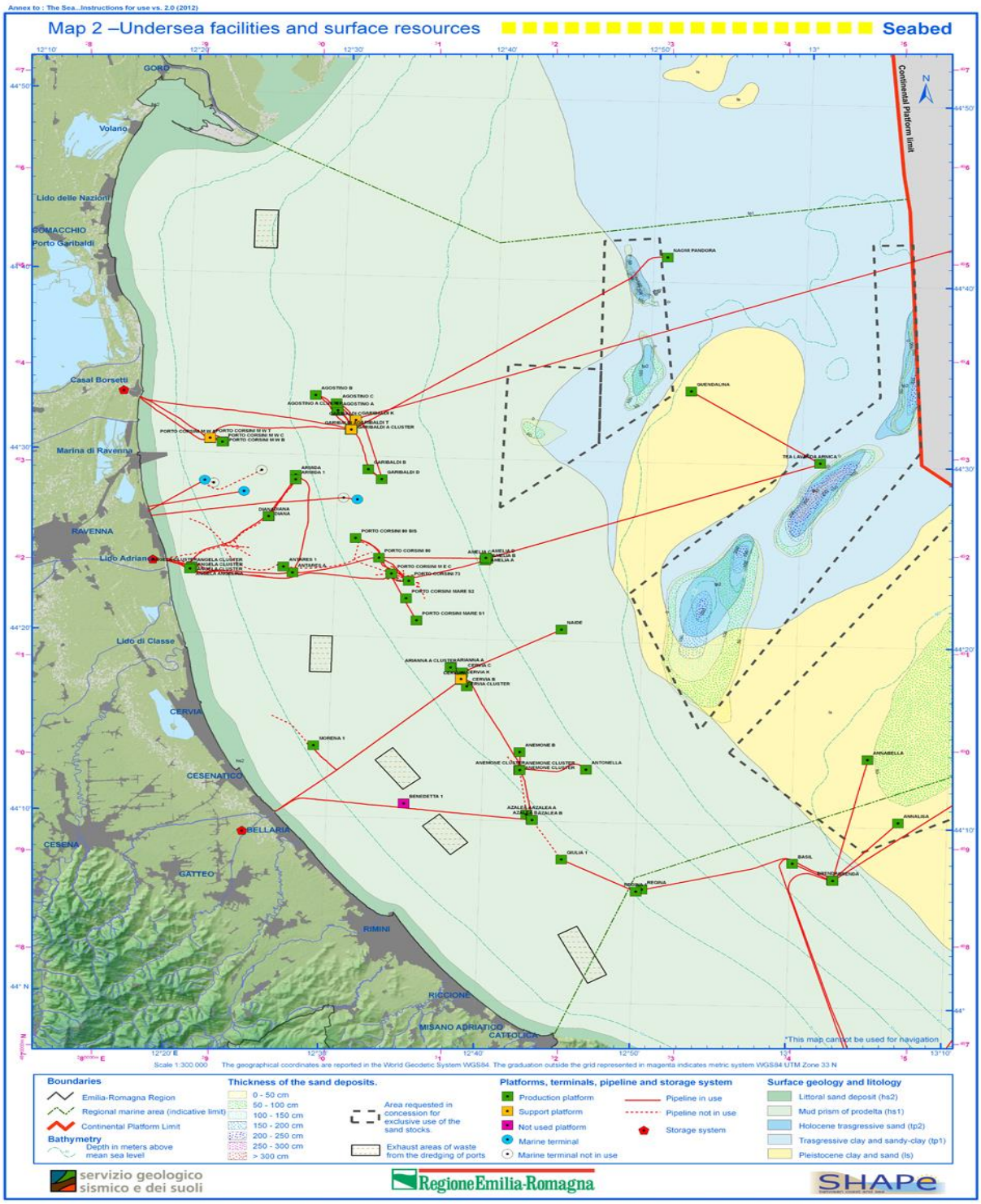


Figure 4-120 Undersea pipelines and trasmision lines in FA1 (top, SHAPE Adriatic Atlas) and undersea facilities and surface resources in FA1. SHAPE project, 2014.

Concerning the Croatian part, with gas transmission as its main activity, Plinacro Ltd, the Croatian gas transmission system operator, guarantees safe, reliable and high quality supply of natural gas from the entry point into the gas transmission system on the Croatian territory to off-take measuring-reduction stations of gas distributers and direct and eligible customers. Plinacro is in charge of development, construction, maintenance and supervision of the whole gas transmission system and of other activities necessary for the technical functioning of the system.

Transmission system of the Republic of Croatia	
Number of transmission system operators	1
Total gas pipeline length of the transmission system	2 516 km
Interconnections / transmission system operator:	Rogatec / Plinovodi d.o.o. (SLO) Drávaszerdahely / FGSZ Ltd. (HU)
Underground gas storage / gas storage system operator:	Okoli / Podzemno skladište plina d.o.o.
Domestic production / gas producer	UMS CPS Molve / INA - d.d. UMS Etan, Ivanić Grad / INA - d.d. UMS PS Ferdinandovac / INA - d.d. UMS PS Gola / INA - d.d. UMS PS Hampovica / INA - d.d. UMS Terminal Pula / INAGIP d.o.o.
Number of end users connected to the transmission system:	Total: 42
Number of distribution systems and distribution system operators:	No. of connections: 157 No. of DSO: 37
Number of balancing zones:	1
Transported quantities (historic data)	(in GWh) 2012: 27 012 2011: 28 222 2010: 27 897 2009: 26 507

Table 4-67 Basic information on the transmission system. Source: Plinacro, Description of transmission system

In compliance with the Croatian legislation and the Third package of EU energy regulations, Plinacro shall manage congestions in the following way:

1. The transmission system operator shall offer possibility of booking interruptible capacity at the entry point and at the exit point at which there is no available firm capacity.

2. Interruptible capacity may be contracted up to the amount of technical capacity at a particular entry point and/or a particular exit point.

3. Information on available interruptible capacity shall be published on the web page of the transmission system operator

List of main oil and gas transmission system infrastructures:

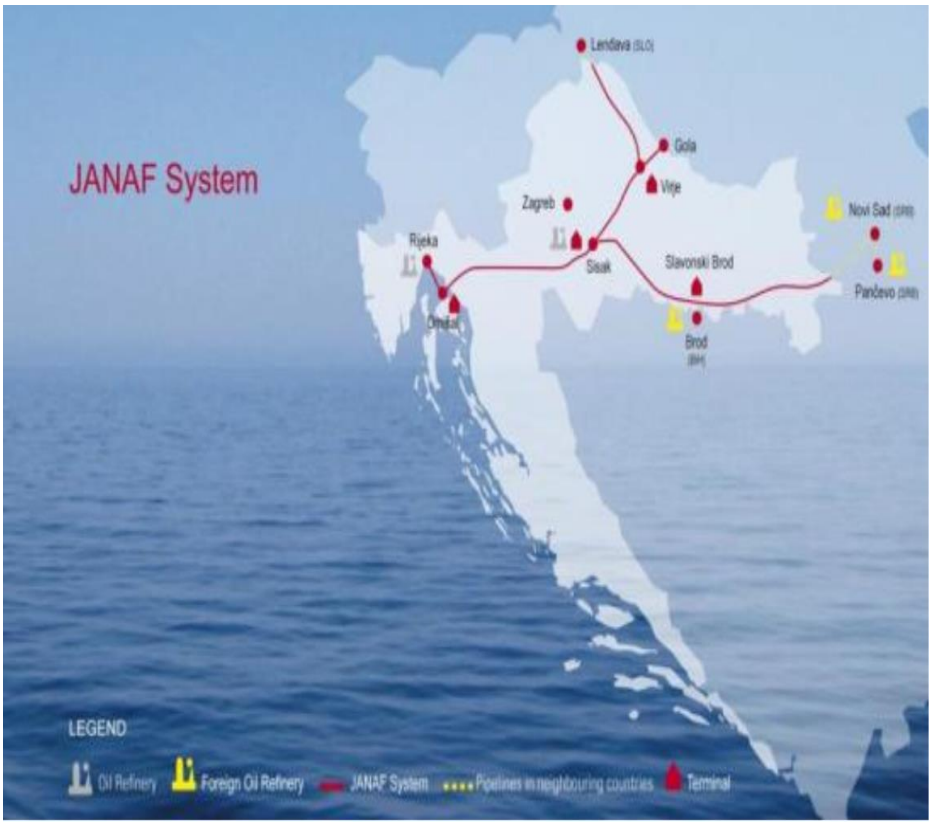


Figure 4-121 Adriatic Oil Pipeline system (JANAF)

•Very large crude carrierport and terminal –Omišalj, Island of Krk

•Connected to numerous refineries in Central and Eastern Europe

•Designed capacity of 34 million tons of oil annually (MTA), current handling capacity is 20 MTA

•Omišalj HandlingTerminal
•760.000 m3 (oil)
•60.000 m3 (products)
•Separate oil pipeline to Rijeka refinery
•Storage capacity
•1.3 million m3 (oil)
•100.000 m3 (products) Infrastructure – Adriatic Oil Pipeline system (JANAF)

Gas Transmission System (Plinacro)
•Gas Transmission System
•2.700 km of high pressure gas pipelines
•10 entry points, 172 exit points

•2 interconnections (Slovenia and Hungary)
•Transport: 4,5 billion m3/gas
•Connected to Underground Gas Storage Facility
•Underground Gas Storage
•Capacity –558 million m3
•Input –160.000 m3/h
•Output –280.000 m3/h
•New Facility Planned
•Underground Gas Storage for peak load at Grubišno polje
•Planned volume: 25-45 million m3
•Output: 70.000 –100.000 m3/h

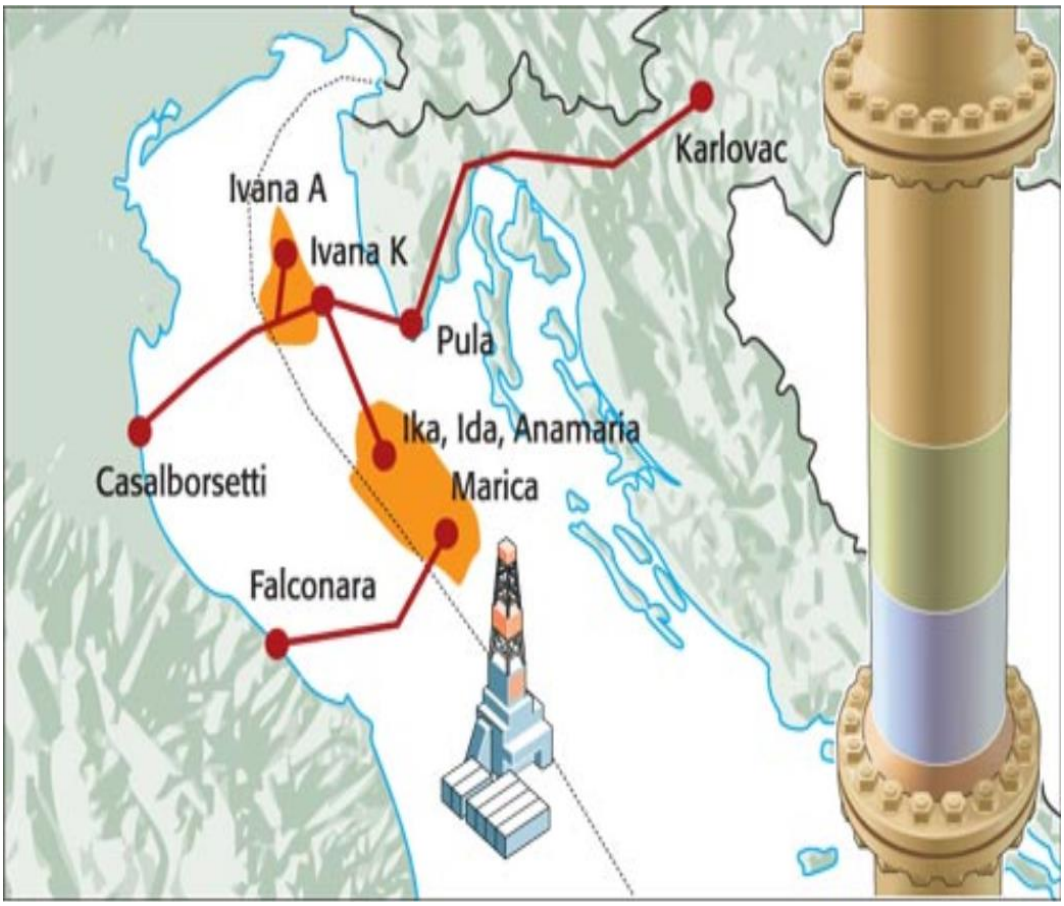


Figure 4-122 Offshore Adriatic

•18 production platforms and 1 processing platform

•Main gas pipeline connects the Northern Adriatic natural gas deposits with the existing high - pressure gas pipeline system of continental Croatia

•Substantially more infrastructure, both oil and gas, exists along the entire coast of Italy

4.11.2 Focus Area 2

FA2 includes potential import pipeline routes for Russian and Caspian gas

Among the import scenarios considered in the ECA regassification study (2009), the four of most immediate interest are:

- imports of Russian gas via existing routes;

- imports of Russian gas via new routes (eg: South Stream, Blue Line;
- imports of Caspian gas via Trans Adriatic Pipeline and/or the Ionian-
- Adriatic Pipeline;
- imports of Caspian and other gas from various sources via Nabucco;
- imports of Caspian or Russian gas via the Italy-Greece Interconnector (IGI), which is part of the larger Turkey-Greece-Italy (TGI) project.

Figure 4-123 Import pipeline routes for Russian and Caspian gas. ECA, 2009

Indees Greece is currently being connected to Italy via the IGI project (Interconnection Greece – Italy) for the import of natural gas in Italy through Greece and has one offshore oil and gas extraction plant (in the northern part of the country, close to the city of Kavala and the island of Thasos) (DG-MARE, 2011).

The IGI project forms part of a larger project, named the ITGI (Interconnection Turkey – Greece – Italy) project, which is a project of European interest (Figure 4-124). The IGI project (a pipeline of around 800 km) comprises an onshore (590 km) and an offshore section (207 km) called the Poseidon Pipeline. The Poseidon Pipeline will connect the Greek Ionian Coast (Thesprotia Prefecture) with the Italian Coast (Apulia Region) (MSP Greek country report, 2011). The project will also include a bypass line between Greece and Bulgaria. Known as Interconnector Greece Bulgaria (IGB), it will have a transmission capacity of three to five billion cubic meters of natural gas per annum. The ITGI project is scheduled to be operational by 2015. The 296km-long and 32in-diameter TG pipeline was inaugurated in November 2007. It can transmit 11.5 billion cubic metres of natural gas annually, shared between Italy and Greece. taly and Greece signed an agreement to support the IGI project in November 2005. The 807km-long pipeline will be built in two sections: 207km underwater crossing the Ionian Sea and a 600km ground section. Onshore installations including a fiscal metering station and a compressor station will be installed along the pipeline (Hydrocarbons Technology).

The 207 km section, also known as the Poseidon pipeline, will reach a maximum depth of 1,380m. The cost of this is estimated at €500m. IGI Poseidon also includes installation of a compressor station and fiscal metering station in the Greek territory of the pipeline, a fiscal metering and pressure reduction station in the Italian territory of the pipeline, and short onshore pipelines connecting the Greek and Italian stations to their respective landfalls. The 600km section is an onshore pipeline named as IGI Onshore built by DESFA, which operates

Greece's national natural gas system. DESFA is a subsidiary of DEPA. The Turkey Greece interconnector originates in Karacabey in Turkey and reaches Komotini in Greece via Alexandroupoli.

The Italy Greece interconnector will begin from the Thesprotia coast in Greece. It will make a landfall in Otranto in the Apulia region of Italy before ending at Komotini. The Greece Bulgaria bypass line will begin at Komotini in Greece and end at Stara Zagora in Bulgaria (Hydrocarbons Technology).

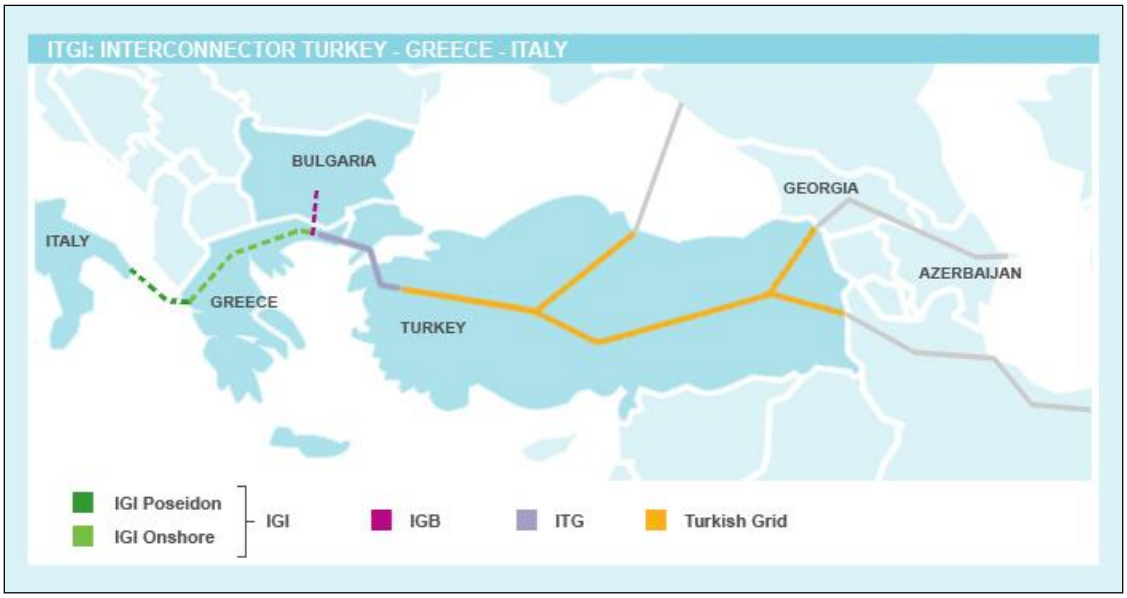


Figure 4-124 Interconnection Turkey – Greece – Italy. Edison Corporate

According to the geographic broadband system of the National Telecommunications and Post Commission, in the Figure 4-125, the locations with broadband services are presented where blue shows the locations where broadband service is supplied and white the locations where services are not provided.

From the maps it is apparent that the largest part of the island of Corfu the whole of Paxos Island is covered sufficiently by broadband services. However, this is not the case the small islands of Othoni, Mathraki and Erikousa, in Antipaxos Island and the northern part of Corfu so the system seems to be covering the most populated areas of the island.

At the regional units of Kefalonia and Ithaki, broadband services are mostly supplied at the urban-tourist areas and specifically at the wider areas of Lefkada, Nidri, Vassiliki, Assos-Fiskardo, AgiaEfimia, Sami, Argostoli, Liksouri, Pastra, Ithaki-Perachori. Coastal and marine areas not included in the system are mostly found at northern Ithaki and the small islands Meganisi, Kalamos and Kastos.

At the regional unit of Zakynthos, broad band services cover the eastern, urban and tourism developed part of the island (Zakynthos city, Laganas and Katastari) with the exception of the western and northern part. At the small islands the connection is achieved either through an undersea cable (Ithaki, Paxos, Meganisi and Othoni) or through an aerial signal (Kalamos, Kastos, Mathraki, Erikousa).

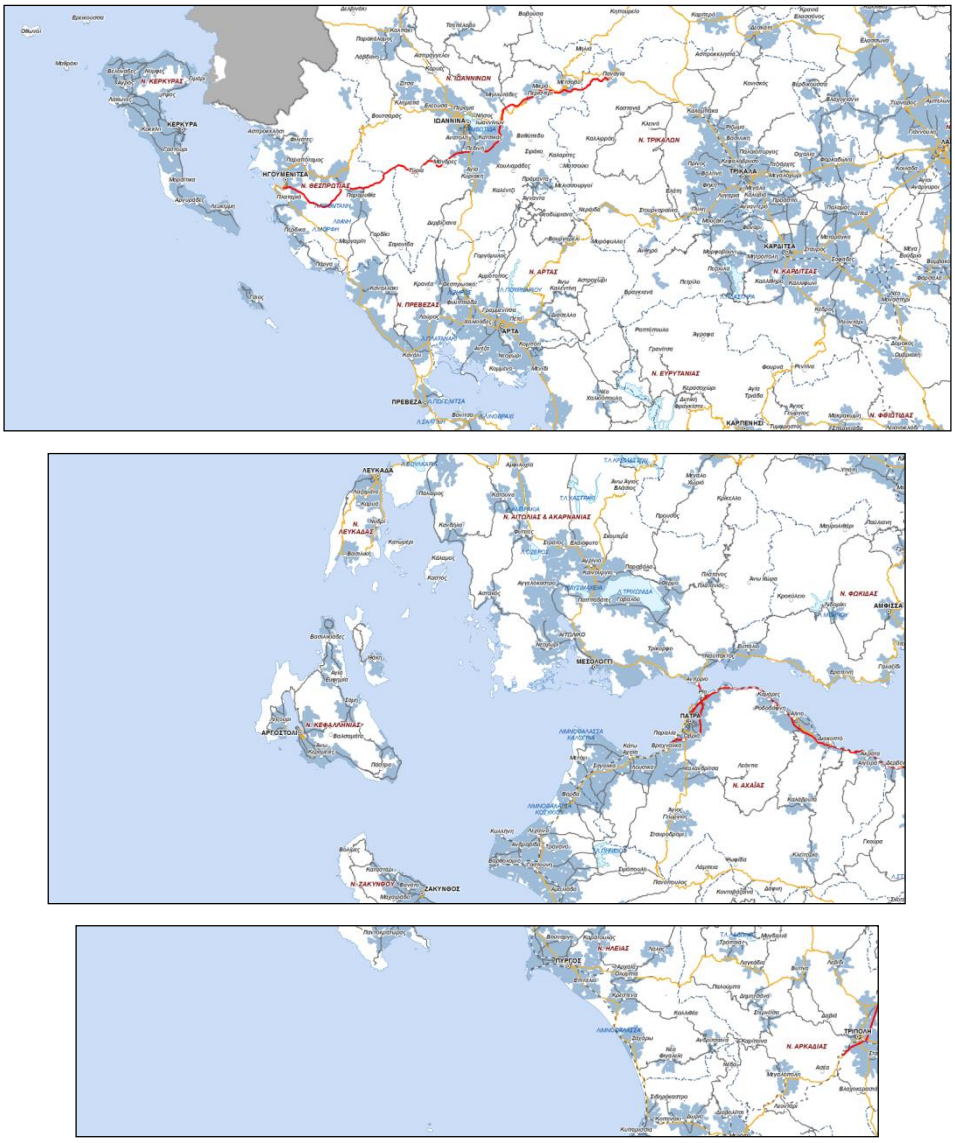


Figure 4-125 Broadband connections in Western Greece and Ionian islands. Hellenic Telecommunications and Post Commission

Moreover, according to the National Network of Research and Technology, in 2008 the optical transport network covering the whole of Greece has expanded, with more than 8000 km of fiber. These connections are presented in Figure 4-126 Figure 4-127.

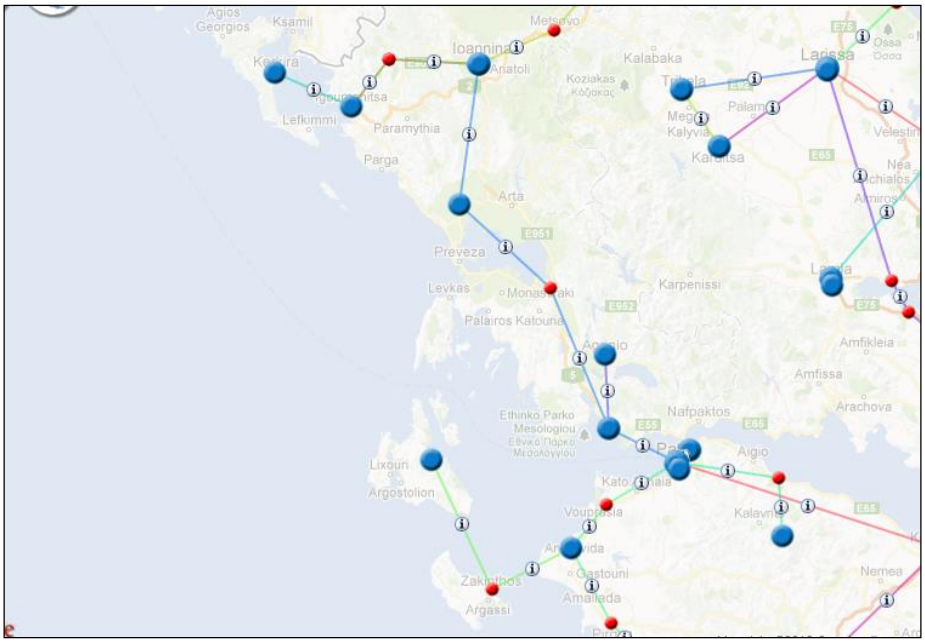


Figure 4-126 Map of optical network in Ionian Sea. National Network of Research and Technology

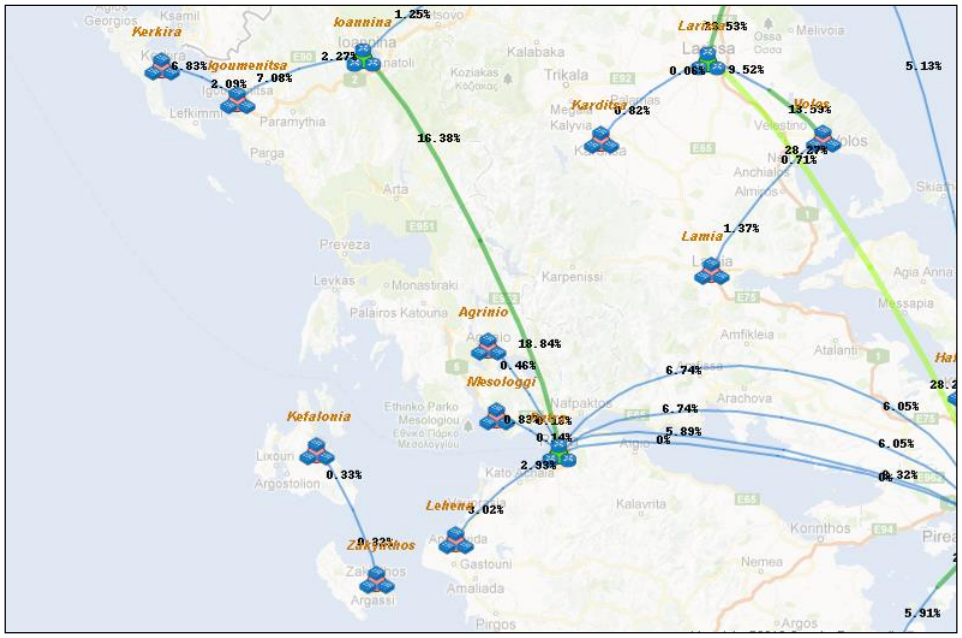


Figure 4-127 Topology map of optical network in Ionian Sea. National Network of Research and Technology

The Organization of Telecommunications of Greece has also completed the installation of digital centres in the Ionian sea. However, there is a lack of a supra-local network which combined with a high capacity telecommunications hub could enable the direct interface with other countries making the areas a digital gateway for the country.

The modernization of telecommunications infrastructure is one of the main goals for development in the telecommunications sector supporting the electronic administrative networking of the regions, their productive sectors, quality of life etc. The continuation of such actions could also act as a significant tool for the reduction of the regionalization of the Ionian Islands.

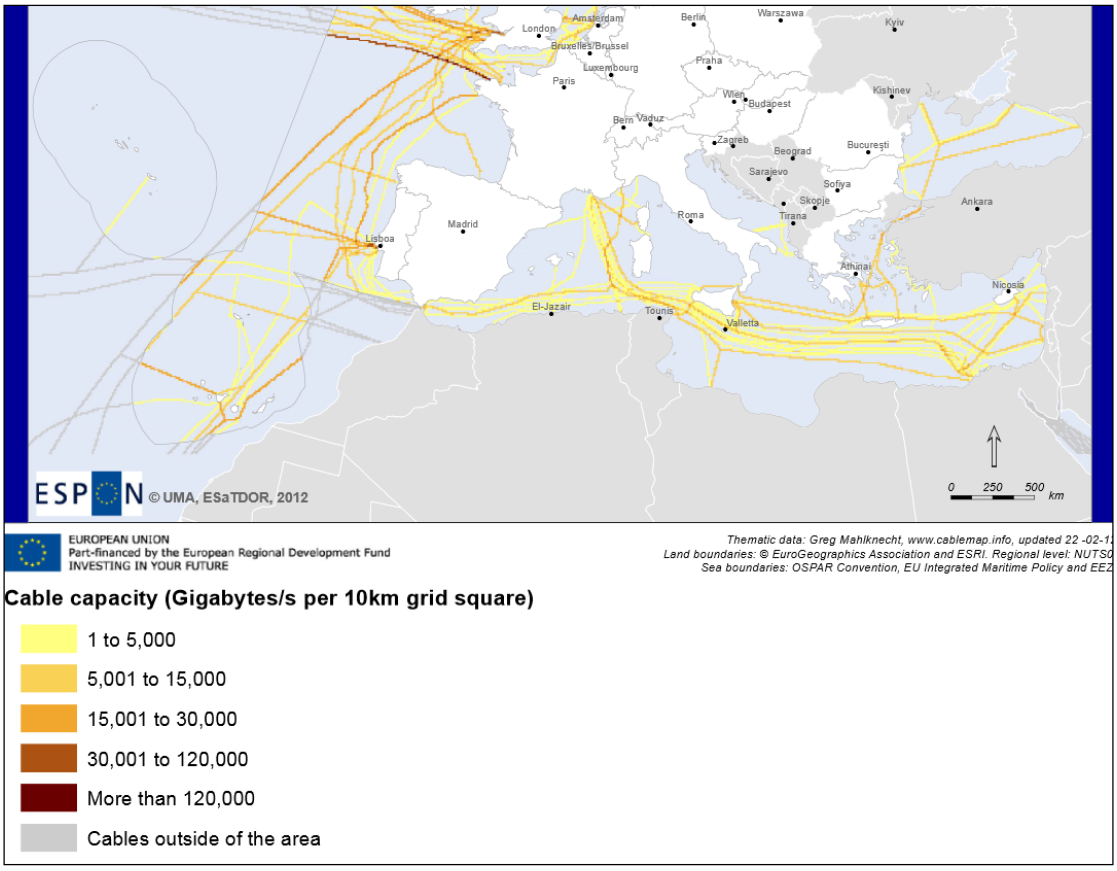


Figure 4-128 Undersea telecommunications cable capacity (Gb/s per 10km grid square). ESPON-ESaTDOR, 2013 (Top).

Three cables are landing in FA2 while the fourth is passing through the Maritime Boundaries of Greece (Figure 4-128) (Source: www.cablemap.info). The landing area is Paleokastritsa inn Corfu Island. "ADRIA-1" cable has 492km length connecting Corfu (Greece) with Durres in Albania and Dubrovnik in Croatia but data abut its capacity are not available. "Corfu-Bar" cable has 2297km length connecting Corfu with Bar in Montenegro and having a capacity of 2.5Gbps. "Italy- Greece" cable has two landings, one in Corfu (Greece) and the other in Otranto of Italy. Its total length is 163km and its capacity is counted for 1695Gbps. "Jonah" is the fourth cable that passing through the Maritime Boundaries of Greece connecting Bari (Italy) and Tel Aviv (Israel). It total length is 2297km and its total capacity id 7.2Gdps.

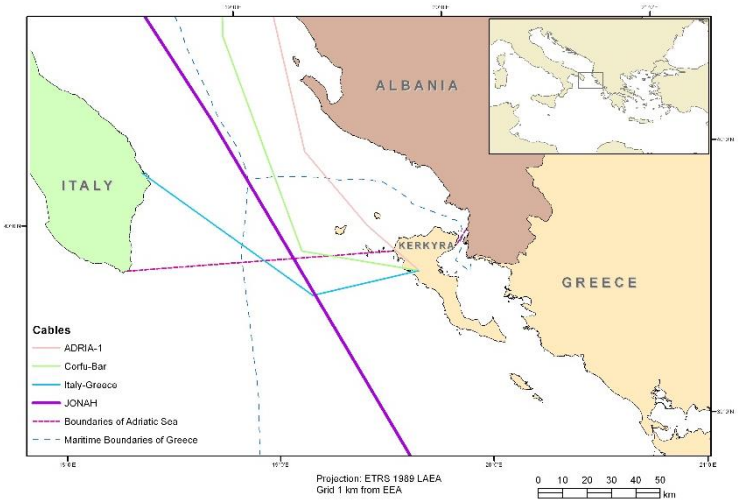


Figure 4-129 Undersea telecommunication cables. COCONET project, 2014

The main project for the AI region is the TAP (Trans Adriatic Pipeline).

On February 2013 an agreement was signed among Italy, Greece and Albania on the TAP project. It was preceded by a Memorandum of Understanding in September 2012, as a preliminary agreement on cooperation in the development of the TAP, in accordance with Community legislation in the field (http://documenti.camera.it/leg17/dossier/Testi/es0124.htm, last access 15.05.2014).

The Trans Adriatic Pipeline will start near Kipoi on the border of Turkey and Greece, where it will seamlessly connect with the Trans Anatolian Pipeline (TANAP). From there TAP will continue onshore crossing the entire territory of Greece and Albania from east to west all the way to the Adriatic Sea coast. The offshore part of the pipeline begins near the Albanian city of Fier and crosses the Adriatic Sea to tie into Italy's gas transportation grid operated by SNAM ReteGas. The TAP route will be approximately 870 kilometres in length (Approx.: Greece 550 km; Albania 210 km; offshore Adriatic Sea 105km; Italy 5 km). TAP's highest elevation point will be 1800 meters in Albania's mountains, while its lowest part offshore will be at 810 meters of depth.

Figure 4-130 TAP pipeline route (https://www.trans-adriatic-pipeline.com/en/progetto-tap/percorso/ last access 15.05.2014)

The project SHAPE reports the location of Powerlines for Italian waters (Figure 4-131).

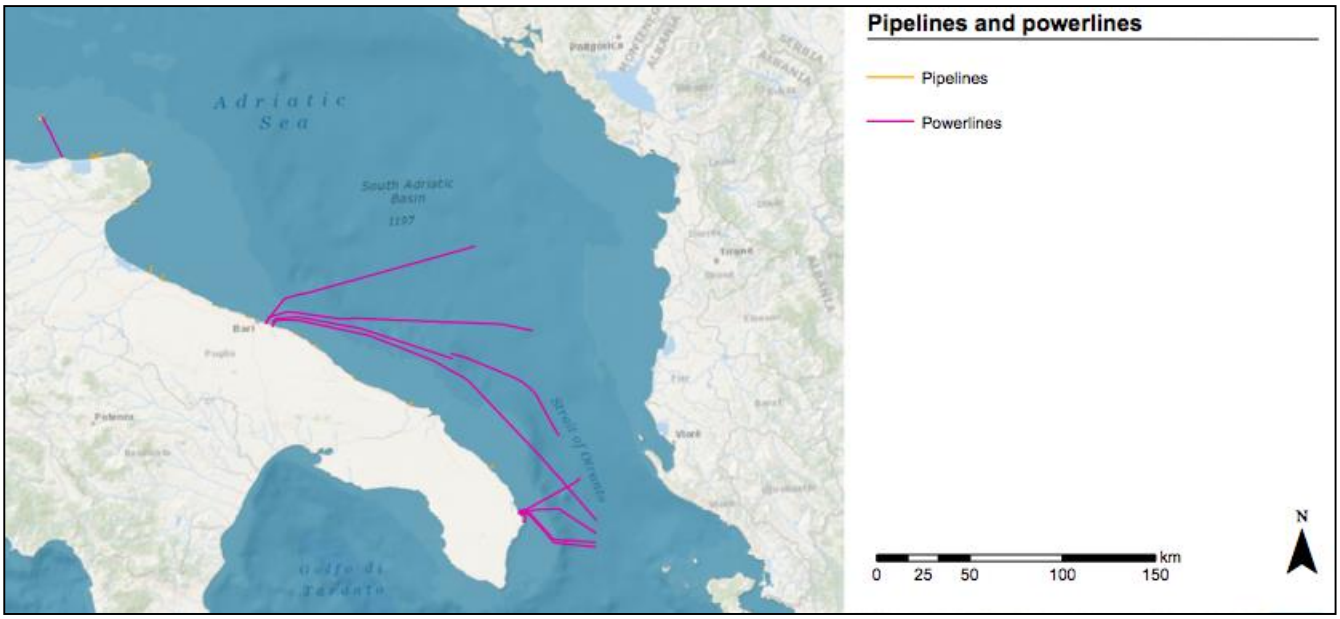


Figure 4-131 Powerlines along the Apulian coasts

4.12 Military zones

D. Scarcella, S. Fraschetti, G. Farella, F. De Leo, T. Papatheochari, S. Niavis, M. Lipizer

At present there is lack of information regarding military areas for all the AIM conuntry except Italy.

The state of the art about the Military zones in Italy is annually included in the document from Istituto Idrografico della Marina "*Allegato al Fascicolo Avvisi ai Naviganti Premessa agli avvisi ai naviganti e avvisi ai naviganti di carattere generale*".

Also, temporary interdicted zones for military reasons are established with Ordinances from the Coast Guard.

In the above mentioned document the following areas are identified:

- Foul areas: areas with presence of old or recent unexploded war devices;
- Danger zones: Firing danger area (training zone);
- Military practice areas: Military training areas (land to sea and sea to land).

The digitalization of the coordinates of these areas have been carried out in SHAPE project (Figure 4-132) and, more recently, information have been collected also for the Croatian, the Montenegro and the Albania coasts and made available through EMODnet Portal for Uman Activities (Figure 4-133).

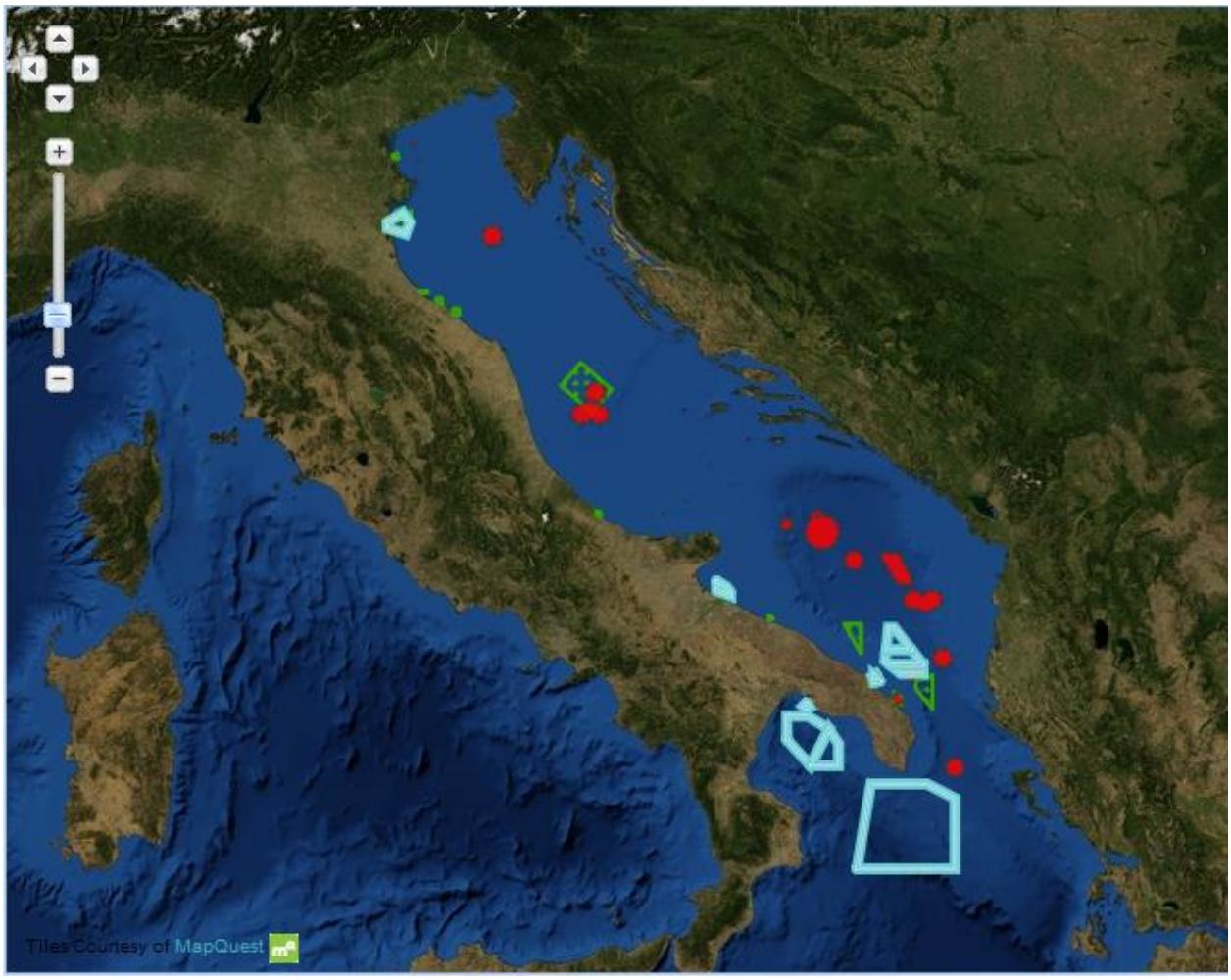


Figure 4-132 Military zones. Foul Areas: areas, Danger zones, Military training areas. From ADRIPLAN Data Portal, data from SHAPE project.

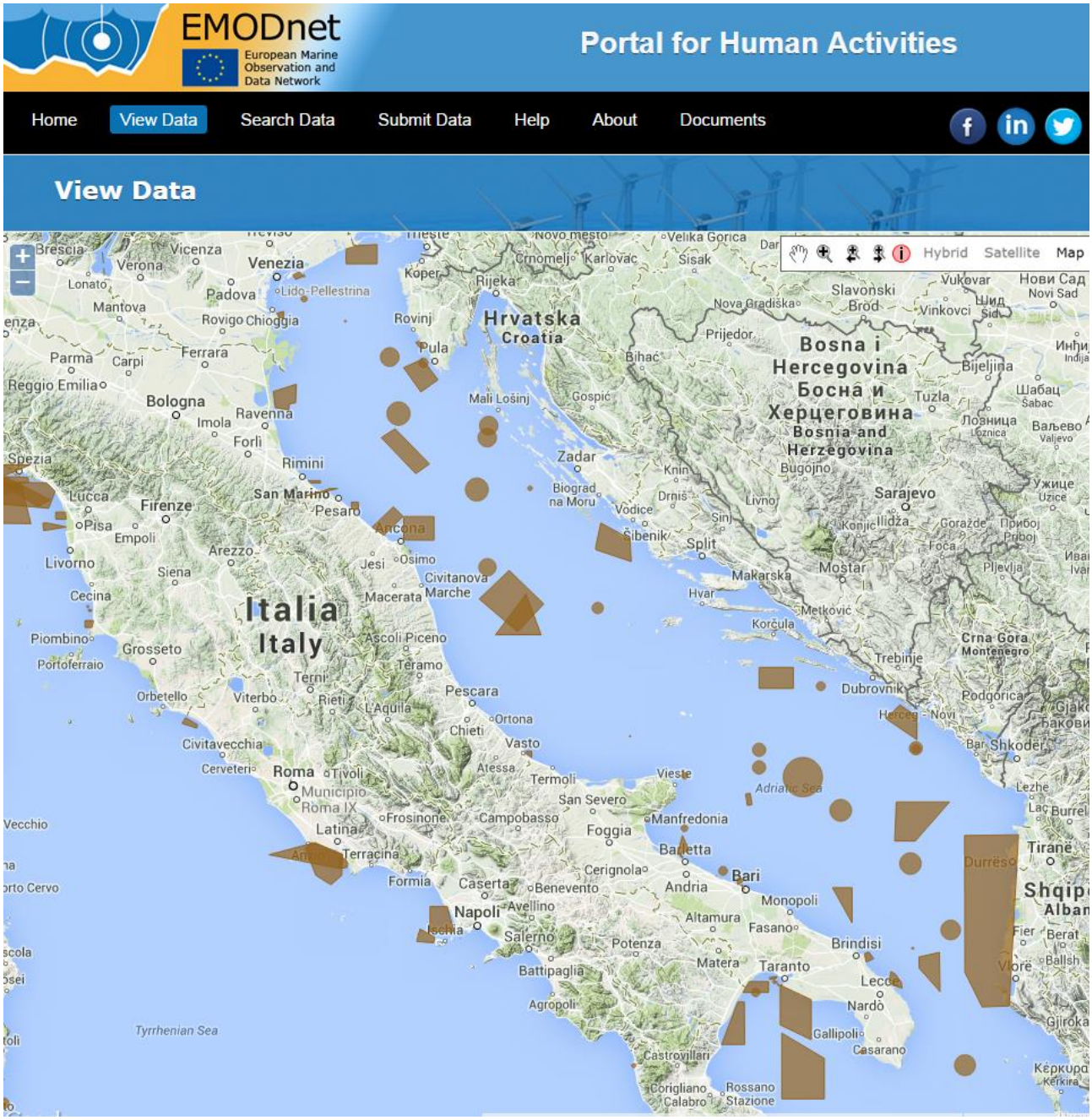


Figure 4-133 Areas of dumped munitions from EMODnet Portal for Uman Activities (bottom) (last visit 6/10/2014).

4.12.1 Focus Area 1

Several dumping areas of munitions are present along the Friuli Venezia Giulia, Veneto, Emilia Romagna and Marche Regions, along the Croatian coastal and offshore waters (Figure 4-134). An additional site where remnants of war have been discharged is reported in the project Adriblu: off the coast of Friuli Venezia Giulia region, a foul area is mapped less than 1 mile off the coast of Grado (Figure 4-135).

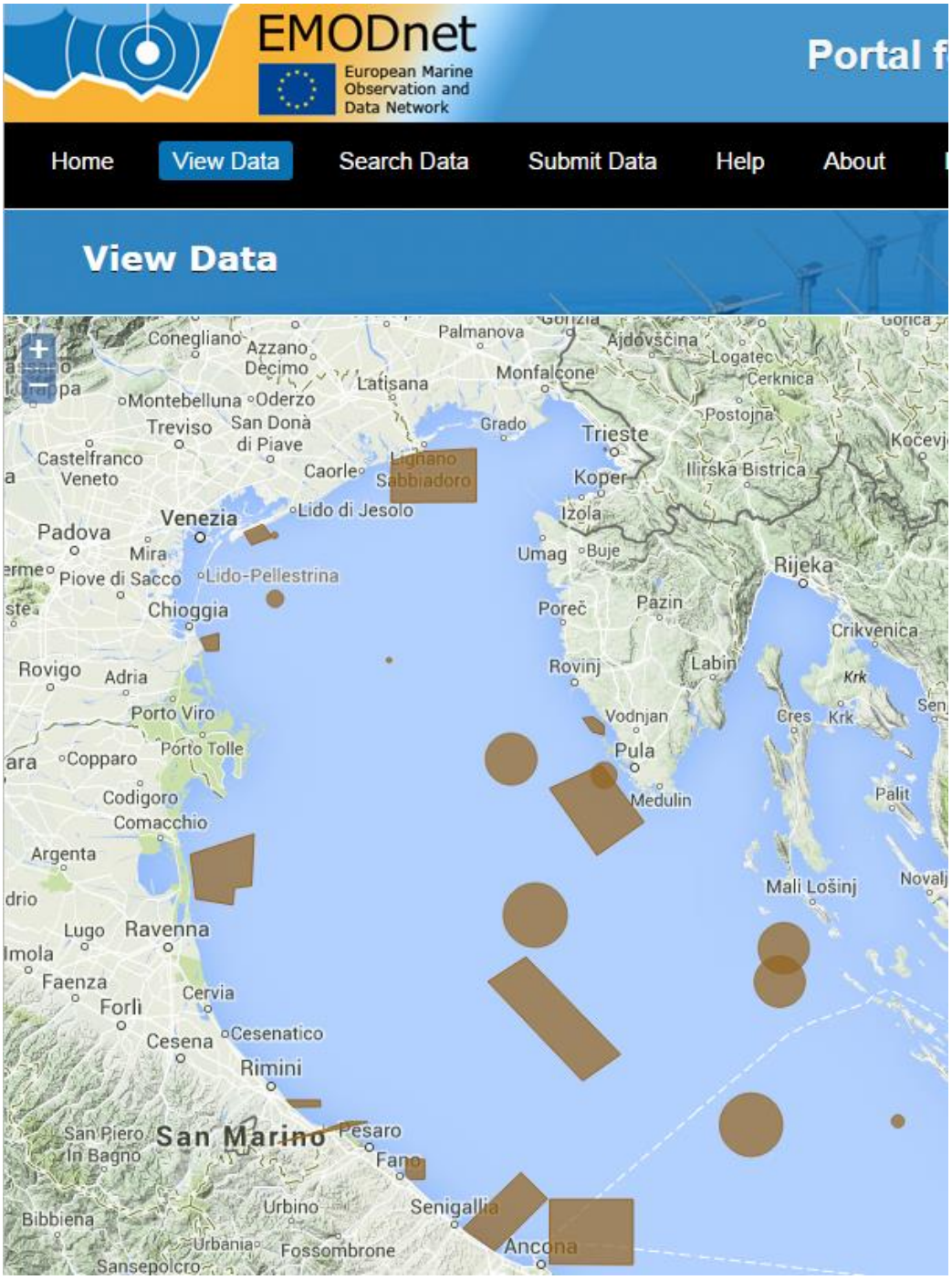


Figure 4-134 Zoom for FA1 of Figure 1-133.

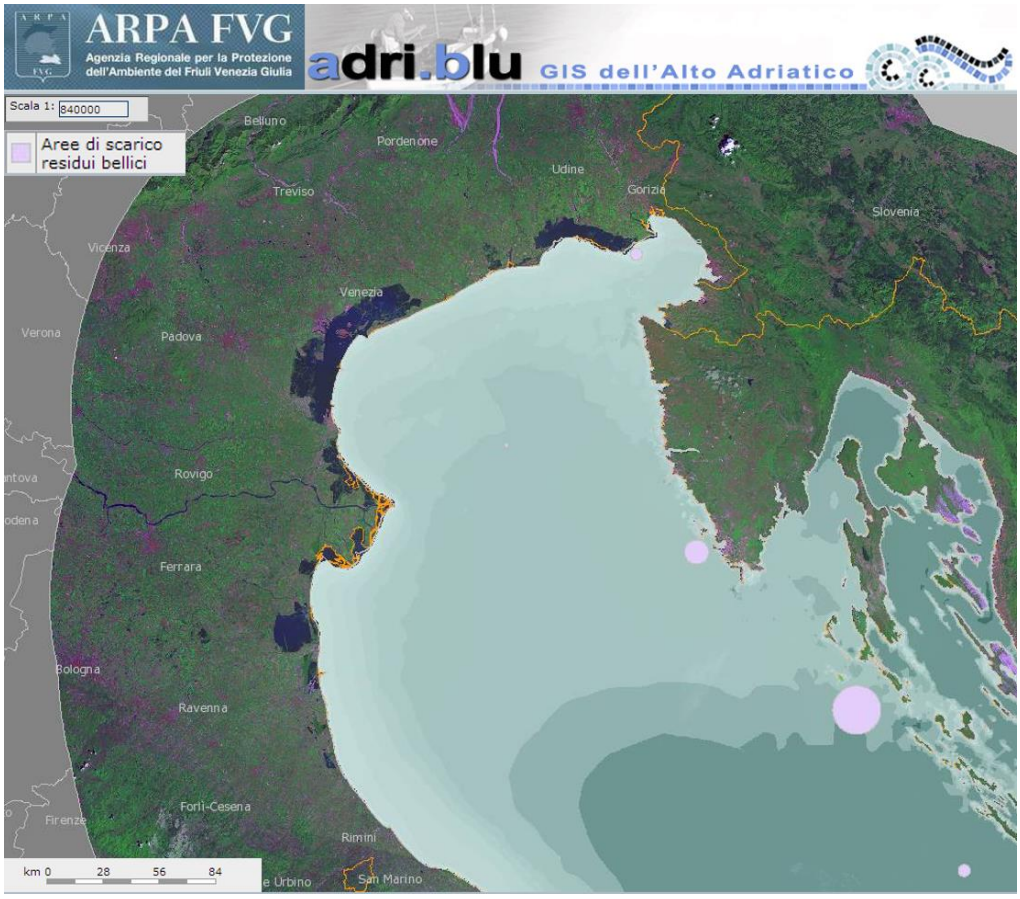


Figure 4-135 Areas of discharge of remnants of war. Adri.blu, ARPA FVG

Off the coast of Veneto Region, Just south of Chioggia an area used for temporary military operation, known as Bacucco shooting area, is established. Access to this marine area is forbidden during the operations that are monthly scheduled.

A large foul area is mapped about 12 miles off the Venice Lagoon and a smaller one 14 miles east of Chioggia.

Areas for temporary military operation were established by Chioggia Port Captaincy – Coast Guard, Ordinance 64/2008; *LNG terminal* from September 2008 until January 2009 on behalf of Soc ADRIATIC LNG operations related to the towing and completion of off-shore terminal for regasification of liquefied natural gas in a site off the coast of Porto Levante (http://www.guardiacostiera.it/capitanerieonline/ordinanze.cfm?id=8; last access 30 March 2014).

Off the coast of Emilia Romagna region, two relevant areas have to be considered:

The first one is in front of Reno river mouth, where a danger zone and a shooting zone are established. Also a foul area is identified where magnetic mines or torpedoes or bullets or other explosive devices dangerous for navigation is still known or likely to be present on the seabed. This area have been interdicted many times and has been interested by intense shooting activities in 2012 (SHAPE, 2014). The area is not environmentally monitored, so there could be a possible existing threats on public health and conservation and safeguard of marine and coastal environment. Also, the area sometimes interdicted for shooting target practice partially overlaps both an area highly frequented by swimmers and leisure boats and some authorize areas for bivalve fish farming. (SHAPE, 2014).

The second one is just north of Riccione, where a shooting zone is established, even though there have been no Ordinance for restriction of use during the observation period of the SHAPE project (January-September 2012).

In Craotia, in Primorje-Gorski Kotar County there are no significant military facilities in the coastal zone and at the sea. Ministry of Defence is just now in the process of selling out biggest military complex Kovčanje on the island Mali Lošinj (and after that it will be used for other purposes). There are several areas of dumping of munitions in front of the Istrian coast (Figure 4-134, 4-135).

4.12.2 Focus Area 2

Bomb dumping areas off Apulia coast

Long after the end of WWII, chemical and conventional ordnance was regularly dumped in the southern Adriatic (dumping at sea was considered the best available solution for war residues and obsolete ordinance). Unexploded ordnance was mainly from clean-up activities in bombed harbours and from stockpiles and production units. Chemical ordinance was mainly "mustard gas" and "lewisite" The Italian problem arose after hospitalization of more than 200 fishermen between 1946 and 1996 as a result of exposure to chemical warfare agents (CWAs) leaking from rusting bombshells or bomb fragments caught in their trawl nets.

Bis-(2-chloroethyl)sulphide, commonly known as "mustard gas" or yperite, and dichloro-(2-chlorovinyl) arsine ("lewisite") are the major CWAs threatening the aquatic environment. In order to gain preliminary knowledge about the threat to marine ecosystems due to leakage of chemical warfare agents (CWAs) and other pollutants from rusting bombshells on the seabed, a case study was conducted in a dumping area in the southern Adriatic Sea (depth 200–300 m) (Amato et al. 2006). In this publication, biological effects of CWAs in the marine ecosystem are investigated in these areas with an integrated ecotoxicological approach.

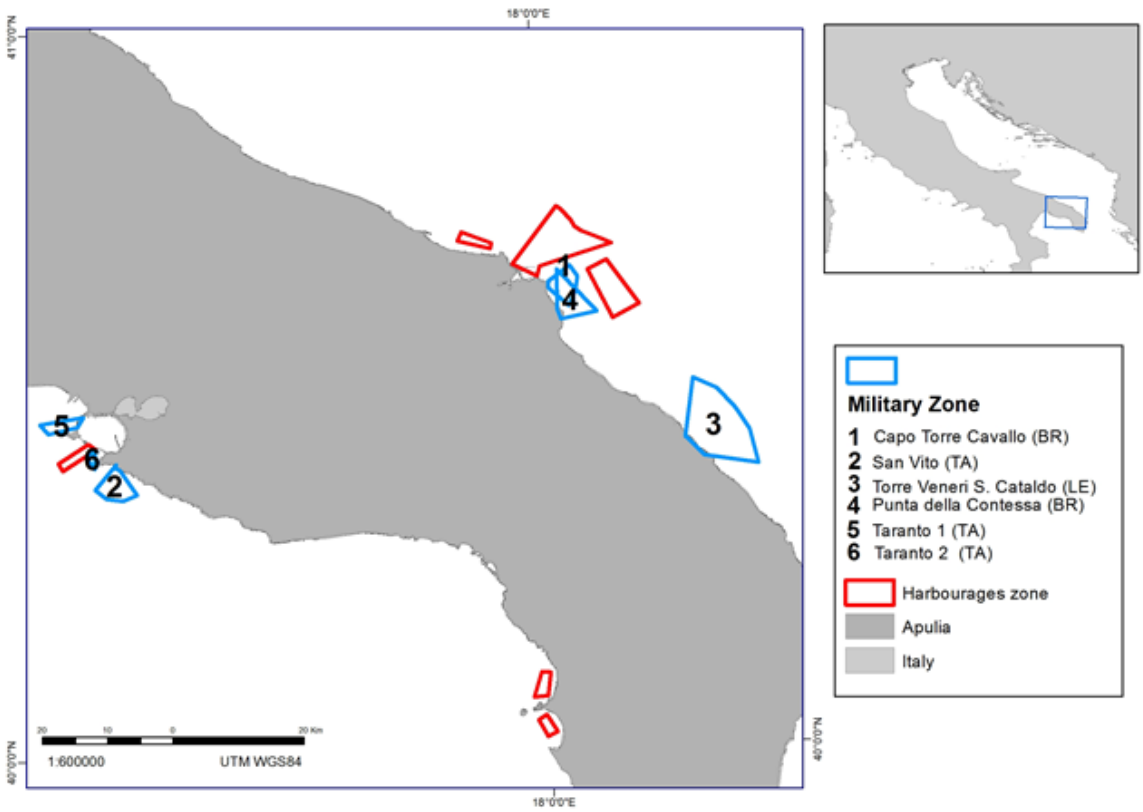


Figure 4-136 Military zones along Apulia coasts.

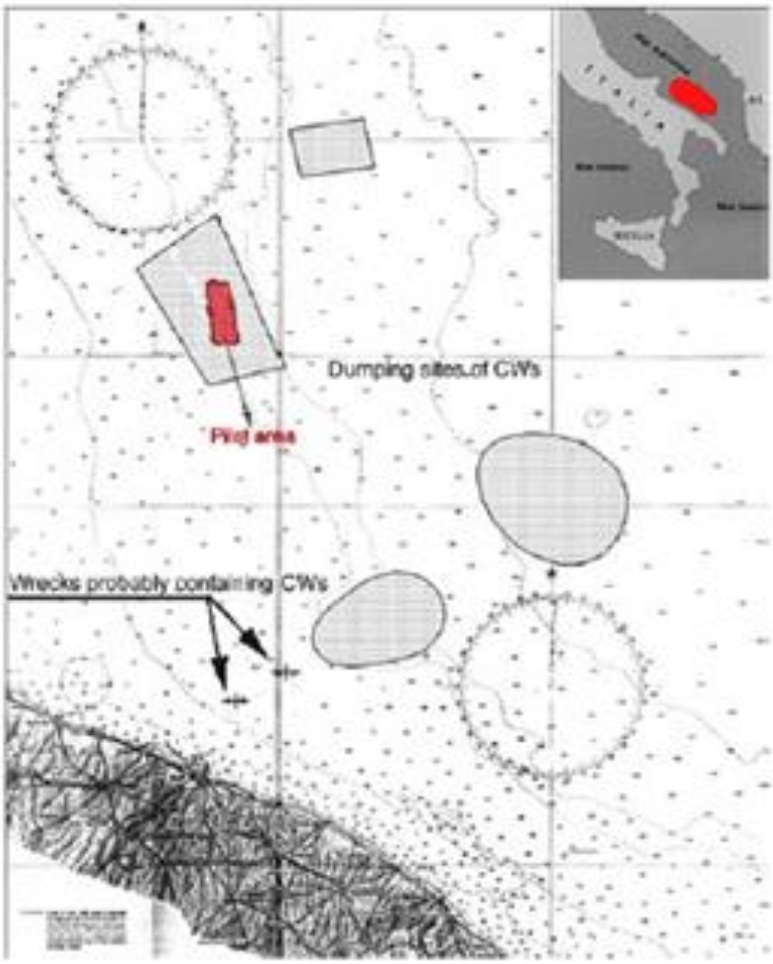


Figure 4-137 Map of sampling sites in souther Adriatic (CWA dumping site) and Thyrrenean Sea (reference site). Amato et al., 2006

5 Environmental Status through MSFD Descriptors

This chapter wil present the main environmental features at, both, the Adriatic-Ionian Macroregional scale and at the Focus Area level in terms of environmental status descriptors proposed in the MSFD. For each MSFD descriptor, the main threats to GES provoked by the maritime uses of the sea present in the AIM (Chapter 4) are presented, highlighting issues which particularly require a transboundary approach. In the context of Marine Spatial Planning, in order to correctly evaluate the impacts on the environmental status of the different planning options, specific information at higher spatial and temporal resolution must be collected and used, in accordance with the spatial and temporal extension of the maritime space involved in the activity (e.g. from local mussel farms to large scale transport routes).

5.1 D1 Biodiversity

S. Fraschetti, G. Farella, F. De Leo, M. Lipizer, D. Tagliapietra, F. Bernardi-Aubry, P.K. Karachle, M. Giannoulaki, V. Vassilopoulou, S. Mezek

In the MSFD, GES in terms of biodiversity is achieved when: "Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions" (European Commission 2008). Thus, the descriptor refers to different level of biodiversity, has a very broad biological and geographical scope and does not entail ecological processes.

To achieve GES a multi species and multi habitat approach is needed, together with a robust assessment of human pressures (and impacts) upon each of these components. Most activities in the marine environment affect biodiversity in some way, and achieving GES in the other Descriptors will ultimately help achieve GES for this Descriptor. The proposed characteristics of GES for this Descriptor in many countries of the EU (see UK as an example) are as follows: Biodiversity loss is halted and where possible restored, with key ecosystems maintained or recovered. The abundance, distribution and condition of species and habitats reflect, or are consistent with, prevailing environmental conditions, taking into account sustainable use of the marine environment.

GES are met when:

1- The extent and natural range of habitats and species is not being significantly reduced (nor likely to be so in the foreseeable future) and the specific structures and functions necessary for their long-term maintenance exist and are likely to exist for the foreseeable future.

2- Habitats and species defined as rare or threatened under existing national or international agreements are conserved effectively through appropriate national or regional mechanisms.

3- Impacts of human activities do not lead to significant degradation of marine habitats or adversely affect species at the population or key functional group level.

It is also true that for descriptors such as biodiversity, non-indigenous species, food webs and sea-floor integrity, there is a general lack of technical guidelines and agreed methodologies adequate for the purposes of the Marine Directive.

The habitat types and biological features are distributed spatially according to their ecological preferences and thus vary considerably from place to place, depending on the physiographic, oceanographic, geographic conditions and biologically driven processes. In addition, marine ecosystems are dynamic and thus subject to constant natural changes (e.g. due to predator-prey relationships and species migrations) as well as fluctuations resulting from climatic variation. There can periodically be regime shifts in some ecosystems which result in significant changes in the balance of species in the ecosystem. The temporal scale for aspects of the life cycle (e.g. reproduction, growth, mortality) also varies considerably between species, from hours up to decades, and can, in some cases, result in dramatic fluctuations in population size between years.

In the context of MSP, in order to correctly evaluate the impact of different planning optins on biodiversity, it is important to understand the nature and scale of such spatial and temporal dynamics, with monitoring of biodiversity consequently undertaken at a periodicity which is suitable to distinguish such natural dynamics from the identification of changes due to anthropogenic pressures. The determination of GES, the setting of state-based targets and the assessment of the state of marine biodiversity needs to take account of such spatial and temporal patterns in biodiversity. In view of spatial and temporal distribution patterns, a suitable set of ecological assessment areas, which can adequately reflect both the ecological scales exhibited by the biodiversity components in each region or subregion and the links to scales which are effective for management measures, may be particularly helpful to define.

5.1.1 Main threats

According to the EU Commission Staff Working Paper SEC (2011), biodiversity is threatened largely by the introduction of non-indigenous species, selective extraction of species, fish stock exploitation, hydrographical changes, contamination by hazardous substances, physical habitat damage and loss and nutrient and organic matter enrichment. These pressures are directly or indirectly linked with several human activities such as commercial and cruise transport, tourism and recreation, demersal and pelagic fishing, aquaculture, sand extraction, dredging, coastal engineering, pollution and nutrient input (land and sea-based).

Habitat degradation is also related to increased human activity, urban development, and sewage and agricultural discharges in the coastal area. Being the most northern arm of the semi enclosed Mediterranean, the Adriatic as a whole is strongly influenced by the adjacent terrestrial area. Yet it remains relatively well preserved on its eastern side due to political isolation during the cold war period. However, Croatia, Montenegro and Albania have undergone significant change over the last 20 years. Associated with this, an increase in human population density in the coastal zone, and accompanying urban development have taken place. In some areas these developments have been uncontrolled, causing considerable impacts to marine biodiversity and environment.

Chemical water pollution in the area is mainly due to industrial activity, especially on the Italian coast. Also of concern for the Gargano area and Tremiti Islands are chemical residuals from the 2nd World War. Perhaps the most polluted region of the eastern Adriatic is located in the northern part of this area. Kaštela Bay north of Split, Croatia's second city, hosted a chlor-alkali cement works between 1950 and 1990 as well as other heavy industry, and the bay remains contaminated with inorganic mercury and other heavy metals (Kljakovic-Gaspic *et al.*, 2006). Other major towns and cities along the Croatian coast have inappropriate waste water treatment with high levels of faecal coliforms in adjacent waters (World Bank, 2008).

Excessive tourism can be found in some localised areas, such as Velipoja beach in Albania, and Velika Plaza in Ulcinj, Montenegro. In Croatia, where tourism is the largest contributor to GDP, there are numerous islands, including Mljet, Lastovo, Vis, Korcula, Hvar, Brac and Solta, subject to high levels of seasonal migration related to tourism, as well as hosting fishing communities and agriculture (Mackelworth and Caric, 2010). Additionally, sites along the coast host major tourist populations in the summer season, including in and around the major cities of Split and Dubrovnik.

Increasing maritime transport, with merchant, ferry and cruising tourism, is another important factor affecting marine biodiversity. Maritime transport is one of the main reasons for increased pollution, noise and disturbance in marine waters. The impact of noise is of major concern, especially for cetaceans, since the central Adriatic is an important area for these animals. The area around Dubrovnik faces threats from increasing pollution from visits by cruise liners, associated with this waste water pollution, solid pollution (including plastics), and air pollution (Caric, 2010).

Marine traffic also increases the transport and introduction of invasive species. Perhaps the greatest threat is from *Caulerpa taxifolia* and *C. racemosa*, both of which are overwhelming

habitats in the region. Since 2001, *C. taxifolia* has been present in Stari Grad Bay, Hvar Island (Zuljevic and Antolic, 2002). Although data on alien and invasive species for this area are limited, a recent assessment in the shallow coastal waters of Albania and Montenegro, together with existing data, has recorded about 23 alien species for both countries, including macroalgae, macrophytes, annelids, crustaceans, molluscs and fish (Beqiraj *et al.*, in press).

On the Albanian coast, erosion has become a major problem in the last 3 decades, mainly related to human activity and especially to hydrological changes and river damming. In the Buna/Bojana delta, the Velipoja coast is one of the areas highly impacted by coastal erosion, and of Franz Joseph Island is rapidly losing its surface.

Finally, uncontrolled and illegal fishing practices are important threats to marine biodiversity in the Adriatic, and have a significant impact on fish stock depletion. High fishing pressure and non- selective fishing gear has already affected the demersal ecosystem and species biodiversity around the regions of Jabuka Pit and the Palagruza Sill (Jukic-Peladic *et al.*, 2001). Depletion of catches in Albanian waters is mainly related to overfishing, water pollution, and habitat destruction. Generally in Croatia, the development of the industrial pelagic fishery threatens to overwhelm fish stocks if unchecked (Mackelworth *et al.*, 2011). Ghost nets are also a threat to sensitive ecosystems, such as coralligenous facies.

For the north Adriatic Sea, Lotze et al. (2006) used a multidisciplinary approach to assess the ecological changes and overall shift in diversity over historical time scales in 12 estuaries and coastal seas worldwide, including the north Adriatic Sea. They assessed the number of species that became depleted (50% decline), rare (90% decline), or extirpated (locally extinct) in the north Adriatic Sea over past centuries and millennia, based on records for 64 species or species groups that used to be of ecological or economic importance in the Adriatic Sea (Coll et al, 2010). These records included marine mammals, birds, reptiles, fish, invertebrates, and plants and were grouped into ten distinct cultural periods. Exploitation stood out as the most important factor causing or contributing to 93% of depletions and 100% of local extinctions or extirpations (see Coll et al. 2010). Habitat loss or destruction was the second-most-important human impact, followed by eutrophication, introduced predators, disease, and general disturbance. While 64% of depletions and 88% of local extinctions were caused by a single human impact, in all other cases the combination of two or several human causes was responsible for the decline or loss. This highlights the importance of cumulative human impacts, especially in coastal ecosystems, with emphasis on species with commercial interest.

Physical damage and loss of habitats are also considered important sources of threats for this area.

In the whole Adriatic and Ioniain Sea, impacts associated with different human pressures to key Mediterranean habitats are generally significant, and overall greater for hard-bottom habitats (rocky reefs, rocky shores, and coralligenous communities) and vegetated habitats (sea grass beds) than for muddy and sandy bottoms. In Croatia, Montenegro, Albania and Apulia, shallow rocky calcareous habitats are heavily threatened due to the destructive fishery of the European date mussel *Lithophaga lithophaga* (L.), which leads to the desertification of tens of kilometres of rocky coast each year.

Regarding the priority habitat of *Posidonia oceanica*, regressions have been already noticed. A general reduction of shoot density since 2001 has been detected in the MPA of Torre Guaceto (Brindisi, Italy). Along the coasts of Albania, a 50% reduction has been detected in 15 years of coastal development. Data for the MPA of Zakynthos in Greece show that fishing activities and anchorage have destroyed a remarkable percentage of the meadows and *Caulerpa* is spreading on the *Posidonia* matte. In the Bay of Boka Kotorska (Montenegro), *Posidonia* meadow has almost disappeared but also some protected species are under serious threat. The reasons for this are different anthropogenic impacts, but first of all waste water discharge without treatment as occurs along the Montenegro coasts. Even though quantitative studies and historical information are largely lacking, it has been estimated that along the Albania coasts the 70% of the *Cystoseira* canopies have been lost during 2002–2005. Similar losses have been documented for the Conero Promontory and Apulia (Italy). Information on the effects of human activities (e.g. diving frequentation, harvesting) on submarine caves is very limited. As

shown by several studies, submarine caves are poorly resilient ecosystems, and understanding their potential of recovery after major disturbances is mandatory for their management and conservation.

Lastly, climate changes should also be considered with caution. Climate models predicted that by 2041–2060, the major part of the Mediterranean will become warmer except the northern Adriatic, which is expected to become cooler (OPAMED8 model based on the A2 IPCC scenario). By 2070–2099, the Mediterranean is projected to warm by 3.1°C, the last cool enclaves being the Gulf of Lions and the northern Adriatic, with a mean SST of 18°C.

5.1.2 Main features at AIM scale

The information available on biodiversity (from species to habitats) largely differs if the Adriatic and the Ionian Sea are compared (Table 5-1). The Adriatic Sea has been largely studied and despite important differences between the North and the South Adriatic Sea, the west and the east, this basin can be considered one of the better known area of the Mediterranean Sea.

	W Med[1]	E Med[2]	NW Med	Alboran Sea	SW Med	Adriatic Sea	Central Med	Ionian Sea	Aegean Sea	Tunisian Pl.[3]/Gulf of Sidra	Levantine Basin[10]	Reference [11]
Ceramiales (Rhodophyta)	248					198	211		193			
Phaeophyceae			161		119[(4)]	160	183[(5)]	122[(6)]			74	[16]
Porifera			432	181	123	230		181	200	90	94	
Anthozoa	151					100		58	90		38	
Gastropoda	1148					462	582		622		83	[66]
Cephalopoda	61	55				45						[435]
Polychaeta	946	877										
Harpacticoid copepoda	254								96			
Cumacea	85	74	78	43	42	13	50[(5)]	28	43	4	48	
Mysidacea	90	55	62	9	2	34	64[(5)]	7	5	30		
Euphausiacea	13					12	13		12		11	[67]
Isopoda	149					47	26		74		34	[66]
Cirripedia	34					17	17		17		13	[66]
Amphipoda	421					242	160		260		144	[66]
Decapoda [(1)]	316					228	205		252		59	[66]
Decapoda [(2)]						293[(7)]			260		230	
Echinodermata	144[(8)]					101	98[(9)]		107		73	
Sipuncula			45	19	15	36	36			16		
Ascidiacea	193	167										

N: North, S: South, W: West, E: East, Med: Mediterranean.
[(1)]Including NW Med, Alboran Sea, SW Med, Tyrrhenian Sea, and excluding Adriatic Sea;
[(2)]Including Aegean, Ionian, Levantine, and Central Mediterranean;
[(3)]Plateau;
[(4)]North Africa,
[(5)]Tyrrhenian Sea;
[(6)]Mediterranean Greece and Turkey,
[(7)]Italian waters;
[(8)]Including Thyrrenian Sea, Alboran, and SW Mediterranean;
[(9)]Including the Ionian Sea,
[(10)]There are severe gaps in our knowledge of most invertebrate taxa in the Levantine Sea,
[(11)]This contribution (details in supplementary material), except where noted.
doi:10.1371/journal.pone.0011842.t002

Table 5-1 Species richness by taxa and regions of the Mediterranean Sea.

Despite the human pressures, the Adriatic Sea is considered a hot spot of biodiversity (Coll et al. 2010, 2011). The Western Mediterranean displays the highest values of species richness,

likely owing to the influx of Atlantic species and the wide range of physicochemical conditions. The central Mediterranean, Adriatic, and Aegean seas are areas of second- highest species richness, although with exceptions (Figure 5-1). The Adriatic Sea sometimes displays lower species numbers because of restricted exchange with the western basin, decreasing depth toward the north, the presence of fresh water, and the larger amplitude of temperature variations. However, this basin shows a large number of endemics, possibly owing to its higher isolation. This is especially true for fish: for this group, the Adriatic appearing as a hot spot of endemism. In addition, the northern Adriatic hosts many species of seabirds, marine mammals, and turtles, deserving conservation and management initiatives.

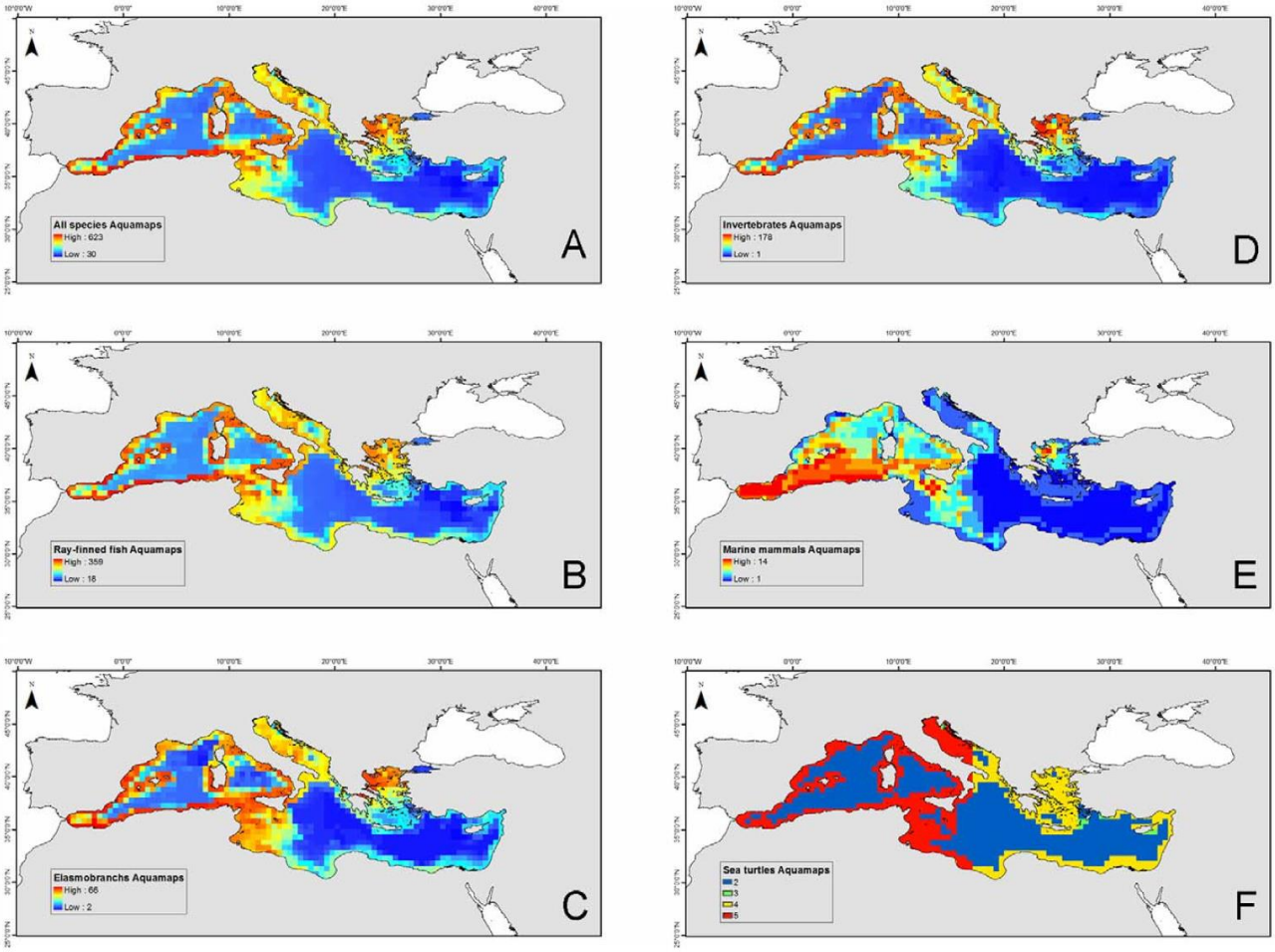


Figure 5. Spatial predicted patterns of species richness in the Mediterranean Sea based on the AquaMaps model [80, and File S2]. (A) All species (n = 693), (B) ray-finned fishes (n = 397), (C) elasmobranchs (n = 74), (D) invertebrates (n = 193), (E) marine mammals (n = 16), (F) sea turtles (n = 5). All maps were generated without imposing a probability threshold except for marine mammals, for which we used a probability threshold of ≥0.4. Colors express species occurrence from blue (little or no occurrence) to red (highest occurrence). The size of the cell is 0.5×0.5 degree.
doi:10.1371/journal.pone.0011842.g005

Figure 5-1 Spatial predicted patterns of species richness in the Mediterranean Sea based on the AcquaMaps model) (see legend in the figure).

This is the reason why the central eastern Adriatic Sea has been included (together with the northern Adriatic) in the lists of important areas for biodiversity in the Mediterranean, such as the potential SPAMI candidates (UNEP/DEPI/MED WG.348/5), in the Ecologically or Biologically Significant Areas (EBSAs), in the priority conservation areas of sea birds (UNEP/DEPI/MED

WG.348/inf.5) and in the priority conservation areas considering the impacts of fisheries in the open seas, including the deep sea (UNEP/DEPI/MED WG.348/inf.4).

In the macroregion, a lot of information is also available at habitat level. In the Adriatic and in the Ionian Sea, forests of Fucoids used to be diverse and abundant. Nowadays losses have been documented at numerous locations, and *Cystoseira* forests are presently scattered and fragmented canopies. Maps for the whole macro region are not available, but an effort for combining information on the distrubution of *Cystoseira* is presently carried out in the framework of the EU FP7 project Coconet.

Recently the project Mediseh Marea revised current knowledge on the distribution of the mediterranean seagrasses. In the south Adriatic, within Apulia Marine Protected Areas a detailed mapping (1:5000) is available for the seagrass *Posidonia oceanica* (Figure 5-2). Rough estimations approximate that about the 16% of the meadows along the Apulian coasts is protected within the borders of Apulian MPAs. Only "presence points" of seagrasses are available for Slovenia, Croatia, Montenegro. In these Countries several coastal habitat mapping projects are still ongoing. Croatia is implementing the Natura 2000 marine Community Interest Sites, and *Posidonia* seems to be largely present.

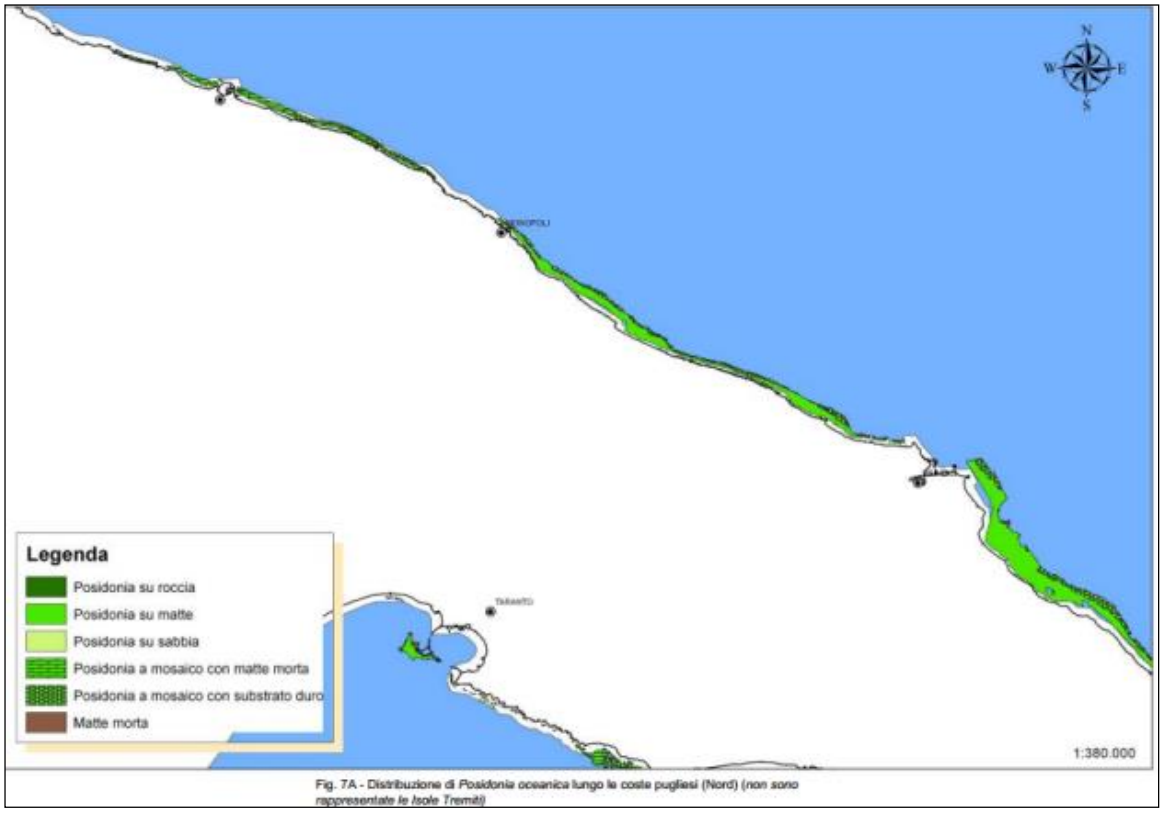


Figure 5-2 Distribution of *Posidonia oceanica* along the Apulian coast.

Posidonia cartography is complete for Albania, where *Posidonia* is largely distributed. In this Country 2.837 ha of *Posidonia* meadows were mapped. Eleven meadows were identified between Cape Rodon (northern coast) and Cuke (southern coast). In Albania, in Vlora Bay, an interdisciplinary study (Interreg III, CISM project 2006 – 2008; www.cismalbania.it) showed that 15 years of coastal development can result in a loss of over 50% of seagrass A large number of personal observations have been collected related to the occurrence of *P. oceanica* along the coasts of Greece. This type of point data reflects years of experience and hundreds of diving all around the Country. In Montenegro, the infralittoral *Posidonia oceanica* meadows are very well distributed and in relatively good conservation status. Existing information on *Zostera* spp. seems to be limited to scattered records in Aegean Sea, the lagoon systems of the east part of Ionian Sea, the north and the south part of the Adriatic Sea, and the Bay of Boka Kotorska (both for *Cymodocea nodosa* and *Zostera noltii*).

Also for *Ruppia cirrhosa* existing information seems to be limited to scattered records in the lagoon systems of the east part of Ionian Sea, and the north part of the Adriatic Sea.

Coralligenous outcrops are also particularly extended in this sector (Figure 5-3).

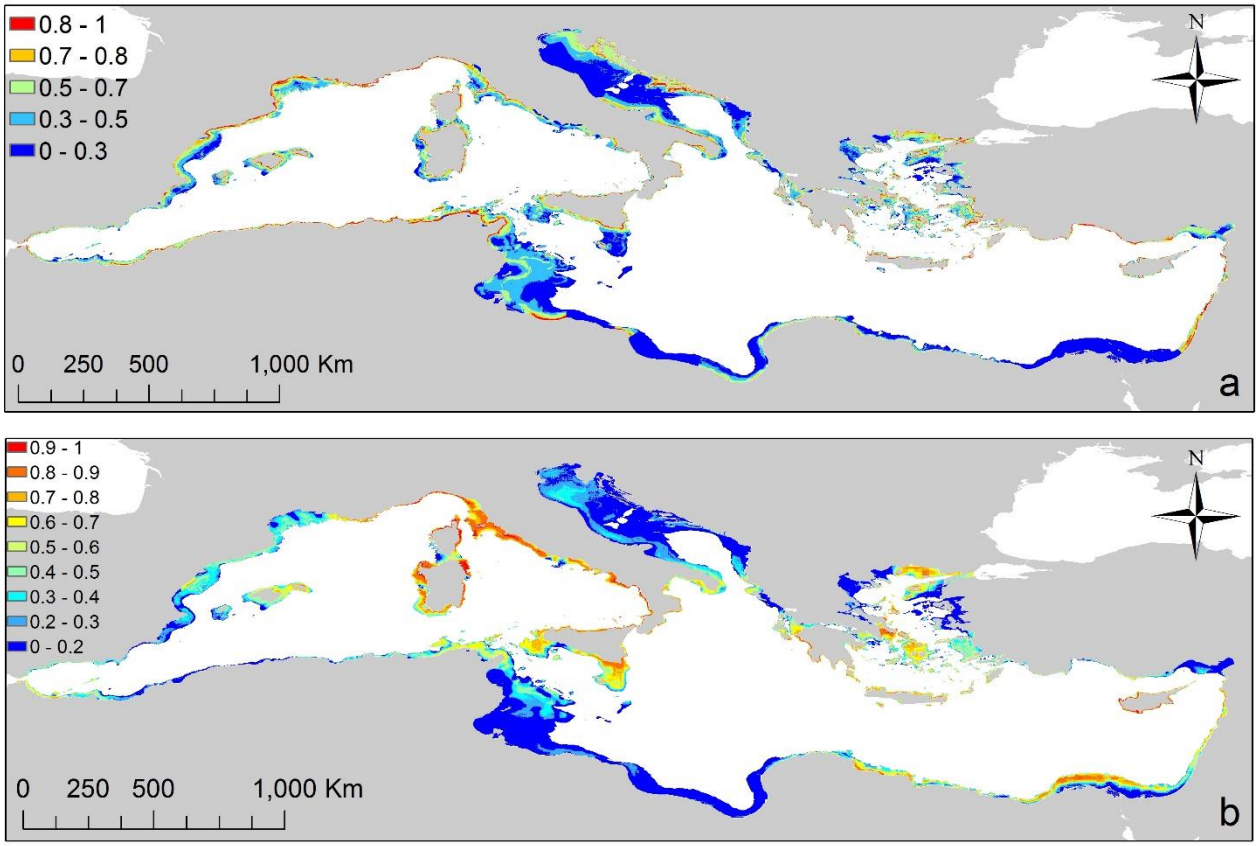


Figure 5-3 Model predicting the distribution of coralligenous outcrops and maerl at Mediterranean scale.

There is a plethora of studies addressing taxonomic issues and species composition of benthic communities of coastal and offshore waters, but they are mostly related to soft bottom biota (Zenetos et al., 2010). There are gaps in knowledge of biodiversity in unexplored geographic areas and habitat types e.g. hard bottom zoobenthos. Reference habitats of the infralittoral are underexplored. Hard bottom phytobenthos in clean reference areas has been studied only at the upper infralittoral but there is only scarce data for communities in deeper waters such as sciaphilous and coralligenous communities. Lack of expertise is also observed in several groups of zoobenthos (e.g. Nemertea, Oligochaeta, Foraminifera) and phytobenthos. Overall species diversity is believed to be a lot higher. Similarly there are gaps in knowledge of biodiversity in unexplored geographic areas and habitat types e.g. hard bottom zoobenthos, as well as of little studied and/or unexplored groups such as Ascidia, Foraminifera among zoobenthos, dinoflagellates, mesozooplankton groups (other than copepoda and cladocera), and macrozooplankton, microplankton (Zenetos et al., 2010).

In the northern Adriatic Sea several "points" of coralligenous-maërl are available for the coasts of Italy. In this area, an effort has been carried out to map peculiar formations called *tegnùe*, *trezze presure* or *grebeni*, submerged rocky substrates of biogenic concretions irregularly scattered in the sandy or muddy seabed and containing extraordinary zoobenthic assemblages (Casellato and Stefanon, 2008) (Figure 5-4).

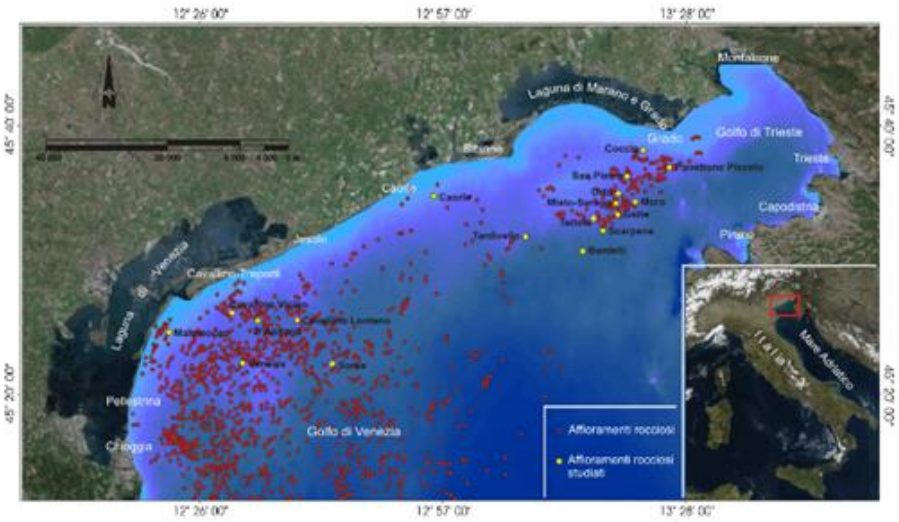


Figure 5-4 Rock outcrop of methane-related carbonate cementation of marine sediment and macroalgal coralligenous assemblages (Gordini et al., 2010).

Recently, a study of macroalgal assemblages of this area revealed important differences with the coralligenous assemblages found in other areas of the Mediterranean Sea. For Croatia only point data sources are available, even though it is clearly evident that coralligenous might be largely present in this area. Very few data refer to maërl. Some information is available for Albania while no information is officially available for Montenegro, even though there are internal reports referring to the presence of bioconstructions. In Apulia, there are a lot of data on the presence of bioconstructions (as the map shows) and this information will be refined through the on-going project BIOMAP (see project list), since the continuous distribution suggested by this map is just a rough assessment of the real distribution. Good quality data are instead available for the three Marine Protected Areas (Archipelago Tremiti, Torre Guaceto, Porto Cesareo) where the available resolution is at 1:5000. However, along the Apulian coasts, only the 4% of this habitat is under protection regimes and, for the moment, it is not included under international regulation interventions. Limited information has been included for Calabria region, even though several projects have been carried out in this area (see the project MoBioMarCal). Specific studies referring to these projects have been included in the analysis of the literature. It is a common opinion, that while the Thyrrenian portion of the region is featured by large extension of this habitat, it might be nearly absent in the Ionian portion of it.

Submarine caves also represent a widespread habitat in this area and one of the few deserving a generalized form of protection from EU initiatives Habitat Directive. The North Ionian (Salento peninsula), Ionian Greece and Albania are rich in caves, although at present they are mapped only along 100 km of rocky Apulian coast (www.tamug.tamu.edu/cavebiology/Research/research.html). Other habitats, e.g. terrigenous muddy biocenosis with facies of *Labidoplax*, facies of sessile forms, as well as by detritic bottoms with facies of *Pinna pectinata*, are represented.

The recent exploration of the deep sea in the area between the Southern Adriatic and the Ionian seas led to the discovery of important white-coral banks, one in between Italy and Albania (canyon of Bari), and one South of Capo Santa Maria di Leuca. The latter coral banks represent an important "hot-spot" of species diversity in the Mediterranean basin comparable to the *Posidonia* meadows and coralligenous bioconstructions on the shelf.

Finally, the deep-sea Ionian maintains extremely peculiar and interesting ecosystems, such as the deep hypersaline anoxic "lakes", that are reported to include several new and little-known microbial lineages.

In the study area there are important nursery and spawning grounds for the main commercial demersal and small pelagic fish species are indicated mainly within the continental shelf and especially in the coastal waters between the Ionian Islands and the mainland (see later in the

presentation of D3-Commercial fish stocks). Concerning anchovy and sardine, the main commercially inportant small pelagic species in the area spawning grounds are indicated along Montenegro and Albanian coast, in the coastal waters between the Ionian islands and the mainland and further south in Patraikos and Amvrakikos gulfs (Schismenou et al., 2008; Tugores et al., 2011). Nursery grounds for these two species are more limited in extent, largely located within the inner part of the continental shelf along the Albanian coastline and closely associated with the Greek mainland southward (Giannoualki et al., 2011). Concerning demersal fish and shellfish the main commercial species include European hake, red mullet, red pandora, red and blue shrimp, deep water rose shrimp, norway lobster, common and horned octopus.

Persistent juvenile grounds for European hake are identified in the relatively deep areas (100-450 m depth zone) between continental Greece and the Ionian Islands complex characterized by mud layers (Colloca et al., 2013). Nursery grounds of red mullet present a very coastal distribution whereas spawning grounds expand up to 100m depth (Colloca et al., 2013). Common pandora nurseries are indicated in the south Ionian Sea area, mainly outside the large Messolonghi laggon and near the coasts of Epirus (Colloca et al., 2013).

The North Ionian Sea is featured by a coastal development and human population densities lower than in other areas of the Mediterranean Sea. However, the lack of quantitative information on spatial and temporal variations of biodiversity and of floro-faunistic inventories in this area might raise expectations about the presence of pristine environments that might not be present anymore.

Also, poor historical baseline data prevent impact assessment and restoration practices. Key species for D1 are cetaceans and according to the MSFD initial assessment for the Ionian Sea (Anonymous, 2012a) sperm whales Physeter macrocephalus in the Ionian Sea are found along the Hellenic Trench from Corfu to the south Peloponnese since the individuals of this species prefer areas where they can dive in deep waters (Frantzis et al. 2011). Certain groups of Delphinus delphis occuring in the northern inner Ionian Sea and in the Corinthian Gulf are genetically isolated (Bearzi et al., 2003). The Ionian Sea hosts an important part of the total Mediterranean populations of the sperm whale (*Physeter macrocephalus*), the bottlenose dolphin (*Tursiops truncatus*) and the common dolphin (*Delphinus delphis*). Regarding the latter, the Inner Ionian Archipelagos - a Natura 2000 Site of Community Importance- used to be one of the last places in the central Mediterranean Sea where abundant common dolphins would be found (Politi et al. 1999). However Bearzi et al. (2008) showed recently a dramatic decline of the species' local population (from 150 to 15 recorded individuals in the last 13 years), urging for direct management measures for the conservation of this endangered species. . As for Mediterranean monk seals (Monachus monachus) are still widely distributed throughout Greece including Ionian Sea, occupying mainly isolated and inaccessible islands, islets or coastal areas (MSFD initial assessment for the Ionian Sea (Anonymous, 2012a).

Three species of marine turtles, namely the loggerhead turtle *Caretta caretta*, the green turtle *Chelonia mydas*, and the leatherback turtle *Dermochelys coriacea* are encountered in the Hellenic seas. For the loggerhead populations (*Caretta caretta*) in the Mediterranean Hellas is among the major nesting sites (Margaritoulis, 2007) (Figure 5-5). According to same source, one among the highest nest density, is Laganas Bay on the Ionian island of Zakynthos. As for loggerhead seaturtles (Caretta caretta), beach surveys in the western Greece coastline (1984-2007) also revealed a big number of nesting areas in the Ionian Islands (MSFD initial assessment for the Ionian Sea (Anonymous 2012a)). These major nesting areas have a mean of 100 nests/ km/ season (Casale & Margaritoulis 2010). They are located in Laganas bay (Zakynthos) and in Kyparissia bay (Peloponnesus). The importance of Zakynthos Island that concentrates about 36% of the total nesting activity in Greece in only 5.5 km of coastline should be emphasized.

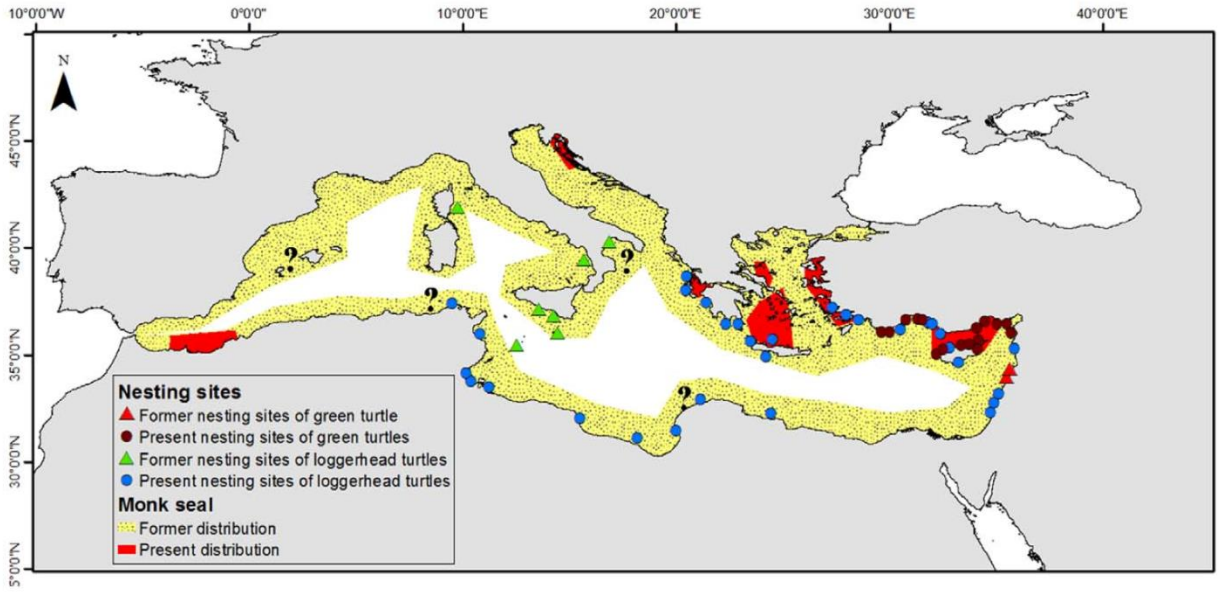


Figure 9. Distribution of monk seals and nesting sites of marine turtles in the Mediterranean. Present (red areas) and historical (yellow areas) distribution of the Mediterranean monk seal [22,23,101,106,117–119], and nesting sites for loggerhead turtle and green turtle [modified from 22]. Green and red triangles, respectively, are the former nesting sites for loggerhead turtle and green turtle; green and red dots are the present sites. Question marks represent sites where one or a few Mediterranean monk seals have been recently seen.
doi:10.1371/journal.pone.0011842.g009

Figure 5-5 Distribution of monk seals and nesting sites of marine turtles in the Mediterranean (see legend in the figure).

The functional group of inshore pelagic feeding birds includes four species: Larus audouinii, Larus cachinnans, Calonectris diomedea and Puffinus yelkouan (Anonymous 2012a). All these species are migratory, except Larus cachinnans. So they are mainly summer visitors to Greek waters. Despite that, most of these species have breeding colonies in the Aegean Sea whereas there is insufficient information on their status in the Ionian . The most important of these species is Larus audouinii, which is a gull species endemic of the Mediterranean. Strofades Islands in the Ionian Sea host one of the most important colonies of Scopoli's Shearwater in the eastern Mediterannean which is estimated in 5.500 pairs (Karris, 2014)

Scattered information is available also for Microphytoplankton community, Zooplankton and Macrofauna of soft bottoms. Only long–term studies on the microphytoplankton community composition were able to identify an upward regime shift in the 1980s concomitant with enhanced eutrophication pressure and downwards shifts in 2000. The abundances of all principal fractions (diatoms, dinoflagellates and nanophytoplankton) were markedly lower in the period 2000–2009 than in the period 1972–2009 in the open Nad (Maric et al., 2012) as well as in the Gulf of Trieste (Kamburska and Fonda Umani, 2009; Cabrini et al., 2012). Dinoflagellates were more abundant in the mid 1980s. In the period 1989–1994 significant changes in the species composition occurred, with a shift to smaller size species (Maric et al., 2012). At the basin scale a reduction in the intensity and frequency of the late winter diatom bloom was observed, as well as a shift toward smaller size specie, which in turn can explain the observed chlorophyll *a* decrease (Giani et al., 2012)
Changes of the copepod community, as well as a general increase, were observed over a period of almost 30 years in the Gulf of Trieste (Kamburska and Fonda Umani, 2006). There were also significant phenological changes in most of the dominant copepod species (Conversi et al., 2009). A relevant upward shift of mesozooplankton biomass since 2001–2002 in comparison with the 1980s was observed by Kamburska and Fonda Umani (2009). The area South of Po Delta was studied in the past by Moodley et al. (1998) who found high macrofaunal biomass and production, which indicated the presence of consistent inputs of organic matter from the water column and an intense benthic–pelagic coupling. Submerged macrophytes that were dominant primary producers in shallow-water soft-bottom areas as well as algal vegetation on the rocky coast have become much less abundant over the last century

probably due to an increased turbidity of the waters and to the overgrazing by flourishing sea urchin populations (Newell and Ott, 1999; Falace et al., 2010). Repeated events of hypoxia and anoxia the 1970s and 1980s caused mass mortalities of benthic macrofauna. The largest mortalities were due to the anoxic crisis of 1974, 1977, 1983 and 1989. In the last decades no mass mortalities due to hypoxia at regional scale were reported and a general recovery was observed in the areas previously impacted by eutrophication (Giani et al., 2012). Soft-bottom polichaete declined after the anoxic event of 1989 causing instability in the macrobenthic communities dominated by bivalves, which decreased during the recovery (Mikac et al., 2011).

5.1.3 Specific features of Focus Area 1:

The marine and coastal areas of the North Adriatic contain the most notable marine and coastal Mediterranean habitats that provide valuable ecosystem services and which are classified of primary importance according to the Habitat Directive (Directive 92/43). They include *Posidonia oceanica g*rassland, which are among the most productive ecosystems in the marine environment, coralligenous communities, macroalgae forests, sea caves, coastal lagoons and marshes. Coastal lagoon such as the Grado – Marano Lagoon in the northernmost part of the Adriatic (Triches et al., 2011) (Figure 5-6), the Venice lagoon (Figure 5-7) and salt marshes such as SEcovlij are particularly sensitive and dynamic habitas important sites for migrating birds and fish reproduction. Some parts of the italian lagoons are protected under Ramsar Convention protocols and declared ZCS (Zones of special conservation) both, for environmental conservation purposes and to promote environmental-sustainable tourism. The Grado – Marano lagoon has been declared "Natura site 2000" as Site of community interest (SIC – IT3320037). For specific information on the Venice lagoon, the atlas of the Venice lagoon provides a collection of interactive maps which are associated text, tables, illustrations, and external databases, covering various aspects of the lagoon, the area and the coastal area of Venice (http://www.silvenezia.it/).

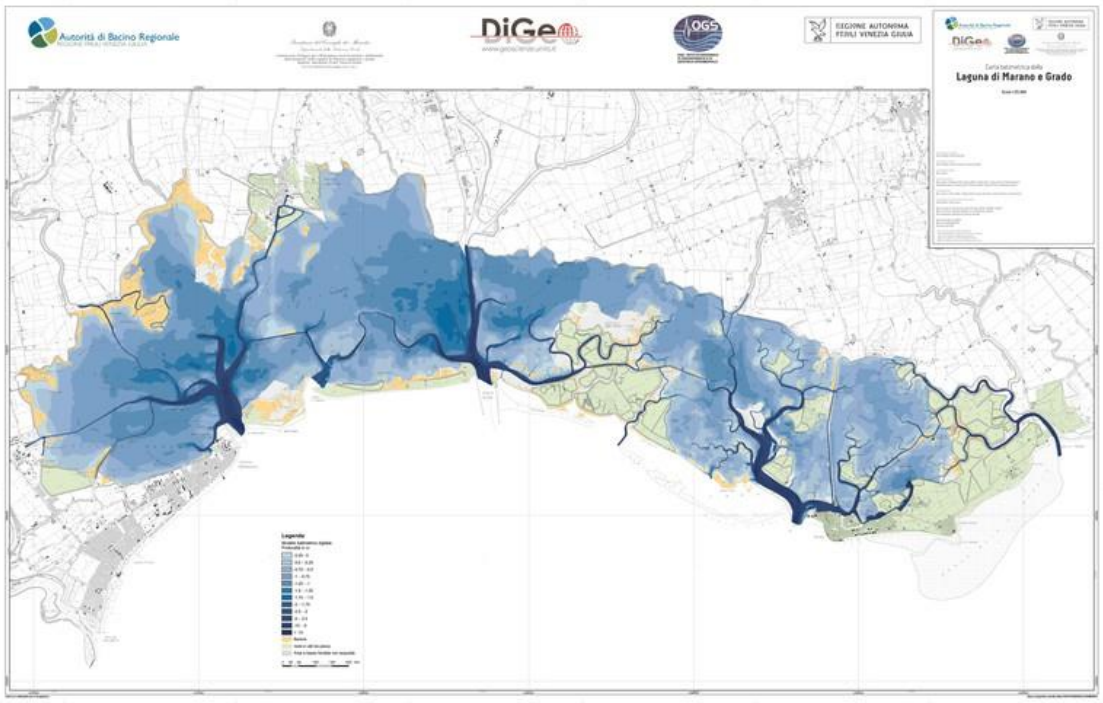


Figure 5-6 Map of the Grado – Marano Lagoon.

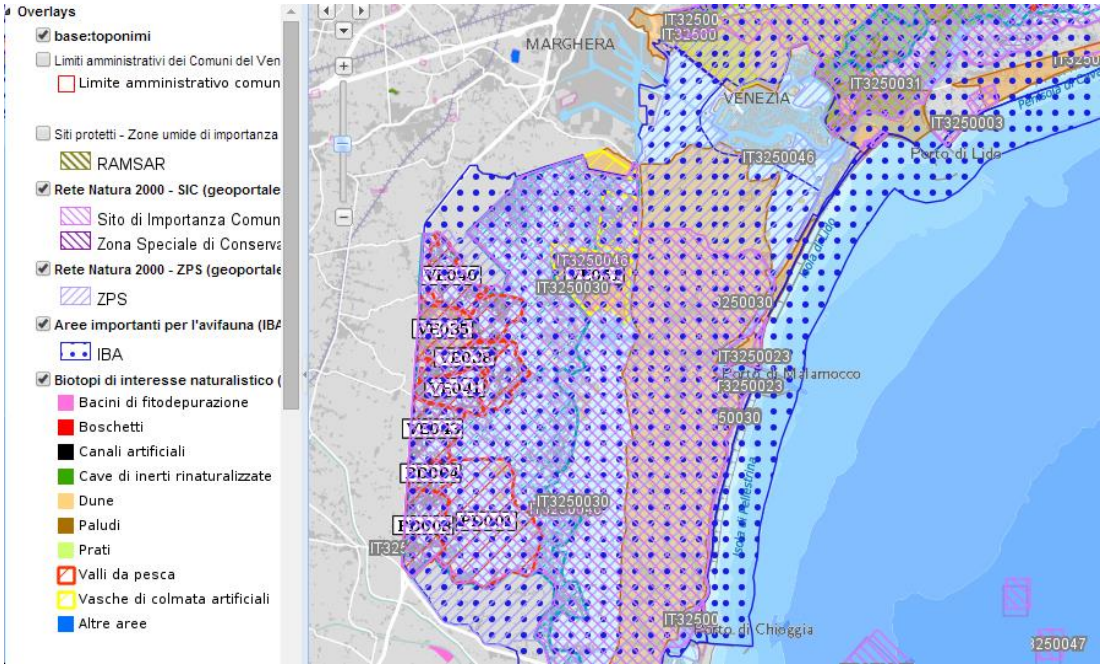


Figure 5-7 Map of the Venice Lagoon: natura 2000 sites (SIC and ZPS), relevant biotopes and important areas for birds (IBA).

In addition to such habitats, also relevant are the so called "tegnue" or "trezze", particular rocky habitats of high ecological value which host hotspots of biodiversity and are spread in the north Adriatic (Figure 5-8). The North Adriatic hosts, furthermore, several rare or endemic species such as the seagrass *Zostera marina*, the seaweed *Fucus virsoides* (UNEP/MAP, 2012). Relevant information on benthic biocenosis (Figure 5-9) and several characteristics of the North Adriatic sea are available through the adri.blu GIS of the North Adriatic developed by the Regional Environmental Agency of Friuli Venezia Giulia Region (ARPA, FVG).

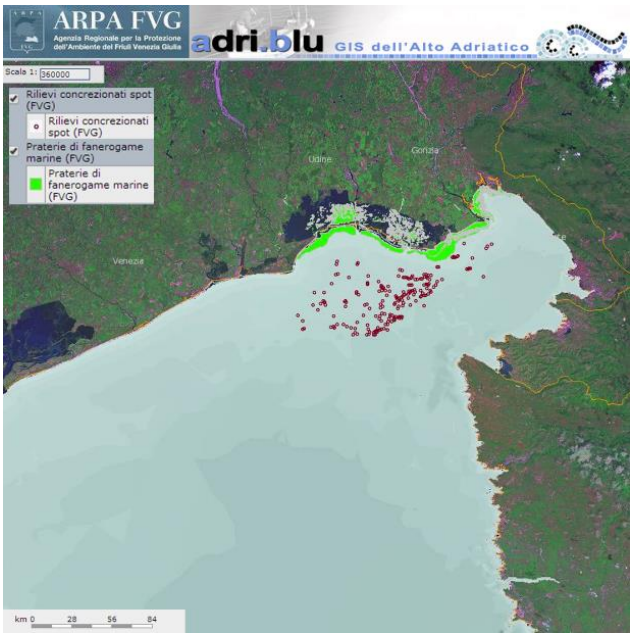


Figure 5-8 Maps of hard bottom spots (red) and seaggrass meadows (green) in the Gulf of Trieste, North Adriatic (Adri.Blu, ARPA FVG).

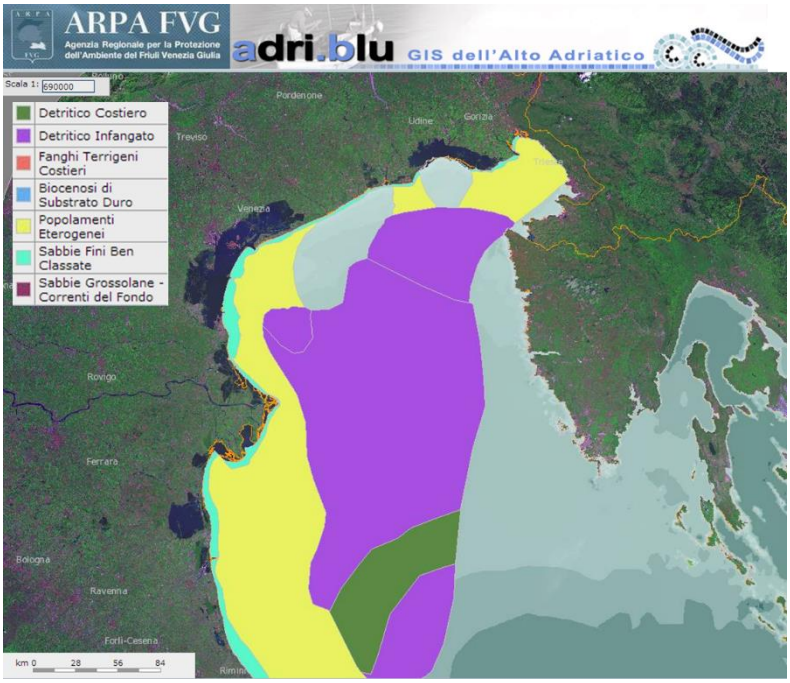


Figure 5-9 Maps of benthic biocenosis (Adri.Blu, ARPA FVG).

With regard to marine mammals and reptiles, which are target groups for GES assessment and conservation, the North Adriatic is inhabitated regularly only by one cetacean species, the bottlenosed dolphin (Tursiops truncatus), whereas other cetaceans are only sporadically or rarely observed in the area. Other dolphins known to be reported in the area are the striped dolphin (Stenella coeruleoalba), the Risso's dolphin (Grampus griseus) and the Common dolphin (Delphinus delphis). The eastern Adriatic coasts are reported as possible breeding of the monk seal, Monachus monachus (Antolovic et al., 2010). Among marine reptiles, the loggerhead turtle Caretta caretta is the only resident turtle of the Adriatic Sea. Small offshore islands are key habitats for several breeding seabird species from Annex I of the SPA/BD Protocol, while coastal habitats like wetlands Neretva Delta and Vrana Lake or mudflats/sandflats in Northern Dalmatia are important for migratory and overwintering birds (Radovic et al., 2005).

With regard to the Slovenian and Croatian waters, the state of benthic habitats is good, but the level of assessment reliability is low. The mediolittoral habitats are an exception, as their status has been assessed as poor, because these habitats are shrinking due to anthropogenic impacts.The prevalence of habitat types in infralittoral and circumlittoral zones may also not decrease significantly and must be maintained in current good condition. Rare and threatened habitats must be included in the existing legislation and protected at the level provided for by the law. Habitats must include all key functional groups. Biodiversity in communities within habitats must be maintained. Special attention must be given to large and highly mobile species (e.g. dolphins, turtles, cartilaginous fish) and other endangered and important species (e.g. stony coral, noble pen shell, Neptune grass). Anticipated changes in habitat and species composition must be properly assessed and agreed in advance. Habitat changes resulting from human activities may not cause an overall decrease in the functionality or biodiversity of an area. It is necessary to establish a network of marine protected areas where management must be carried out effectively to ensure the protection of all biodiversity elements of the Slovenian sea. Another necessary step is to remove the uncertainties and gaps in determining the baselines and setting the goals and target values for all criteria and indicators.

5.1.4 Specific features of Focus Area 2

There is a significant difference in knowledge of marine biodiversity between the north-central

and southern parts of the Adriatic Sea. The Northern Adriatic has been studied for many decades, while in the southern basin, especially in the south-eastern part, data about marine biodiversity are more limited.

In recent years, there has been increasing interest in research and environmental work in the southern part of the proposed area, mainly through the implementation of projects at national, bilateral and regional scale, with the participation of universities and research institutions from the bordering countries. An important contribution has also been provided by non-governmental organisations (Tethys Research Institute (Italy), Blue World Institute of Marine Research and Conservation (Croatia), Association for Protection of Aquatic Wildlife of Albania), especially studies of cetaceans, marine turtles, fish, birds and macrobenthos. This work is enlarging the data on marine biodiversity of the southern Adriatic and contributing to the improvement of biodiversity conservation and management in this region. In Apulia, in particular, since the end of the syxties systematic efforts on species and habitats of this region have been carried out.

Recent research outcomes have provided crucial progress on the knowledge of spatial and temporal patterns of species and assemblages (Fraschetti et al., 2001, 2002, 2005; Terlizzi et al., 2007; Giangrande et al., 2003; Bussotti et al., 2007; Beqiraj et al., 2008; 2010; Kasemi et al., 2008; Kashta et al. 2005; Kashta et al. 2007; Pititto et al. 2009; Maiorano et al. 2010; Miho et al. 2010), trophic cascades (Guidetti, 2006), effects of Marine Protected Areas (Terlizzi et al., 2004; Fraschetti et al., 2005, 2009; Guidetti & Sala, 2006; Guidetti et al., 2008; Kashta & Beqiraj 2009; Kashta et al., 2010) and impacts of human-driven stressors such as coastal sewages (Terlizzi et al., 2002, 2005; Fraschetti et. al., 2006), offshore platforms (Terlizzi et al., 2008, 2009), species introductions (Gravili et al., 2010; Beqiraj et al., 2010; Katsanevakis et al. 2010), habitat destruction (Fraschetti et. al. 2001, 2010; Claudet & Fraschetti 2010), fisheries (Bearzi et al. 2006, 2008), and direct and indirect effects of climate change (Guidetti & Boero 2001; Kapur et al., 2010).

The coastal terrigenous mud biocenosis is well developed along almost the entire south-eastern Adriatic, and particularly well developed in areas with relatively weak bottom currents. Sessile form facies are formed through a prolonged process of sedimentation; these are widely distributed and economically important for the coastal demersal fishery. Many economically important commercial species are found in this area, such as picarel, red mullet, hake, squid, cuttlefish, octopus, as well as many selachian species. Coastal and open water detritic bottom biocoenoses, as well as bathyal mud biocoenoses are also present in this area.

The south eastern portion of this area (including north Albania and south Montenegro) is an important area for the coastal biodiversity and includes sensitive coastal habitats such as caves, coralligenous outcrops, and seagrasses (see the above section). The Buna/Bojana delta shelters a high proportion of coastal biodiversity of the southwestern Balkans. The role of this area is particularly important for certain vertebrates such as birds, fish, mammals, reptiles and amphibians. One of the most important ecological features of the area is migration, especially for globally threatened species fish and bird species. This area is a part of one of the three migration routes of European birds in the north – south direction. It plays a very important role for maintaining bird diversity at regional level, also sheltering species of global conservation concern and species of European conservation concern.

In general, results show that this area is a complex mosaic of habitats and assemblages. The eastern part of the Ionian Sea (Greece and Albania), has been identified by the WWF Mediterranean Program as one of the 10 Mediterranean marine and coastal areas that are vital for biodiversity. This sector is also featured by the presence of important lagoons (Aquatina, Alimini and Mar di Taranto in Apulia and Butrinti in Albania). In Greece, the Amvrakikos Gulf (which comprises a series of marshes and lagoons and is one of the most important wetland systems in Greece), was designated as a Ramsar site in 1975, as a Special Protection Area (EC Directive 79/409 on the conservation of wild birds) and as a Specially Protected Area (SPA) under the SPA/BD Protocol to the Barcelona Convention (Bearzi et al. 2008). In Albania, the

Butrinti lagoon together with its surrounding wetland complex has been designated as a Ramsar site in 2003 and as an international Important Plant Area (IPA) and Important Bird Area (IBA). The Albanian part of this area, especially the Karaburuni Peninsula – Sazani Island, has also been identified as a priority area for marine biodiversity conservation by many recent national and international environmental reports.

One of the key habitats in the Ionian Sea is the seagrass meadows of *Posidonia oceanica* (Figure 5-10). They grow on soft bottoms from the surface down to 35-40 m depth. In the gulfs of the mainland the deeper limit is always less deep that in the islands (Zenetos *et al*., 2010).

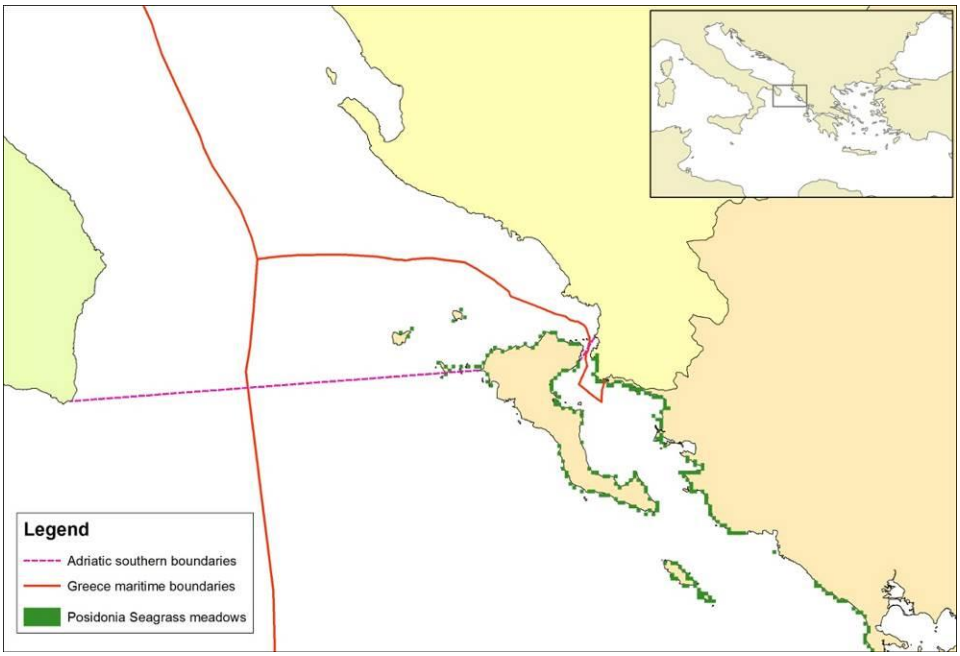


Figure 5-10 Posidonia meadows distributional pattern (Source: COCONET project)

According to the presence of common dolphins, the eastern Ionian area around the island of Kalamos has been included by the Greek Ministry of the Environment in the Natura 2000 network ("Sites of Community Importance") under the 9243 EEC "Habitats" Directive (Frantzis, 1996). The area around the island of Kalamos has also been identified by ACCOBAMS (2002) as one where pilot conservation and management actions should be developed and implemented immediately to preserve common dolphin habitat. So far, however, no specific conservation actions have been taken.

The central Adriatic is an important region for cetacean species. Since 2007, cetacean research has been undertaken around the Vis archipelago; bottlenose dolphins (*Tursiops truncatus*) are regularly seen, and the presence of mother and calf groups indicates that this area may be important for this species. In addition to bottlenose dolphins, surveys also encountered other animals like giant devil rays (*Mobula mobular*), blue-fin tuna (*Thunnus thynnus*), swordfish (*Xiphias gladius*), as well as birds like Eleonora's falcon (*Falco eleonorae*), Manx shearwater (*Puffinuspuffinus*), Cory's shearwater (*Calonectris diomedea*) and European shag (*Phalacrocorax aristotelis*) among others (Holcer *et al.*, 2010). A recent aerial survey for large marine vertebrates indicates that this region hosts fin whales (*Balaenoptera physalus*), particularly around the Palagrusa archipelago where they are sighted on a regular basis. Striped dolphins (*Stenella coeruleoalba*) can be found in the middle of the Adriatic, and Cuvier's beaked whales (*Ziphius cavirostris*) and Risso's dolphins (*Grampus griseus*) are found on the edges of the Southern Adriatic Pit (Fortuna *et al.*, 2010) (Figure 5-11). Other globally threatened species may also be encountered in the proposed area. The Mediterranean monk seal (*Monachus monachus*) is believed to be a transient in the region (Figure 5-12). The loggerhead turtle (*Caretta caretta*) can also be found in large numbers and is believed to be resident year round (Lazar, 2010; Fortuna *et al.*, 2010). Finally, the otter (*Lutra lutra*) is found

around river mouths and deltas, particularly in the southeastern region of the area (MacDonald and Mason, 1994).

As far as sperm whales, Cuvier's beaked whales, common dolphins, Risso's dolphins, bottlenose dolphins, marine turtles, sharks and rays can be present in this area. This area is a "bridge" between the Adriatic and the Ionian, and it is an important migrating corridor for the cetaceans, marine turtles and the monk seal to and from the Adriatic Sea.

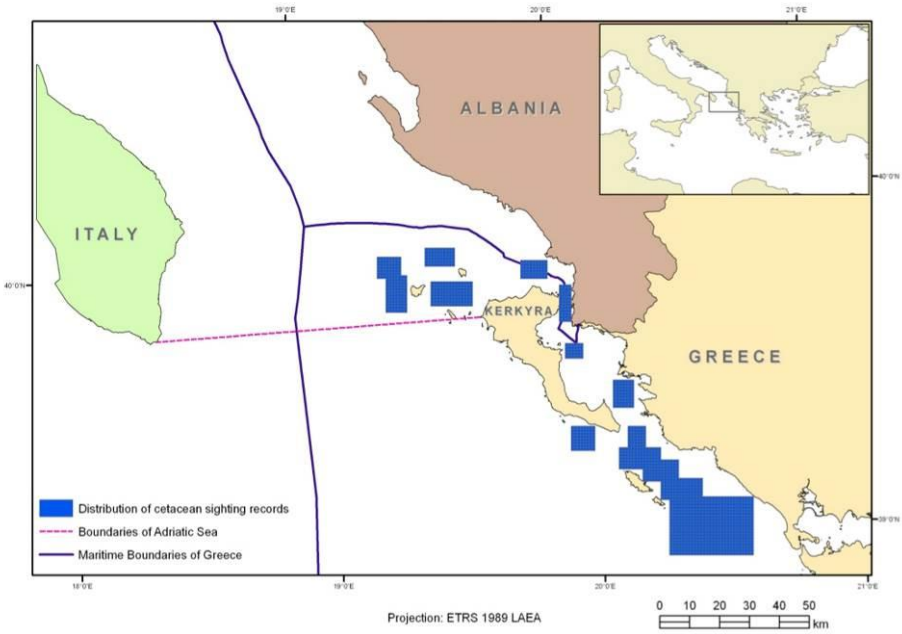


Figure 5-11 Cetacean sightings in the Northern Ionian Sea (Source: modified from Frantzis, 2009)

However, Bearzi et al. (2005, 2006) recently showed that dramatic changes are occurring in Ionian Sea ecosystems. Once-abundant top predators such as the monk seal *Monachus monachus* and the short-beaked common dolphin *Delphinus delphis* are becoming ecologically extinct due to human impact. They indicate that other high-order marine predators are at risk of approaching a similar fate unless appropriate management measures are implemented immediately, particularly with regard to fishing. Once one of the most common cetacean species in the Mediterranean, the common dolphin has declined throughout the region during the last 30–40 years (Bearzi et al., 2003). In 2003, the Mediterranean common dolphin population was classified as Endangered in the IUCN Red List of Threatened Animals (www.iucnredlist.org). The causes of this decline remain poorly understood but are thought to include prey depletion (Bearzi et al., 2003 and Bearzi et al., 2004a).

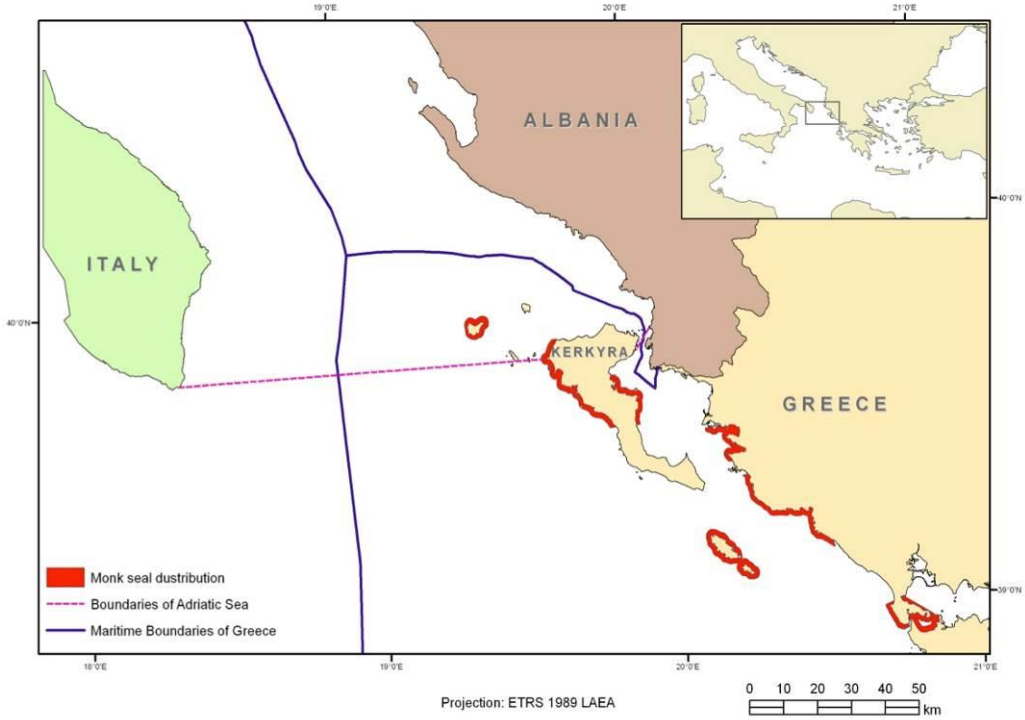


Figure 5-12 Monk seal distributional pattern (Source: modified from Mom).

Within the central Adriatic, there are a number of islands which, due to their isolation, host endemic species, including reptiles and mammals (UNDP, 2005). Jabuka island has particularly high biodiversity. Zavodnik *et al.* (2000) review surveys around and on the island of Jabuka and identify 300 taxa, more than 150 of them noted for the first time for the area. In addition, 159 taxa were identified during a dive survey of the near shore. Jabuka Pit, adjacent to the island of Jabuka, is also the most important spawning and nursery ground in the Adriatic Sea for European hake (*Merlucius merlucius*) and Norway lobster (*Nephrops norvegicus*) (Vrgoč *et al.*, 2004). The area around the Palagrusa archipelago is also an important fishing area with productivity related to the mixing of waters from the northern Adriatic with the southern Adriatic (Vilibic and Supic, 2005). The Palagrusa archipelago is also considered an important habitat for fin whales *(Balaenoptera physalus)* that are sighted on a regular basis in this area. The Vis archipelago is a habitat for a resident population of bottlenose dolphins (*Tursiops truncatus*) (Holcer *et al.*, 2010).

The Neretva river region is unique in Croatia as a marsh delta. It provides numerous habitats important for nesting bird species. Nesting is important in the cane fields, on the sand beaches and the trees. The mouth of Neretva provides a nursery habitat for fish and crustacean species. The river also functions as a gateway for fish migrations (Muzinic, 2007).

The karst limestone coastline found along the eastern border of the Adriatic Sea provides a diversity of unique threatened habitats (Bakran-Petricioli and Petricioli, 2008). Within the karst system, a number of unique habitats can be found such as anchialine caves, sea caves, cold saltwater caverns with bathyal elements, submarine springs, karstic estuaries, saltwater lakes and submarine bare karst stone. These are all considered as endangered in Croatia (Ministry of Culture of the Republic of Croatia, 2009).

On the Italian coast (Gulf of Manfredonia) of the proposed area, the Varano and Lesina lagoons are important habitats for bird sheltering and nesting, especially waterfowl, as well as spawning and nursery sites for fish. In this area, several studies have been carried out on

benthic assemblages (Marzano *et al.*, 2003; Munari *et al.*, 2009). Attempts have been made to analyse the affinity between the zoobenthic assemblage recorded in the hyperhaline lagoon of Karavasta and the assemblages from two Italian lagoons, the brackish Lake of Lesina and the euhaline Lake of Fogliano, according to the different hydrological conditions and the geographical location (Marzano *et al.*, 2010). In the Gulf of Manfredonia, previously considered an area essentially dominated by muddy assemblages, extensive coralligenous banks have been found (Terlizzi, unpub. data); this represents important information in terms of spatial planning, since this area was recently selected for development as a wind farm area.

The south-eastern corner of the proposed area represents a large transboundary ecosystem between Albania and Montenegro, the delta of Buna/Bojana River. This ecosystem is important on a regional scale in terms of biodiversity and hydrology. The Buna/Bojana delta, with Ada Island in Montenegro, the Velipoja coastal forest in Albania, the whole river bed and the Shkodra/Skadar Lake from whence the river flows, has been proclaimed a Ramsar site and an international IBA (Important Bird Area). The mouth of the Buna/Bojana facilitates fish migration from Shkodra Lake and its watershed into the Adriatic Sea. It also links the lakes of Ohrid and Prespa through their connection with Drin River, which joins Buna upstream. This effectively covers a large hydrographic network of the southwestern Balkans, including Albania, Montenegro, Kosovo, Former Yugoslav Republic of Macedonia and Greece. At least 13 fish species and subspecies migrate through Buna/ Bojana mouth, of which 6 are globally threatened. The Buna/Bojana delta offers important food sources for fish, spawning grounds, nursery and migration paths on which fish stocks depend (either within the wetland or other habitats connected to them). This area is also very important hydrographically, and is well-known fot its high ecological sensitivity. The so called "hydrologic junction" Shkodra Lake - River Buna - River Drin determines the hydrological regime of Shkodra Lake, River Buna itself, and their tributaries, and has an important impact on the morphology and water regime in Buna delta in the south-eastern Adriatic.

5.2 D2 Non-indigenous species

A. Zenetos, S. Fraschetti, G. Farella, F. De Leo, D. Tagliapietra, M. Lipizer, S. Mezek

Non-indigenous species (NIS) (also called Alien, exotic, non-native) are species introduced outside their historic or native range, which might survive and subsequently reproduce. Their presence in the given region is due to deliberate or unintentional introduction resulting from human activities; conversely, natural dispersal attributed to climate change or dispersal by ocean currents does not qualify a species as a NIS.

The approach to NIS must be addressed in conjunction with that of biodiversity. The concept of ecological niche and its dimensions is not, in fact, separable from that of habitat and pressures. The concept of biodiversity is also closely linked to the concept of alien species through xenodiversity. The failure to achieve GES for NIS (Descriptor 2) also has consequences on several other descriptors including: D1-Biodiversity, D3-Commercial Fish and Shellfish and D6-Seafloor Integrity.

The assessment of GES for D2-NIS is based on two criteria, considering the abundance and state of non-indigenous species, in particular invasive species (2.1), and the environmental impact of invasive non-indigenous species (2.2).

In many cases, non-indigenous species do not harm the regional ecology and economy. However, in certain cases, NIS are rapidly spreading or have demonstrated their potential to spread elsewhere, and have an adverse effect on ecosystem functioning and /or ecosystem services. These are called "invasive aliens species" (IAS) and may have serious negative consequences for their new environment and they represent a major threat to native plants and animals in Europe, causing damage worth millions of euros every year. Lastly, species of unknown origin, which cannot be ascribed as being native or alien, are termed cryptogenic

species. They may also demonstrate invasive characteristics and should be included in IAS assessments.

5.2.1 Main threats and documented impacts

All alien species have by definition a negative impact on biodiversity. However, the vast majority of them are possibly harmless and have no impact on ecosystem/ecosystem services.

Biological invasions severely challenge the conservation of biodiversity and natural resources, and are considered as one of the most important direct drivers of biodiversity loss and a major pressure to several types of ecosystems, with both ecological and economic impacts (MEA 2005). As an example, invasive NIS seaweeds have contributed to the decline in Mediterranean Sea seagrass meadows, impacting their ecosystem functions, and compromising their restoration (Mooney & Cleland, 2001; Boudouresque and Verlaque, 2002 and 2005; Williams, 2007).

Unlike terrestrial systems where bioinvasions have caused significant damage to economic interests (e.g., agriculture, forestry, animal husbandry), the majority of demonstrable marine bioinvasion impacts appear to be primarily on native biodiversity and ecosystem health. However, virtually all established NIS have at least some impact on the environment in the area where they dwell, feed and occupy a certain territory (e.g. Leppäkoski et al., 2002; Hewitt et al., 2009) with few demonstrable direct impacts on economic values (e.g. Shine et al., 2008).

Alien species may be introduced, as a direct or indirect result of human activities, through three broad mechanisms: the importation of a commodity, the arrival of a transport vector, or dispersal from a neighboring/connected region (Hulme et al., 2008).

Five pathways are associated to these broad mechanisms (ICES, 2012):

- commodities intentionally released or escaped (aquaculture, aquarium & live food/bait trade),
- contaminants of commodities (aquaculture),
- stowaways on modes of transport (shipping),
- exploitation of corridors resulting from transport infrastructures (man-made marine or inland canals).

The sixth pathways proposed by Hulme et al. (2008) refer to alien species that may arrive unaided in a region as a result of natural spread following a human-mediated introduction in a neighboring region. For simplicity and to be more specific to the European marine environment, we used five categories of pathways of introduction defined on a human activity basis: 'shipping', 'aquaculture' (imported for mariculture and 'accidentally' introduced with them), 'corridors' ('Suez', which is the only marine man-made corridor in Europe,), 'aquarium trade' (including escapes from public aquaria), and 'other' (including: live food / bait trade; floating objects; import for military purposes).

The shipping sector is one of the predominant industries causing translocations and introduction of NIS in all European Regional Seas (Figure 5-13). Invasive NIS in larval form can be easily transported in ship ballast water, or in adult form, on ship hulls. NIS will impact on other marine sector businesses (e.g. aquaculture, fisheries, recreation and tourism) (Knights et al., 2011). The effectiveness of the transport mechanisms of the stowaway organisms (eg. trough ballasts waters hosted or fouling on the hulls), may be influenced by the routes followed and the time and mode of permanence in ports.

The recognition and spatial identification of these introduction pathways are critical in the context of ADRIPLAN. For example, knowledge of the environmental characteristics of the ports of origin and destination of the nautical vectors can allow us to predict the adaptability and the possible spread of the main NIS, in order to act proactively.

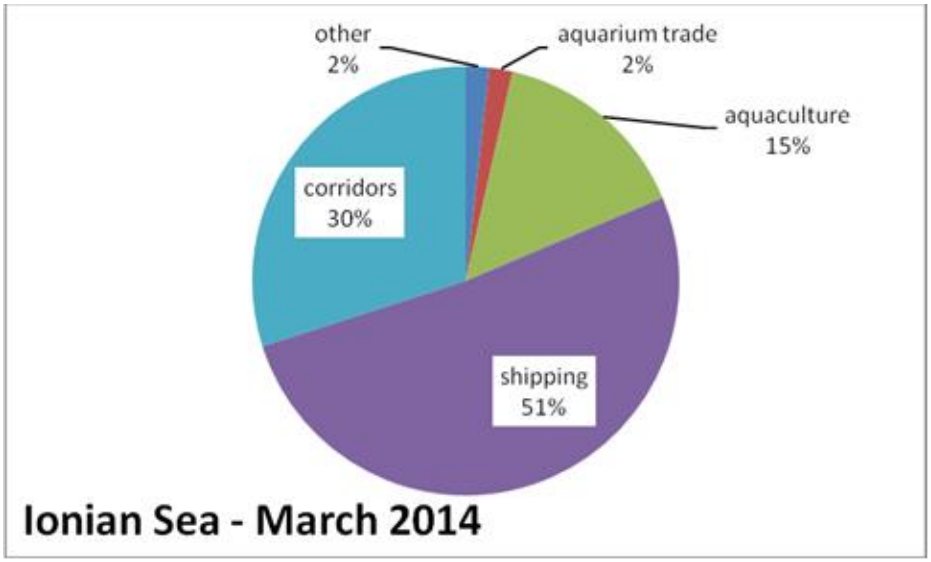


Figure 5-13 Main NIS introduction patterns to the Ionian Sea.

Among the documented impact of NIS in the AIM, the Adriatic hosts the American bluecrab, *Callinectes sapidus,* a commercially important species and a dominant invertebrate in estuaries along much of the east coast of North and South America, including the Gulf of Mexico. Since 1900, the blue crab has extended its distribution to many European coastal waters, transported in ballast waters. In the Mediterranean, *C. sapidus* was first recorded in the Northern Adriatic Sea in the Lagoon of Grado-Marano in 1949 and the subsequent year in the lagoon of Venice. Its presence was reported in the Aegean Sea as early as 1935 (Nehring, 2011). From the end of the1950s, additional specimens were collected along the Adriatic coast both in brackish and coastal waters and eventually in the Ionian Sea, near Ugento (Gennaio et al., 2006). It has been recorded in the early '70 (Froglia 1972) off the Metauro river, in 1991 and 1992 again in the lagoon of Venice (Mizzan, 1993) and in 2007 in Ravenna. In the Central Adriatic it was recorded on the western shore in Varano and Lesina Lake (2007) and it is considered established on the central eastern shores at the mouth of the Neretva river in 2004 and 2006 (Dulčić et al 2010 and references therein). In 2011 one specimen of *C. sapidus* was caught at Silvi Marina (Central Adriatic, Abruzzi Region) at the Piomba River mouth (Castriota et al, 2012).

Being aggressive towards, and a predator of, other species, they can compete with other crabs for food and space (Gennaio et al., 2006). *C. sapidus*is is also a host for several parasites and diseases, some with a high potential to cause mass mortalities. Thus, the introduction of blue crabs can have significant consequences to the ecology of the invaded environments. Most of the reports of the species in Italy refer to episodic catches, limited in terms of number of the number of specimens collected and periodic captures (Nehring 2011 and references therein) until its recent establishment was documented (Mancinelli et al. , 2013). In the Greek Ionian it was sporadically reported (Kapiris in Eleftheriou et al., 2011; Perdikaris in Thessalou et al., 2012) until 2013 when an established population was recorded in Antinioti Lagoon, Corfu island (Karachle in Bilecenoglu et al., 2013). According to local fishers that exploit the lagoon, the presence of the species dates back to the late 2000's, whereas its exploitation has a history of only a couple of years. The fisheries production of the species is rather low (approximately 5-7 kg per day). This production is being distributed to the local market, since the species has also "invaded" the local cuisine and is being used in the preparation of traditional fish-dishes (Karachle in Bilecenoglu et al, 2013).

The history of its invasion in the Adriatic and Ionian Sea (Mancinelli et al., 2013;Karachle in Bilecenoglu et al., 2013) is illustrated in Figure 5-14 (a,b, c).

Figure 5-14a Chronicle of Callinectes sapidus sightings in the Adriatic and Ionian Sea.

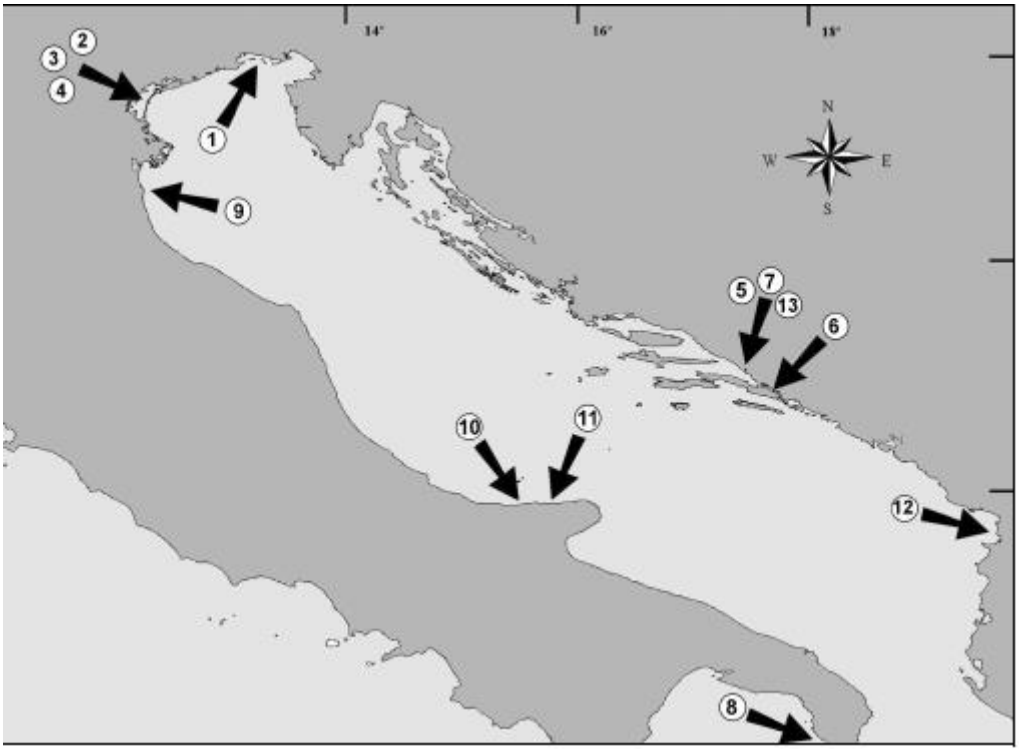


Figure 5-14b As Figure 5-14a, from Dulčić at al 2010.

Figure 5-14c As Figure 5-14a, from Castriota et al, 2012.

In the Mediterranean Sea, the biological invasion by the green algae *Caulerpa racemosa* represents maybe the most striking marine sea-bottom landscape change of the last decades. Caulerpenyne, caulerpine and caulerpicin, the most studied metabolites of *C. racemosa*, are considered among the factors contributing to its invasion potential and several biological activities were found for these molecules. In spite of the toxicity of its metabolites, *C. racemosa* has became an important food item in the diet of the sea bream *Diplodus sargus* which, as a consequence, accumulate in its tissues the alkaloid caulerpin [Terlizzi et al. 2011].

The presence of caulerpin in fish tissues, used as a trophic marker of a *C. racemosa*-based diet, was related to the appearance of some cellular and physiological alterations, including activation of some enzymatic pathways (catalase, glutathione peroxidases, glutathione S-transferases, total glutathione and the total oxyradical scavenging capacity, 7-ethoxy resorufin O-deethylase), the inhibition of others (acetylcholinesterase and acylCoA oxidase), an increase of hepatosomatic index and the decrease of gonadosomatic index [Felline et al. 2012; Gorbi et al. 2014]. Besides the changes in the cellular and molecular activity, *C. racemosa* has also the potential to induce changes in the nutritional properties of *D. sargus*. Fish feeding on the invasive seaweed showed, indeed, a significantly altered muscle fatty acids composition, with a lower percentage of polyunsaturated fatty acids (PUFA) of the n-3 and n-6 series, such as eicosapentaenoic (EPA, C20:5), docosahexaenoic (DHA, C22:6) and arachidonic acids (AA, C20:4) [Felline et al. 2014]. The appearance of such biochemical alterations might imply a detrimental health status and altered behaviours, potentially preventing the success of fish populations.

Noteworthy is the presence of the three Lessepsian herbivorous fish ***Siganus rivulatus*** and *Siganus luridus, Upeneus moluccensis.* The two siganids and the golden banded goatfish are commercially important in the eastern Mediterranean Sea (Streftaris et al., 2006). Although their presence in the Ionian is sporadic, their establishment success and future exploitation is not to be ruled out.

Another potentially exploited species in the Ionian Sea is the northern brown shrimp *Farfantepenaeus aztecus,* native to the western Atlantic coasts. It was firstly recorded in the eastern Mediterranean Sea in 2010 from Antalya Bay, Turkey (Deval *et al*., 2010). Within the last 3 years, the species has expanded to the Gulf of Iskenderun to the east and Finike to the west where it was caught regularly in trammel nets and sold in the market (Gökoğlu & Ovzarol, 2013). Based on recent findings on the rapid range of expansion of *F. aztecus*, a wider distribution of the species in the Mediterranean Sea is to be expected (Gökoğlu & Ovzarol, 2013). Indeed the species has reached the northern Aegean Sea (Nikolopoulou et al., 2013). A single adult female specimen of *Farfantepenaeus aztecus* was caught in Boka Kotorska Bay (southern Adriatic Sea) in September 2013 (Markovic et al., 2014). Surprisingly enough, one female individual was caught by a commercial trawler from the eastern part of Corfu island (Ionian Sea) on a sandy–muddy bottom in November 2013 (Kapiris et al., 2014). The last two records may imply an established population in the area.

Lagocephalus sceleratus has received considerable public attention shortly after its first reports in 2003 from Gökova bay along the south-eastern coastline of the Aegean Sea due to the presence of tetrodotoxin. In a global perspective, occasional accidental poisonings have lead to numerous human deaths, the majority of which have been documented in south-eastern Asia. It is one of the most invasive species in the eastern Mediterranean (Zenetos et al, 2010), which has progressively made its way to the Greek Ionian Sea (Zenetos et al, 2013) reaching as north as Croatia in the Adriatic (Jakljan Island: Dulcic et al, 2014). In January 2014 it was caught with a trammel net in Avola, near Syracuse (south-east Ionian Sea) (Tiralongo & Tibullo in Kapiris et al., 2014). Given the toxicity of the species, an early warning should be issued in Italy.

Other invasive species whose impact has not been evaluated in the study area include: the macroalgae *Caulerpa racemosa var cylindracea, Asparagopsis armata, Asparagops istaxiformis, Codium fragile fragile, Stypopodiumschimperi, Womersleyella setacea*, the Atlantic crab *Percnon gibbesi* and the Persian conch *Conomurex persicus*.

5.2.2 Main features at AIM scale

The Adriatic seems to be conducive for the establishment of NIS and deserves attention, with some areas becoming hotspots of alien biodiversity (e.g. Taranto because it houses the shipyard of the Italian navy, the largest Italian mussel farms and an expanding trade port) (Figure 5-15; 5-16; 5-17, 5-18). An exhaustive review of the NIS status along the Italian coasts up to 2010 can be found in Occhipinti-Ambrogi, 2010 who report that the western shores of Northern Adriatic Sea is characterised by the highest number of alien species (51

species, 39 of which are in the lagoon of Venice), followed by the southern Italian Adriatic (32), while the Italian coasts of the central Adriatic display only 9 alien species.

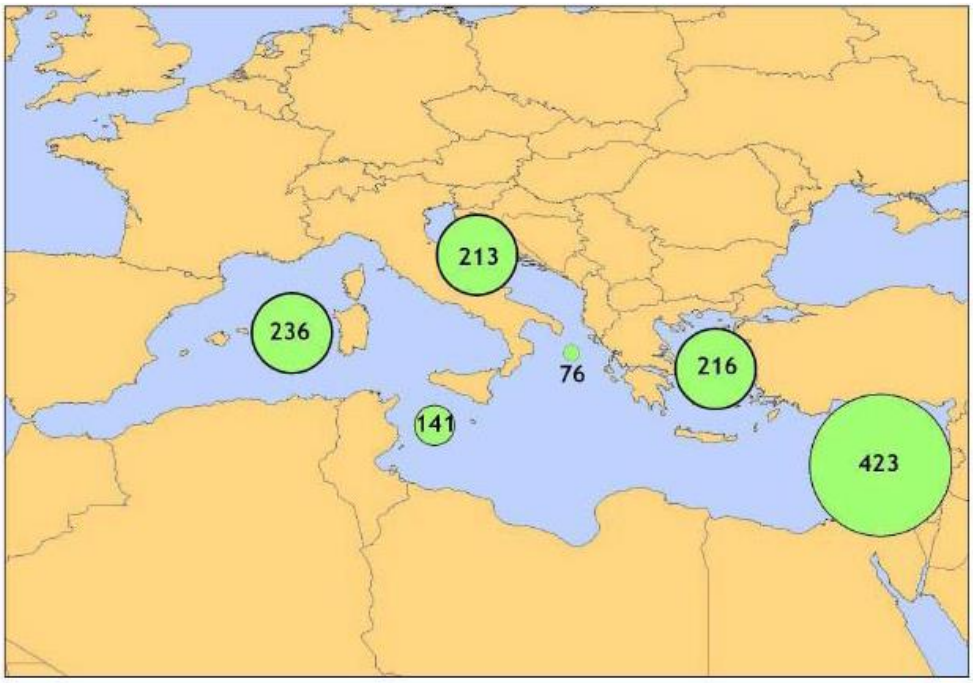


Figure 5-15 Distribution of exotic species in the Mediterranean (Zenetos & Streftaris 2008)

Figure 5-16 Map of alien species distribution from the LIFEWATCH web site (http://www.lifewatch.eu/web/guest/home).

Concerning the Albanian and Montenegrin coasts, among the 20 species recorded for Albania and 10 for Montenegro, *Caulerpa racemosa* was the most frequent and with the highest observed occupancy.

Pećarević et al. (2013) produced a detailed a checklist of introduced species along the Croatian seashores, which cover a big part of the eastern Adriatic coasts. The study reports a total of 113 species (15 phytoplankton, 16 zooplankton, 16 macroalgae, 44 zoobenthic and 22 fish species).

Seaweed of the genera *Caulerpa taxifolia* was found in the western Adriatic in 1994 and *C. racemosa* in 2000. Their invasive potential made these two species of *Caulerpa* the most critical NIS for the Croatian waters.

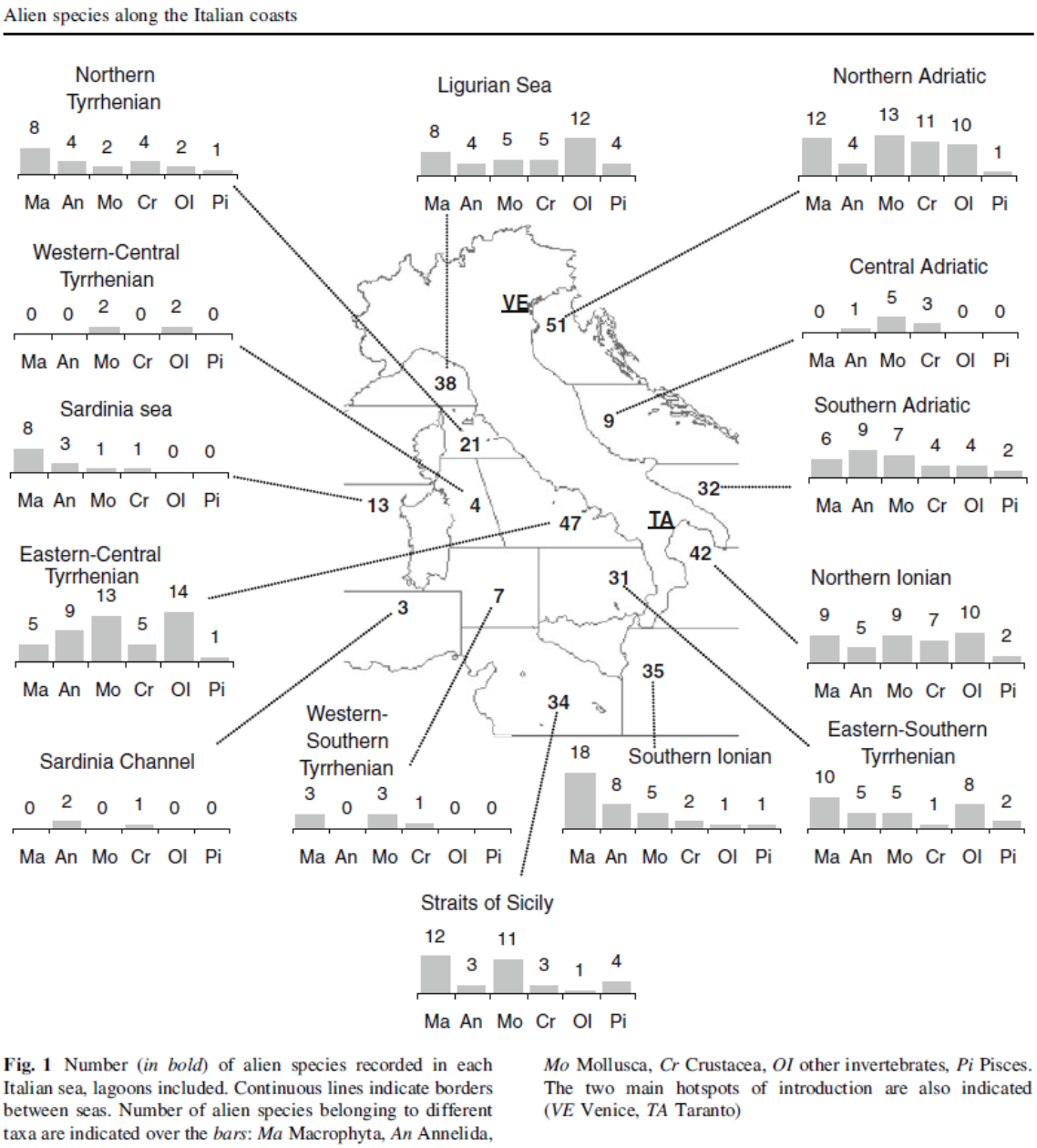


Fig. 1 Number (*in bold*) of alien species recorded in each Italian sea, lagoons included. Continuous lines indicate borders between seas. Number of alien species belonging to different taxa are indicated over the *bars*: *Ma* Macrophyta, *An* Annelida, *Mo* Mollusca, *Cr* Crustacea, *OI* other invertebrates, *Pi* Pisces. The two main hotspots of introduction are also indicated (*VE* Venice, *TA* Taranto)

Figure 5-17 Distribution of NIS as evidenced by Occhipinti et al., 2010, The Venice and Taranto hotspots, included in Focus areas 1 and 2 respectively are evidenced.

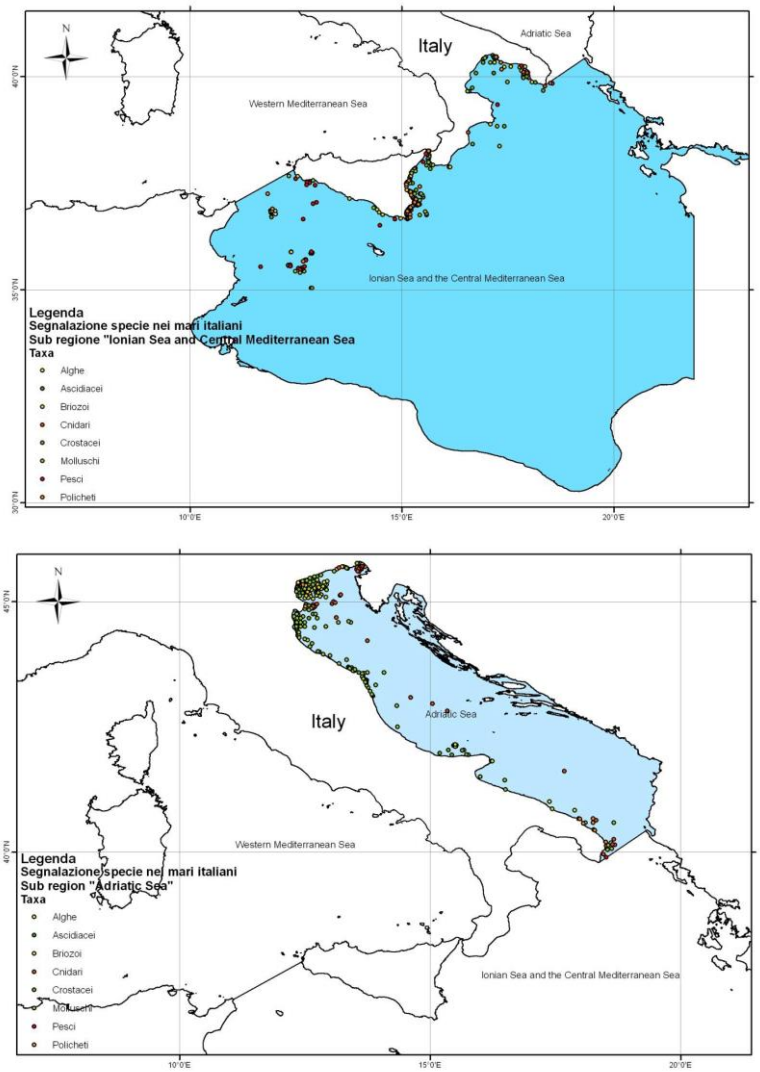


Figure 5-18 Distribution of NIS as evidenced by the Italian Initial Assessment, the North-Adriatic hotspot is evident (Source document ISPRA 2013_IA_5.6).

Some species with invasive behavior in a given area of the AI Macroregion, can not have the same invasiveness into another. For example, the opistobranch *Bursatella leachii* (ragged sea hare), which is considered invasive in the Ionian coasts (Focus Area 2), is present but not invasive in the North Adriatic Sea (Focus Area 1).

Trends on the introduction rates of non-indigenous species along the entire Italian coast (Occhipinti-Ambrogi, 2010; Figure 5-19) are in line with those reported to the Ionian Sea (Figure 5-20).

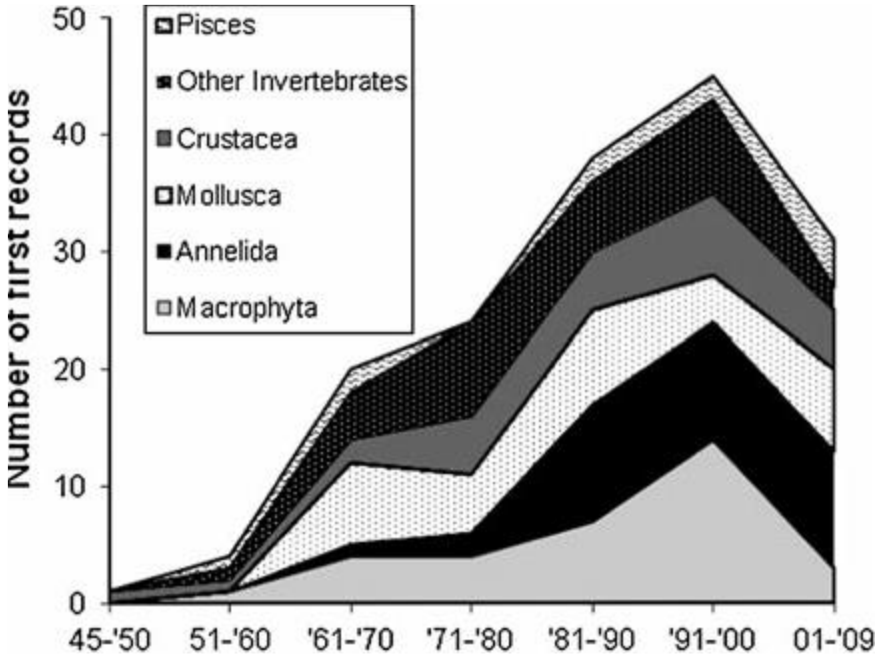


Figure 5-19 Rate of NIS introduction per decade along the Italian coasts (from Occhipinti-Ambrogi et al., 2010).

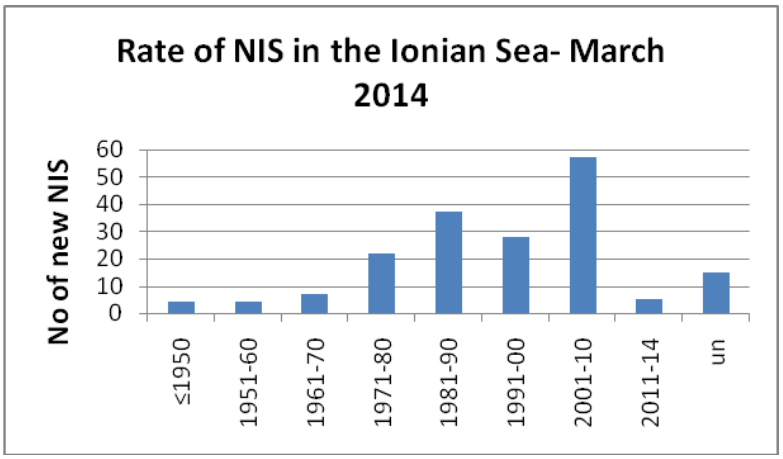


Figure 5-20 Rate of NIS introduction per decade. Last column represents 3 years only.

5.2.3 Specific features of Focus Area1

The Northern Adriatic Sea (NAS), hosts the larger number of NIS found along the Italian shores, particularly in the Lagoon of Venice species (51 species, 39 of which are in the lagoon of Venice update to 2010), which can be considered a main hotspot of introduction (Occhipinti-Ambrogi, 2010). The updated list of macroalgal NIS in the lagoon of Venice, includes about twenty species (Sfriso and Curiel, 2007). This number is higher than the umber macrophytae NIS reported by Occhipinti-Ambrogi, 2010 for the whole Italian NAS.

Among the most significant are the brown seaweed *Undaria pinnatifida*, *Sargassum muticum*, *Desmarestia viridis* and red algae *Antithamnion pectinatum*, *Neosiphonia harvey*, *Polysiphonia morrowii* and *Grateloupia Turuturu* (Curiel et al, 2006).

The rapid diffusion of *U. pinnatifida* and *S. muticum* in the lagoon of Venice is due to the high degree of adaptation, efficient reproductive system and the lack of competitors of equal size present in other seas (e.g. *Laminaria*, *Saccorhiza*), or potential predators such as the mollusks *Helcion*, *Haliotis* and *Aplysia* (Curiel et al., 2007). In the Venice Lagoon, *U. pinnatifida* and *S. muticum*, have changed the macroalgal community of hard substrates also entering into direct competition with the native *Cystoseira barbata* (Curiel et al., 2007).

Among the zoo - NIS significant for possible impacts on biological communities we highlight the estuarine crabs *Eriocheir sinensis* (Chinese Mitten Crab), *Callinectes sapidus* (see below) and *Dyspanpeus sayi,* the bivalves *Musculista senhousia* and *Scapharca inequivalvis*, and the gastropod *Rapana venosa* known as a fearsome predator of bivalves of economic interest.

The colonial ascidian *Didemnum vexillum* has been found in the Lagoon of Venice (Italy) in 2012, the first record in the Mediterranean Sea. The invasiveness of *D. vexillum* is regarded as a threat for native species that can be outcompeted, dominated and overgrown and as a significant nuisance for the maintenance of maritime structures. *D. vexillum* has also been found to grow massively on seagrass blades, threatening this important habitat. Due to its ability of encapsulating mussels it could become a major economic threat to the mussel farms traditionally present along the northern Adriatic shores as it does in other part of the world, such as in New Zealand. However, in the North Adriatic, this species seems to be subject to two periods of stasis, a winter one and a summer one, that can limit its invasiveness (Tagliapietra et al, 2012). A similar seasonal pattern is also found in two NIS of algae, the Wakame, *Undaria pinnatifida* and the Japanese wireweed, *Sargassum muticum*. Nevertheles the dynamics of *D. vexillum* and its potential for dissemination should be followed carefully.

Many NIS introduced for commercial purposes in the NAS are powerful modifiers of habitat, and the sites in which they were introduced for commercial purposes have become centers of diffusion. As an example, the reefs formed by *Crassostrea gigas* are becoming increasingly important in the Lagoon of Venice as habitat for a number of species. This species, native to the western temperate coasts of the Pacific Ocean, was first introduced in Portugal, then in France, found in the Po Delta (Italy) in 1964, and actively introduced into the lagoon of Venice in 1966 (Parenzan, 1989), where it has been spreading afterwards (Cesari and Pellizzato, 1985).

Crassostrea gigas is considered to be the indirect cause of the introduction of numerous macroalgal species, among which are *U. pinnatifida* and *S. muticum* mentioned above (Curiel et al, 2006).

The impact of some NIS can be increased by human behaviour, this is the case of the Manila clam *Ruditapes philippinarum*. This species was introduced some decades ago in the Lagoon of Venice, with major impact on the ecosystem due to harvesting practices (Facca et al., 2002; Solidoro et al. 2003; Pranovi et al., 2006, Melaku Canu et al., 2011).

Regarding the Slovenian sea, non-native species are present in such numbers and proportions that do not threaten the native species, do not alter the habitats and do not weaken the genetically indigenous populations. The pathways and potential vectors of non-native species

introduction must be controlled, so that the risk of new non-native species entries remains very small. It is also important to monitor the areas, which are most vulnerable in terms of non-native species stocking, and the already established species with a high invasive potential.

5.2.4 Specific features of Focus Area 2

Reviews on alien species in the Ionian Sea are available for Italy (Apulian coast: Gravili et al, 2010; Crocetta et al, 2013), for Albania (Zenetos et al, 2011a) and for Greece (Zenetos *et al*., 2009 updated in Zenetos *et al*., 2011b; Zenetos et al., 2013). This information has been archived in HCMR/EEA database, which is regularly updated with the most recent literature.

According to HCMR/EEA database approximately 179 species have been recorded in the Ionian coasts. The distribution of species per country and sea area is presented in Figure 5-21. As seen in Figure 5-21, more than 80 species are well established in the area, some of them such as *Bursatella leachii, Callinectessapidus, Womersleyella setacea, Clytia hummelincki*) exhibiting invasive behavior. Fortysix species, among which some Indo-pacific species established in the eastern Mediterranean, are known from casual records. Fifteen species are classified as cryptogenic, while the establishment success of 14 more species remains unknown due to data deficiency (not reported in the literature).

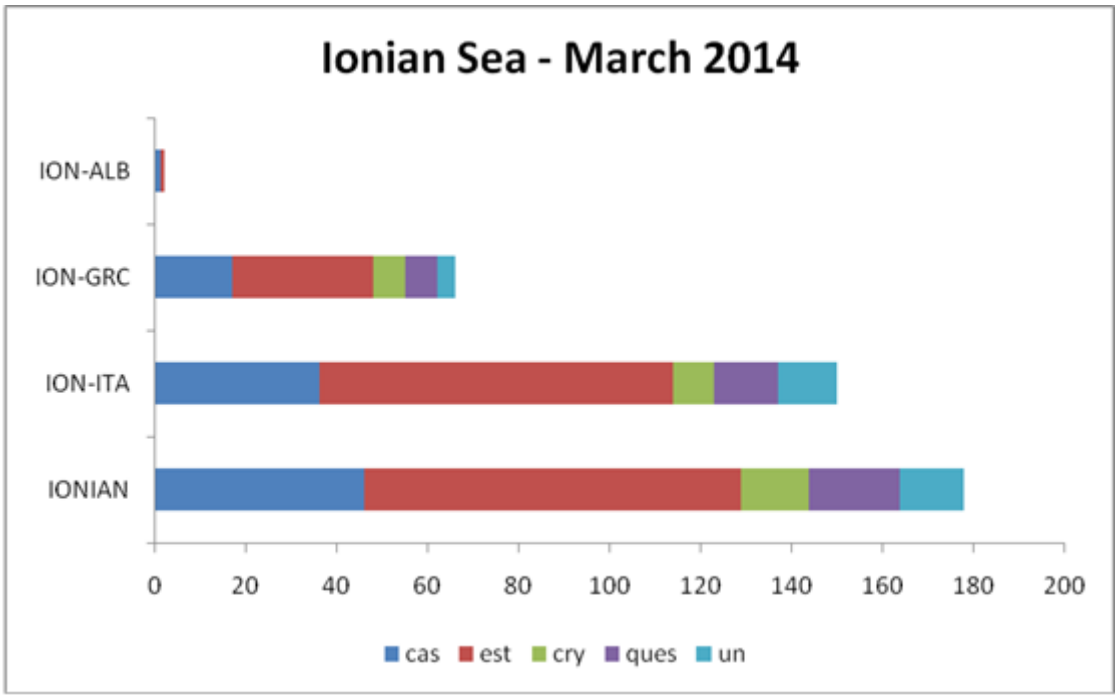


Figure 5-21 Distribution of NIS in the Ionian Sea (IONIAN) and at country level (ION-ITA=Italian Ionian, ION-GRC=Greek Ionian, ION-ALB=Albanian Ionian). Colours are indicative of establishment success (Cas=casual records, est=established, cry=cryptogenic , un=unknown)

In the Ionian coasts of Greece, the number of NIS has reached 66 vs 60 reported in Zenetos et al, (2011b). The latest records refer to *Farfarepenaeus atzecus and Callinectes sapidus (*Eleftheriou et al, 2011; Thessalou-Legaki et al, 2012; Kapiris et al, 2014).

In the Italian Ionian coast the Scyphozoan medusa, *Cassiopea andromeda,* was recorded in 2013 in the Gulf of Palermo - Sicily (Gravili pers. comm.) This is the second record of the species in the Central Mediterranean, after the finding in 2009 in Malta (Schembri et al., 2010). Three alien macrophytes, *Ascophyllum nodosum*, *Colpomenia peregrina* and *Polysiphonia morrowii*, have been reported for the first time from the Mar Piccolo of Taranto (Ionian Sea). Two other species, *Agardhiella subulata* and *Codium fragile* subsp. *fragile* that had not been, or had only sporadically been detected in the basin since their first record in 1987 and 2002, respectively, were also recorded. In the Mar Piccolo, an enclosed coastal inlet near the port of Taranto, a close link is apparent between the establishment of alien species and the regular import of shellfish for direct sale (Petrocelli et al., 2013). *Agardhiella subulata* was also found at Capo Peloro (Sicily) (Manghisi et al., 2010).

Considering the primary pathway/vector of introduction, shipping appears to be the main vector of introduction in the Ionian Sea (Figure 5-13). This does not necessarily imply that NIS were ship transferred in the Ionian. As for the other pathways, the presence of most species in the Ionian is attributed to dispersion from other areas that acted as gateways for their introduction (e.g Venice lagoon, Thau lagoon for aquaculture related introductions; Levantine Sea for Lessepsian immigrants; big ports for ship transfer). As an example, we refer to Lessepsian fish species. The majority of molluscs and macrophytes were introduced via aquaculture, whereas alien crustacean and polychaeta NIS were mostly related to the introduction by shipping ballast waters or as fouling organisms (Zenetos et al., 2012).

5.3 D3 Commercially exploited fish and shellfish

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The Descriptor 3 is "Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock". For this descriptor, the three criteria for assessing progress towards good environmental status, as well as the indicators related respectively to them, are: level of pressure of the fishing activity, reproductive capacity of the stock, and population age and size distribution. GES according to Descriptor 3 is tightly connected to Descriptor 1 - Biodiversity, D4 - Food webs and D6 – Seafloor integrity.

First Criterion: level of pressure of the fishing activity. This criterion has a primary indicator: the fishing mortality (F). Achieving or maintaining good environmental status requires that F values are equal to or lower than F_{MSY}, the level capable of producing Maximum Sustainable Yield (MSY). This means that in mixed fisheries and where ecosystem interactions are important, long term management plans may result in exploiting some stocks more lightly than at F_{MSY} levels in order not to prejudice the exploitation at F_{MSY} of other species. F is estimated from appropriate analytical assessments based on the analysis of catch (to be taken as all removals from the stock, including discards and unaccounted catch) at age or at length and ancillary information. Where the knowledge of the population dynamics of the stock do not allow to carry out simulations, scientific judgement of F values associated to the yield-per-recruit curve (Y/R), combined with other information on the historical performance of the fishery or on the population dynamics of similar stocks, can be used.
When analytical assessments yielding values for F are not available the level of pressure of the fishing activity has a secondary indicator: the ratio between catch and biomass index (catch/biomass ratio). The value for the indicator that reflects F_{MSY} needs to be determined by scientific judgment following analysis of the observed historical trends of the indicator combined with other information on the historical performance of the fishery. Where stock production-based assessments are available, the catch/biomass ratio yielding MSY can be taken as indicative reference. Alternatively to the catch/biomass ratio, secondary indicators may be developed on the basis of any other appropriate proxy for fishing mortality, adequately justified.

Second criterion: reproductive capacity of the stock. The primary indicator for the reproductive capacity of the stock is the Spawning Stock Biomass (SSB). This is estimated from appropriate analytical assessments based on the analysis of catch at age or at length and ancillary information. Where an analytical assessment allows the estimation of SSB, the reference value reflecting full reproductive capacity is SSB_{MSY}, i.e. the spawning stock biomass that would achieve MSY under a fishing mortality equal to F_{MSY}. Any observed SSB value equal to or greater than SSB_{MSY} is considered to meet this criterion. Further research is needed to address the fact that a SSB corresponding to MSY may not be achieved for all stocks simultaneously due to possible interactions between them. Where simulation models do not allow the estimation of a reliable value for SSB_{MSY} , then the reference to be used for the purpose of this criterion is SSB_{pa} , which is the minimum SSB value for which there is a high probability that the stock is able to replenish itself under the prevailing exploitation conditions.

If the analytical assessments yielding values for SSB are not available the secondary indicators are: Biomass indices. It can be used if such indices can be obtained for the fraction of the population that is sexually mature. In such cases, such indices need to be used when scientific judgment is able to determine, through detailed analysis of the historical trends of the indicator combined with other information on the historical performance of the fishery, that there is a high probability that the stock will be able to replenish itself under the prevailing exploitation conditions.

Third criterion: population age and size distribution. Healthy stocks are characterised by high proportion of old and large individuals. Primary indicators based on the relative abundance of large fish include: a) proportion of fish larger than the mean size of first sexual maturation; b) mean maximum length across all species found in research vessel surveys; c) 95 % percentile of the fish length distribution observed in research vessel surveys.

The secondary indicator is the size at first sexual maturation, which may reflect the extent of undesirable genetic effects of exploitation. For the two sets of indicators (proportion of old fish and size at first sexual maturation), expert judgment is required for determining whether there is a high probability that the intrinsic genetic diversity of the stock will not be undermined. The expert judgment needs to be made following an analysis of the time series available for the indicator, together with any other information on the biology of the species.

The Management advisory body is the Scientific Advisory Committee (SAC) of the General Fisheries Commission for the Mediterranean (GFCM). The SAC is organized into Sub-Committees. The Sub-Committee on Stock Assessment (SCSA) gives advice on stock status.

One of the objectives of the GFCM SCSA is to enhance joint practical stock assessment involving the participation of scientists from all the Mediterranean countries of the different Geographical Sub-Areas (GSAs) who provide their data and share them with their colleagues, using standard methodologies and analysing together the results and options for fisheries management.

The outcome of the assessments already undertaken by national experts within national programmes, FAO Regional projects and/or other international initiatives are presented at the relevant working group meetings and subsequently at the SCSA meeting for review.

With the aim of establishing the scientific evidence required to support development of long-term management plans for selected fisheries in the Mediterranean, consistent with the objectives of the Common Fisheries Policy, and to strengthen the Community's scientific input to the work of GFCM, the Commission made a number of requests to Scientific, Technical and Economic Committee for Fisheries (STECF).

STECF recognises the efforts made by GFCM and STECF-SGMED/STECF-EWG in the recent years to harmonize the assessment of the most important stocks among the different Mediterranean countries but notes that, in spite of this, most of the Mediterranean stocks are not yet assessed on a regular basis in all GSAs. STECF advises that the cooperation between EU Member States, GFCM and STECF-SGMED Working Groups should be further improved in order to provide annual assessment of all stocks listed in the Council Regulations 1542/2000, 1343/2007, 199/2008 and Commission Decision 2010/93/EU, based on the national programs

for data collection. Annual assessments are considered informative to monitor the effects of the various multiannual management plans.

STECF notes that none of the reviewed up to date assessments provided precautionary management reference points of stock size due to data deficiencies or shortage of data series, with the exception of sardine and anchovy in GSA 17.

5.3.1 Main threats

Biological production in the Adriatic Sea is affected by diverse environmental factors, including wind mixing, river runoff, eutrophication and increase in water temperature (Arai, 2001; Agostini and Bakun 2002; Santojanni et al. 2006; Coll et al., 2007). Temporal variations in some of these factors have been associated, for instance, with fluctuations in the biomass of anchovy and sardine (Santojanni et al. 2006). Both species experienced marked declines in biomass between the late 1980s and early 1990s, which can be partially attributed to changes in environmental conditions affecting stock productivity.

Among maritime activities of the AIM, all kinds of fishing activities (i.e. professional, artisanal and recreative fishery) together represent the main threats to commercial fish stocks, also due to large by-catch. The second largest threat is consequent to habital damage and loss due to all activities involving the seabottom, such as dredging, sand and gravel extraction, solid waste disposal, cables and pipelines operations, constructions and placement of man-made structures. In addition, changes in the trophic regime (i.e. eutrophication, oligotrophication), hypoxic and anoxic conditions and point-source or large scale pollution due to land-based activities are also potential threats to fish stocks.

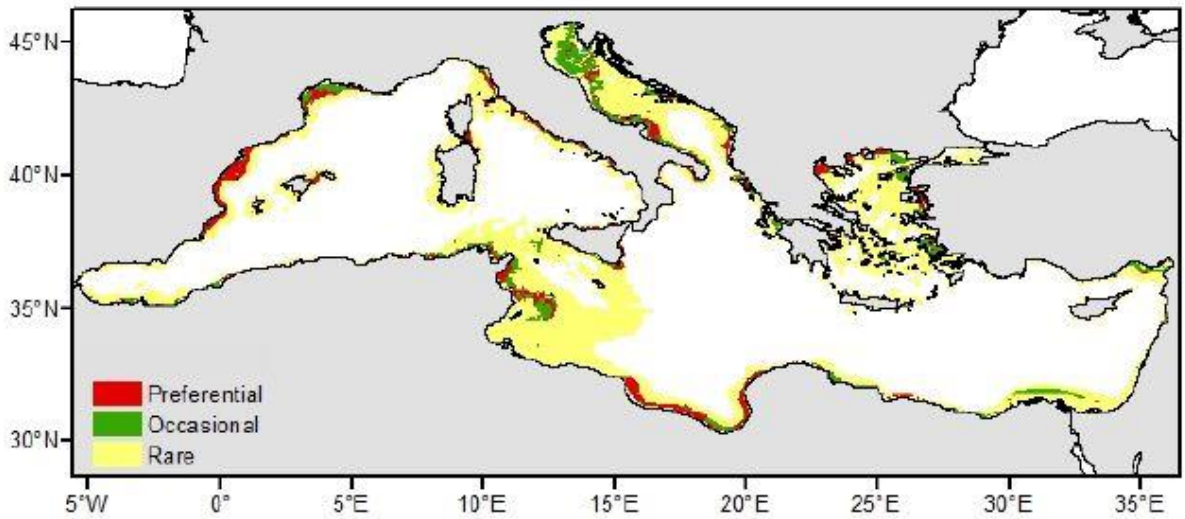
In the framework of MSP, special attention must be dedicated to the transboundary management of commercial fish stocks, as well as achievement of GES according to D3, as spawning, nursery, migratory areas and areas of prevalent occurrence of commercially exploited fish extend over the whole AIM, expecially over the northern and central Adriatic shelf (Figure 5-22 and following).

5.3.2 Main features at AIM scale

The AIM hosts relevant nursery, spawing areas of anchovies (Figure 5-22, 5-23) as well as possible spawing areas of sardines (Figure 5-24).

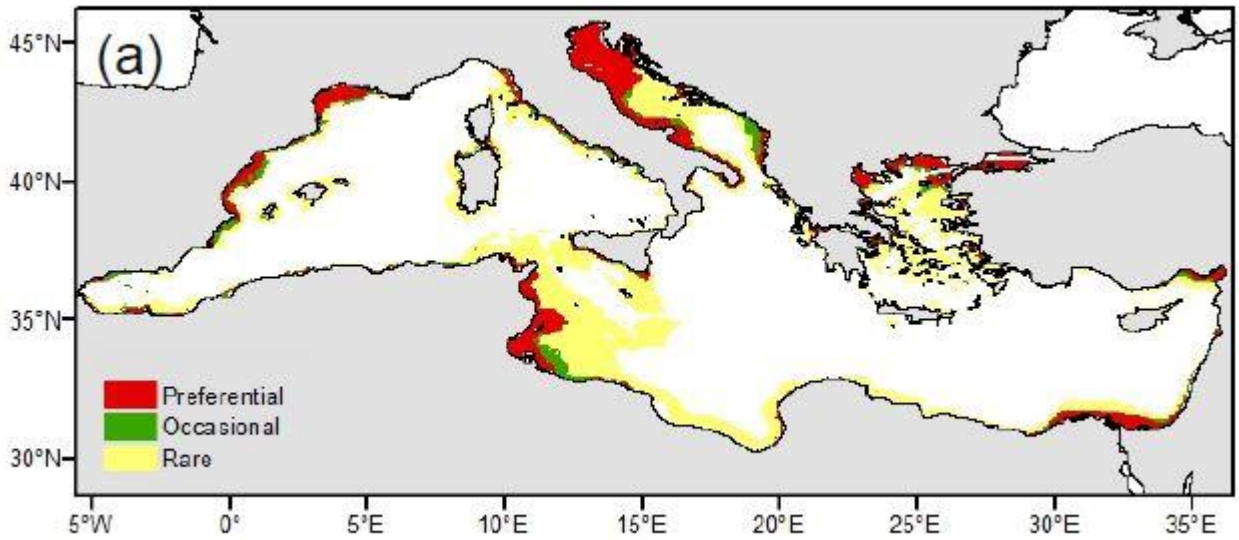
In the Adriatic Sea, suitable nurseries were located in the inner part of the continental shelf in the coastal part of the basin. They were closely associated with the Po river outflow area, also extending southwards along the coasts of the western and the eastern part of the Adriatic Sea and in agreement with known nursery grounds in the area (Giannoulaki *et al.*, 2013; Figure 5-22).

In the Adriatic Sea areas with higher probability of anchovy spawning were consistently indicated in the northern and the western part of the basin as well as around the coastal waters of the mid-Dalmatian islands in the eastern part (Giannoulaki *et al.*, 2013; Figure 5-



23).

Figure 5-22 Persistent habitat map of anchovy nurseries in the Mediterranean Sea for the period 2003-2008 during late autumn (see also web based GIS viewer http://mareaproject.net/mediseh/viewer/med.html).



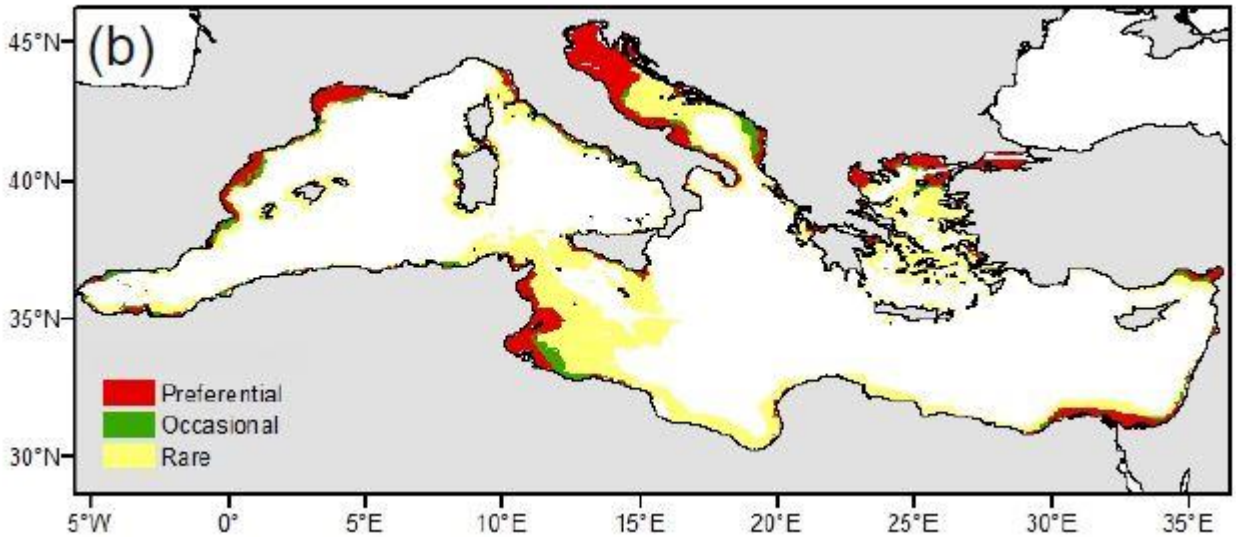


Figure 5-23 Persistent habitat maps of anchovy spawning (egg) habitat in the Mediterranean Sea for the period 2003-2008. (A) June; (B) July (See also web based GIS viewer http://mareaproject.net/mediseh/viewer/med.html).

Over-exploitation of fish stocks is reported across the Mediterranean. More than 65 % of commercial stocks are fished beyond sustainable limits (UNEP/MAP 2012; Abdul Malak et al. 2011). Although commercial fisheries have the greatest impact, recreational fishing also places pressure on stocks. In addition, by catch – the accidental capture of non-target species in fisheries – is a serious issue in many parts of the Mediterranean. Ghost fishing – when lost or abandoned fishing gear continues to catch fish and other animals – is also a problem, most commonly with passive gear (e.g., longlines, gill nets, traps). The lost gear is a threat to marine species and a danger to passing boats if it becomes entangled in their propellers or in their own fishing gear. Finally, trawling is particularly destructive to benthic communities as it

severely alters deepwater coral ecosystems and sea grass meadows and their associated fauna, reducing both the number of species and available habitat (UNEP/MAP 2012; Abdul Malak et al. 2011).

Regarding the Croatian side specifically, results are provided according to the conditions of economically important stocks in the Adriatic Sea as described by their frequency of occurrence (data from expedition DITS) in the Adriatic Sea. The frequency of occurrence is defined as the percentage of positive stations for each type relative to the total number of stations in a given year. As a rule, there were about 180 stations randomly distributed in the study area. Therefore, the frequency of the expedition can be taken as a measure of the distribution of the Adriatic Sea. The most widespread species targeted was hake and its prevalence ranged from 80% positive stations in the 2000th year to 92.86 stations in the 2008th year. The incidence followed the movement of the biomass index of the largest number of species, and fell to the 2000th year (except anchovies and red mullet) followed by an increase in the steady state to the 2008th year. In recent years reveals sharp fall in the area of distribution (frequency of occurrence) of demersal species in the Adriatic sea. During the 2012th year all economically important species showed an increase in frequency of occurrence in relation to the previous year (except shrimp and white musky octopus).

The index shows the growth of the biomass in 2012 for economically important species, and for those who have no economic significance. In addition to the fishing zone A (west coast of Istria) in all other fishing zones indices of biomass in the 2012th year were higher than they were in 2011. Index biomass of hake in the 2012th was higher than in the 2011th The increase in biomass observed in the open middle Adriatic, while in other parts must be seen a slight decline compared to the previous year. Red mullet shows substantial increase compared to the 2011th year, as in the entire study area, as well as in all fishing zones. The measured values of biomass index were the highest recorded in the entire research period. Population decline in the index indicates bream biomass throughout the investigated area, and it is the largest in the channels of the central Adriatic, where the bulk of the biomass of this species. The situation with the shrimp population is extremely unfavorable and on throughout the study area shows a decline that reached a historic minimum in the 2011th year. Although the indices higher biomass in the 2012th year, the situation is still very bad. White and black squid show large fluctuations in biomass index is mostly related to hydrographic conditions in the sea, but the value of the biomass index greater than in the previous year.

5.3.3 Specific features of Focus Area 1

Small pelagic fish stock status:

Anchovy - The GFCM-SAC 2012 concluded that after the collapse of the stock in 1987 a recovery took place, but fluctuations still occurred, in particular in recent years. At the present the stock can be considered as sustainably exploited, being the fishing mortality ($E_{(1-3)}$ = 0.41) equal to the RP (E = 0.4); the level of abundance is considered intermediate (current biomass = 333,404 tons) higher than the proposed B_{lim} (179,000 tons) and B_{pa} (250,600 tons) reference points. Since this stock can display large fluctuations associated with analogous fluctuations in recruitment, and since the exploitation rate is on our precautionary threshold of 0.4, the advice is not to increase the fishing effort. WG recognised that spatial distribution of shared stock of anchovy is not limited to GSA17 area only, but it is extended in GSA18 area also. Therefore, WG suggest that future assessments try to take into account combined data from these two GSAs. STECF also proposes that a multi-annual management plan for small pelagic fisheries is devised and implemented. Such a management plan should take into account mixed-fisheries effects, in particular the technical relation with sardine fisheries.

Sardine - The trend in biomass of sardine started a slow but continuous increase since 2000. The 2011 biomass estimation showed rather high values, the VPA estimation (B = 483,369 t) being much higher than the ICA one (B = 215,050 t). The current biomass is above the proposed reference points B_{lim} and B_{pa}. The fishing mortality starts to increase in 2007 for all

the ages: in ICA age 4 seems to suffer more from the fishing mortality. The recent exploitation rate F/Z(1-4) is above the Patterson's threshold 0.4 since 2009, and increased up to 0.52 in the last year due to the high catches. The catch ratio, instead, started to increase in 2005 up to a value around 0.25 in 2009, but it's stable since then. The present status of the stock up to 2011 can be described with high fishing mortality (E(1-4) = 0.52 bigger than RP (E = 0.4)) and intermediate abundance (Current biomass = 215050 tons higher than the proposed B_{lim} (78000 tons) and B_{pa} (109200 tons) reference points).

Although exploitation level is above Patterson threshold of 0.4, the harvest rate considering the ICA model is stable since 3 years around 0.25, while if we take into account the biomass estimated from the echosurvey, the harvest rate drops below 0.15. Besides, biomass level as well as recruitment level showed a steep increase in the last year. Because of that there are no sign that the stock of sardine in the Adriatic Sea is suffering for this high fishing mortality. Nevertheless, since this stock can display large fluctuations associated with analogous fluctuations in recruitment, the advice is not to increase the fishing mortality.

Nevertheless, since numerous studies have shown that the dynamics of anchovy and sardine populations are strongly influenced by success in the recruitment that is, on the other hand, strongly influenced by environmental conditions, the working group suggests continuing to explore the relationships between these species and the environment.

The northern part of the Adriatic Sea was persistently associated with high probability of sardine juvenile presence (Giannoulaki et al., 2013; Figure 5-24).

In the Adriatic, potential spawning grounds of sardine were indicated in the extended continental shelf of the North Adriatic as well as in the coastal waters of the western and the eastern part, covering consistently the exterior part of the mid-Dalmatian islands (Giannoulaki *et al.*, 2013; Figure 5-25).

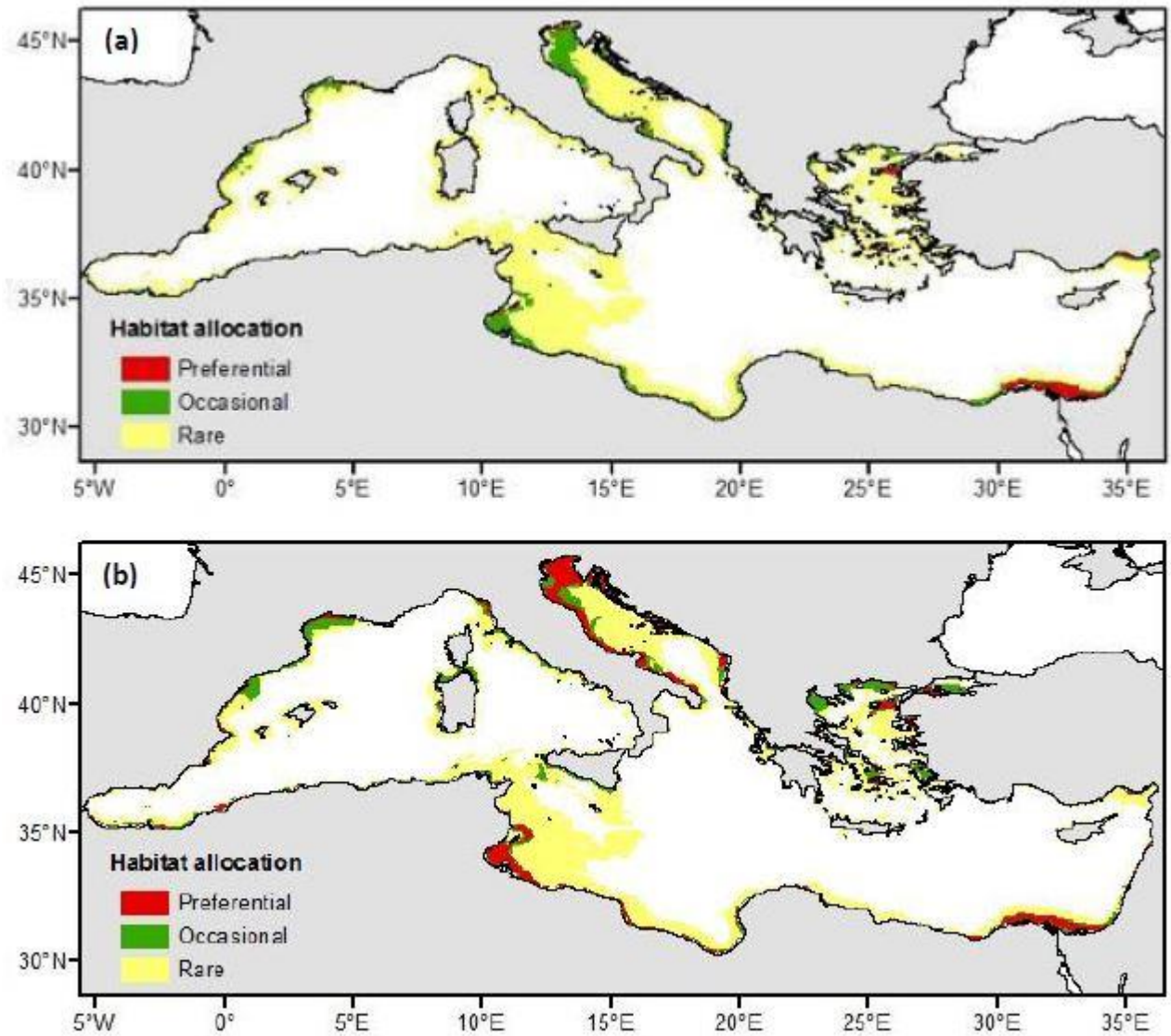


Figure 5-24 Persistent habitat maps of juvenile sardine habitat in the Mediterranean Sea for the period 2003-2008 in (a) June and (b) July. (See also web based GIS viewer http://mareaproject.net/mediseh/viewer/med.html).

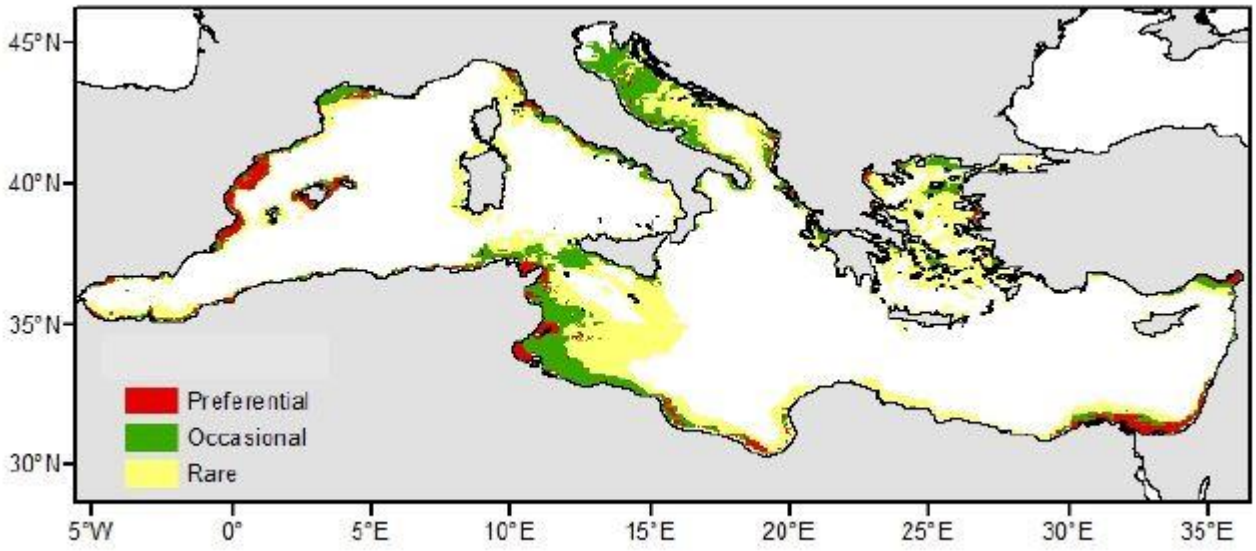


Figure 5-25 Persistent habitat maps of sardine spawning (egg) habitat in the Mediterranean Sea for the period 2003-2006 during early winter (See also web based GIS viewer http://mareaproject.net/mediseh/viewer/med.html).

Demersal fish stock status:

Considering the results of the analyses conducted the common sole stock in GSA 17 is subjected to overfishing, being the current F (2011) estimated with different model comprised between 0.73 and 1.43 and higher than the proposed reference point ($F_{0.1}$ = 0.26 as a proxy of F_{MSY}).

Advices and recommendation: A reduction of fishing pressure would be recommended, also taking into account that the exploitation is mainly orientated towards juveniles and the success of recruitment seems to be strictly related to environmental conditions. This could be achieved by a two-months closure for rapido trawling inside 11 km (6 nm) offshore along the Italian coast, after the fishing ban. Moreover, information provided by VMS will be useful in order to quantify the fishing effort of rapido trawlers in such area and period. Finally, specific studies on rapido trawl selectivity are necessary. In fact, it is not sure that the adoption of a larger mesh size would correspond to a decrease of juvenile catches. The same uncertainty regards the adoption of square mesh.

A recent study on the nurseries and spawning grounds of the common sole in the Central and Northern Adriatic Sea evidenced that juveniles mostly concentrated in the north-western basin along the Italian coast down to 30 m depth (Figure 5-26; Giannoulaki *et al.*, 2013).

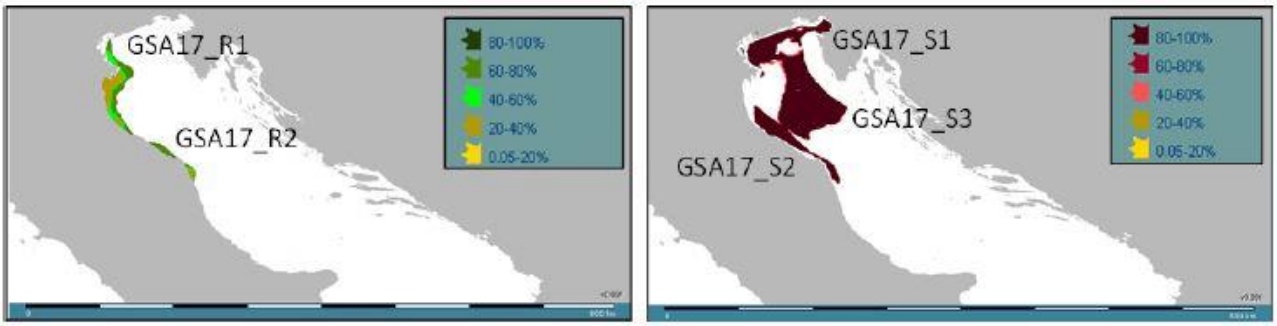


Figure 5-26 Common sole: temporal persistency of the juvenile (left) and adult (right) hotspots in the period 2005–2010. (See also web based GIS viewer http://mareaproject.net/mediseh/viewer/med.html).

Adults aggregated in a wider and different area in respect to juveniles, from 0 down to 100 m depth. The segregation between the juvenile and adult distribution areas supports the hypothesis that the geomorphological and hydrological characteristics of the central and northern Adriatic Sea considerably influence the distribution pattern of sole in these two sub-basins. According to the wide spatial distribution of late juveniles and adults in the northern and central basins of the Adriatic Sea, the common sole fishery is widespread on the overall area. In particular, late juveniles are exclusively exploited by Italian fleets using passive and mobile fishing gears, while the adults living in the central part of the area are mainly targeted by both Italian rapido trawls in international waters and Croatian small-scale fisheries, being the Slovenian fishing fleet very small at present. However, in recent years, some Italian fishing vessels have started to exploit adult sole with gill nets on the offshore grounds where the seabed is untrawlable because of the presence of mega-epifaunal communities dominated by holoturians (*Holoturia forskali* and *Stichopus regalis*) and the bryozoan *Amathia semiconvoluta*. Whereas on the one hand this change in the fishing strategy may be positive as it moves a part of the fishing effort from the younger age classes to the older ones, on the other hand questions can rise on the medium- and long-term effects that such increasing fishing effort on spawners could have on the consistence of the stock.

Concerning red mullet stock status, the signals coming from the MEDITS survey are all positive, with a stable biomass and a really high recruitment estimated for the 2012. The stock biomass at the beginning of the year estimated for 2011 with LCA is 23,954 t, while the average biomass at sea is 4,293 t. The bulk of the catches is concentrated between 9 and 15 cm. The estimated F for red mullet in 2011 reaches very high value for the Italian fleet (up to 2), in particular for specimens between 15 and 17 cm, while the fishing mortality estimated for the Croatian fleet not only increases for much bigger individuals (from 17 cm), but it remains also at lower values. Diagnose of Stock status: $F_{0.1}$ and F_{max} were estimated by the means of a Yield per recruit analysis (YPR) and are equal respectively to 0.234 and 0.408. The F_c is equal to 0.864. The exploitation rate (age 0-4) from the XSA analysis for 2011 is lower than 0.5. LCA analysis evidenced the different fishing patterns of the two fleets, which is also determined by the behavior of the species. The Italian fleet is clearly targeting recruitment; besides, the Fc for the Croatian fleet is between $F_{0.1}$ and F_{max} while the F_c for the Italian fleet is above both reference points, showing a possible situation of growth overfishing. Nevertheless, an exploitation rate (F/Z) of 0.4-0.5 is on the safer side for a demersal stock. The fishing mortality is high on part of the stock and the biomass trends are rather stable. Taking into account the different exploitation pattern, it could be wise to reduce the fishing mortality on the recruitment and this could be obtained by a prolongation of the closed season for trawling along the Western Adriatic coast where in autumn age 0 recruits born in summer are concentrated.

The persistent area identified for the recruits of red mullet in GSA 17 is comprised between 10 and 20 m, located in the mud-sandy coastal areas of the Italian side (Figure 5-27). The western coastal area is characterized by high fresh water inflow, especially by the Po River,

determining eutrophication state from nutrient discharge. The sea bottom of coastal areas consists mostly of mud and sand-detritic sediments. The biocenosis of the area is numerically dominated by polychaetes and other filter-feeding bivalves (mainly *Corbula gibba*), followed by small crustaceans (mostly amphipodes and decapods as *Liocarcinus spp.*) and burrowing Ophiuroids (Giannoulaki et al., 2013).

The areas of persistency identified for the spawners of red mullet in GSA 17 are principally two (Figure 5-27). S1 is the widest one; located from the middle line to the Croatian coast. This area is characterized by relict sand (from times when the water level was lower and the area was a sandy beach), with high densities of holothurian (e.g. *Holoturia forskali*) and bivalves (e.g. *Atrina pectinata*), and by upwelling events. S2 is located between Brac, Hvar and Korcula Islands, where bottoms are rocky and muddy and upwelling events may occur (Giannoulaki et al., 2013).

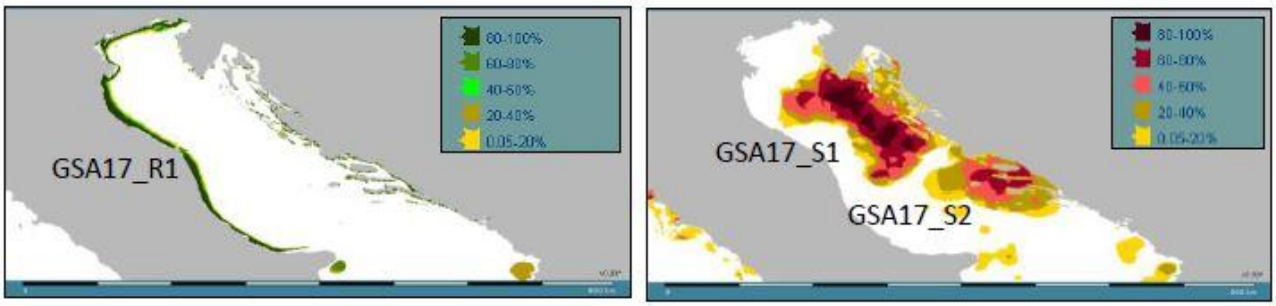


Figure 5-27 Red mullet: temporal persistency of the juvenile (left) and adult (right) hotspots in the GSA 17 (See also web based GIS viewer http://mareaproject.net/mediseh/viewer/med.html).

Concerning European hake status, STECF proposes the following reference point as a basis for management advice: $F_{MSY} = F_{0.1} = 0.21$ as proxy for F_{MSY} and as limit management reference point consistent with high long term yields. Based on the report of the STECF EWG 12-19 the SSB shows a clear decrease trend in GSA 17. The recruitment shows a fluctuating pattern with a general decreasing trend. Taking into account that the current F is comprised in the range 1.48-2.1 and is higher than the $F_{0.1}$ (0.21), STECF concluded that the stock has to be considered exploited unsustainably. STECF considers that in order to reduce fishing mortality to or below the proposed F reference point ($F_{0.1}$) and to avoid future loss in stock productivity and landings, fishing effort and catches of fleets that exploit this stock should be reduced. STECF also considers that this would best be achieved by implementing multi-annual fleet-management plans that take into account mixed-fishery effects.

The areas of persistency identified for the recruits of European hake in GSA 17 are comprised between 150 and 200 m and located in three areas: the former is southwards the Pomo/Jabuka Pit and parallel to the Italian coast (25 nm from Abruzzo – Apulia Regions; R1), the second is the widest one and is located just eastwards the Pomo/Jabuka Pit area and close to the Croatian Islands (R2) and the third is near the southern limit of GSA17 (R3; Giannoulaki et al., 2013; Figure 5-28).

The four areas of persistency identified for the spawners of European Hake in GSA 17 are located in the eastern side of the basins and comprised between 50-200 m of depth. S1 is located in the Kvarner Gulf, S2 is located northwards the Pomo/Jabuka Pit, S3 is located between the Islands of Brac and Hvar, S4 is in the Croatian side of the southern limit of GSA 17 (Giannoulaki et al., 2013; Figure 5-28).

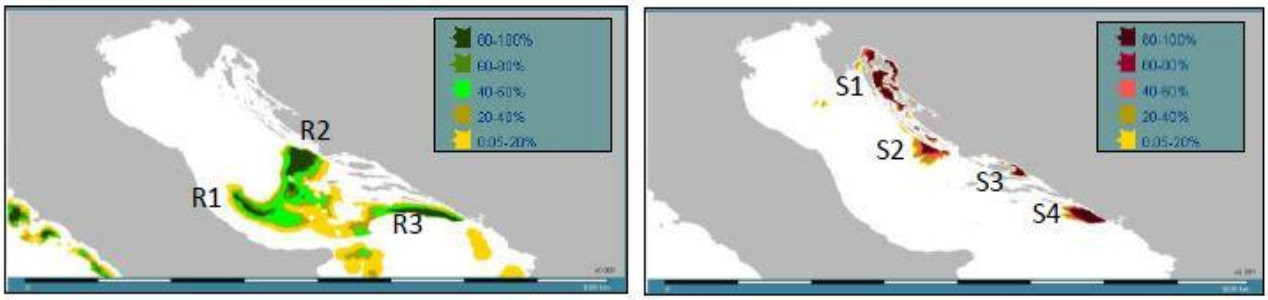


Figure 5-28 European hake: temporal persistency of the juvenile (left) and adult (right) hotspots in the GSA 17 (See also web based GIS viewer http://mareaproject.net/mediseh/viewer/med.html).

Concerning Slovenian waters, in the period from 2005 and 2011, the catch of Slovenian fishermen consisted of 122 commercial species and higher taxonomic groups and shellfish. Overcatching of fish and other animals in the natural environment has significant negative effects on the marine ecosystem. Overfishing may result in excessive reduction of fish stocks, which affects the diversity of species, changes the natural dynamics of predators and prey and consequently causes a change within the food web. The General Fisheries Commission for the Mediterranean has selected 33 fish and shellfish species, but stock assessments have been carried out for only three fish species: European pilchard, European anchovy and common sole. The stock of sole (Solea solea) is overfished, and the stocks of European pilchard (Sardina pilchardus) and European anchovy (Engraulis encrasicolus) are fully exploited. At present, the environmental goals are set according to the management opinion of the General Fisheries Commission for the Mediterranean, which recommends a reduction in fishing mortality (F) for sole, in particular due to the use of dredges. For pilchard and anchovy, the Commission recommends that fishing efforts should not increase. If conditions do not start to improve, the goals and related measures will have to be re-examined in the next period.

5.3.4 Specific features of Focus Area 2

Fisheries of demersal species exist throughout the western Greek coasts, especially in coastal areas presenting increased productivity influenced by the discharge of river output. Stock assessment applied by international stock assessment working groups is available for the main target species of trawl and purse seine fishery in this area. Based on these reports the main small pelagic fish stocks of anchovy and sardine seem to be overexploited based on the empirical reference point of E0.4 (Patterson 1992). However the information is not up to date since the available times series stops in 2008 (Cardinale *et al*., 2010). Stock assessment for the main demersal fish and shellfish stocks suggest that blotched picarel *Spicara flexuosa* in the GSA 20 is sustainably exploited, picarel *Spicara smaris* is sustainable exploited, norway lobster *Nephrops norvegicus* is exploited unsustainably, European hake *Merluccius merluccius is* exploited unsustainably (Cardinale & Osio 2012). *Based on the management plan of the Greek bottom trawl fishery* (Anonymous 2012a) red mullet (*Mullus barbatus*), striped red mullet (*Mullus surmuletus*) and pink shrimp (*Parapeneus longirostris*) are exploited within safe levels of exploitation.

Moreover the MSFD initial assessment for the Ionian Sea (Anonymous 2012a) mentions that according to indicators based on fishing pressure or/and biomass, demersal fish stocks of European hake (*Merluccius merluccius*), pink shrimp (*Parapeneus longirostris*), red mullet (*Mullus barbatus*), striped red mullet (*Mullus surmuletus*), picarel (*Spicara smaris*) show slight departures from the safe limits, with the exception of *Mullus* spp. and picarel; these are species inhabiting waters shallower than 150-180m. Based on the same report pelagic fish stocks of both anchovy and sardine show departures from reference points. Available information on stock status is summarized in Table 5-2.

Time-series data for the most important groups in the northeastern Ionian Sea from 1964 to 2006 were used to construct an Ecopath with Ecosim model of 22 functional groups (Piroddi *et al*., 2011). Results indicated that fishing pressure occurring in the area until the end of 1990 along with changes in primary production was the main responsible for the decline of fishery resources. The need for management actions to sustain target species (eg. pelagic and demersal fishes) was underlined in conjunction to the adoption of marine protected areas. Moutopoulos *et al*., (2013) also suggested that primary production for the sustainability of fisheries was found to be low and cumulative fishing impact estimated from all gears combined exceeded safe limits.

On the other hand, according to the analyses of Tsagarakis *et al*. (2013), where the spatiotemporal patterns of a series of population and community metrics in the E. Ionian Sea throughout a 10 year period were examined, suggested that the magafaunal assemblages of the area under study have presented an improvement. More specifically, biomass, abundance and several size-based indicators have increased for the total community as well as for Chondrichthyes, Osteichthyes, Cephalopods and several commercial species. Additionally, a decreasing trend of the fishing effort was also observed mainly due to the decline in the number of fishing vessels, particularly of small scale fisheries. Abundance, species richness and maximum length proved the most informative metrics concerning the effect of fishing. This approach underlined that by keeping fishing effort at an appropriate overall level measurable ecological effects within a short time frame may be achieved.

Species		**Stock Status**	
	A	B	C
Mullus barbatus	Good		Safe levels of exploitatio
Mullus surmuletus	Good		Safe levels of exploitation
Merluccius merluccius	Good-Moderate (with departures from reference points)	Unsustainable exploited	Unsustainable exploited
Parapeneus longirostris	Good		Safe levels of exploitation
Nephrops norvegicus		Unsustainable exploited	
Spicara smaris	Good	Sustainable exploited	Sustainable exploited
Engraulis encrasicolus	Good-Moderate (with departures from reference points)	Overexploited	
Sardina pilchardus	Good-Moderate (with departures from reference points)	Overexlpoited	

Table 5-2 Stock status for the main commercial fish stocks in Ionian Sea based on (A) the MSFD initial assessment (Anonymous, 2012a), (B) on the Scientific, Technical and Economic Committee for Fisheries (STECF) assessment of Mediterranean Stocks (Cardinale et al., 2010; Cardinale and Osio 2012) and (C) the management paln for bottom, trawls in Greek waters (Anonymous 2012b).

Some spatial information on the distribution of the main demersal and pelagic harvested species in the Italian part of Focus area 2 are given in the following maps (Figs. 5-29 – 5-34). For these species a systematic data collection has been done and mean probability maps of nurseries habitat have been produced (Source: web based GIS viewer http://mareaproject.net/mediseh/viewer/med.html)

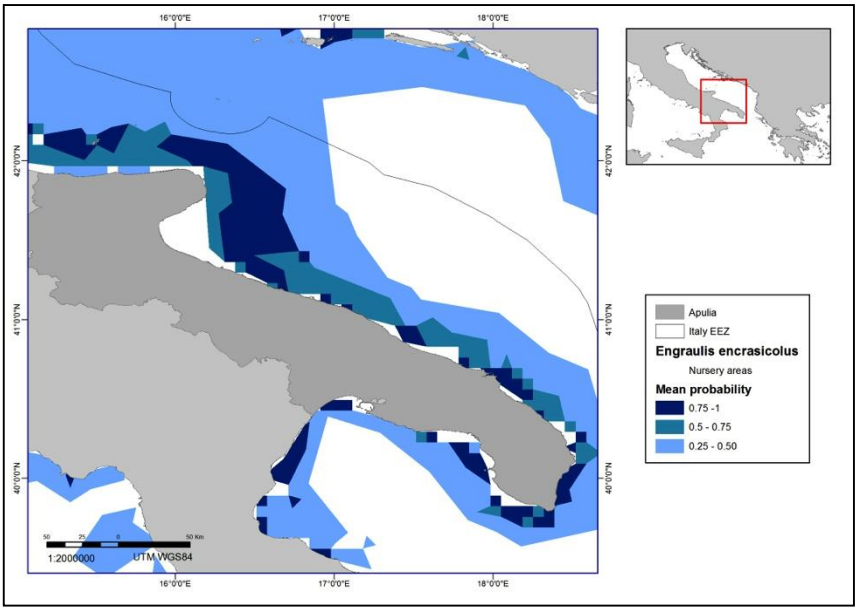


Figure 5-29 Engraulis encrasicolus. Mean probability maps of anchovy nurseries habitat in the Mediterranean Sea for the period 2003-2008 during late autumn (from the project MEDISEH MAREA)

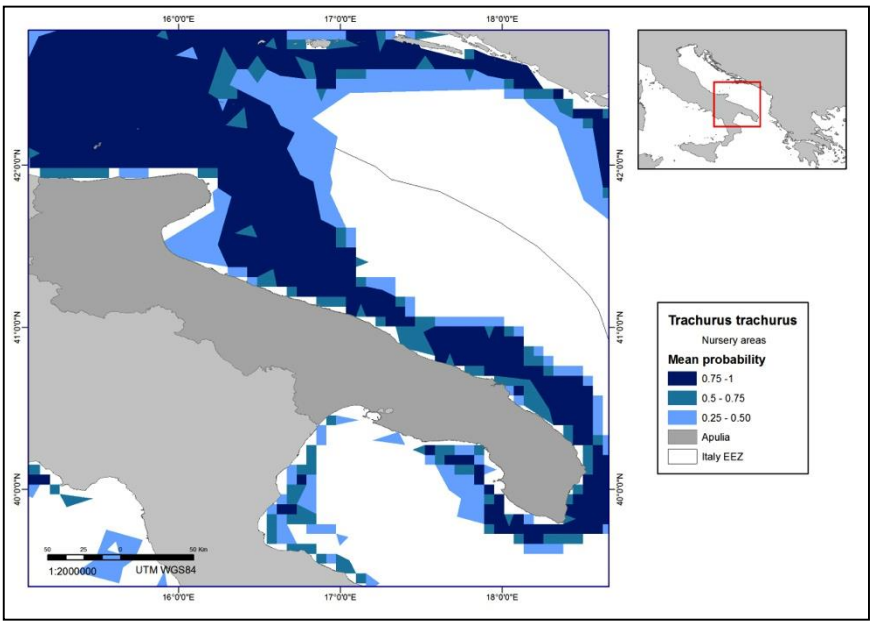


Figure 5-30 Trachurus trachurus. Mean probability maps of Trachurus trachurus nurseries in the Mediterranean Sea for the period 2000-2010 during summer (from the project MEDISEH MAREA)

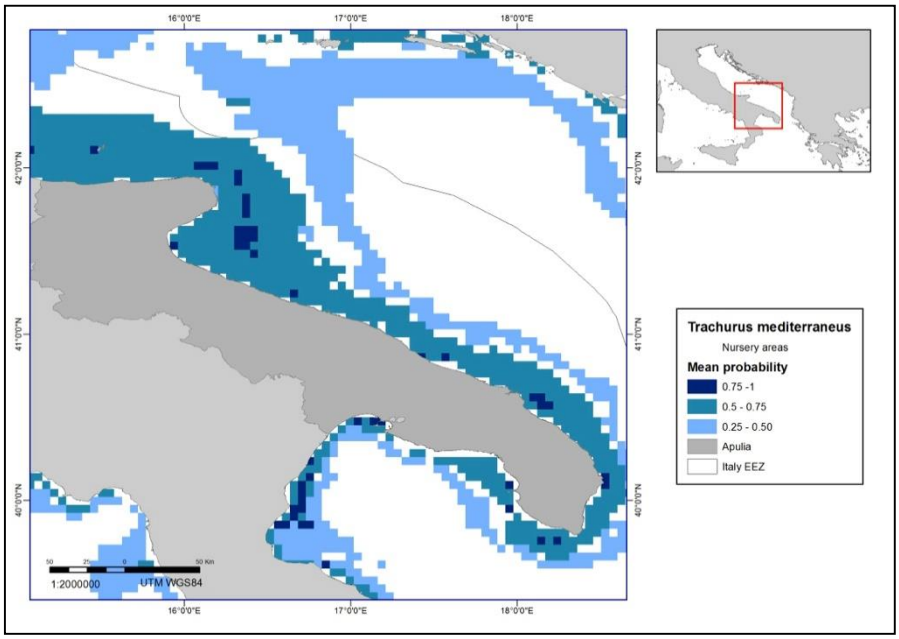


Figure 5-31 Trachurus mediterraneus. Mean probability maps of juvenile Trachurus mediterraneus habitat in the Mediterranean Sea for the period 2003-2009 during early winter (from the project MEDISEH MAREA)

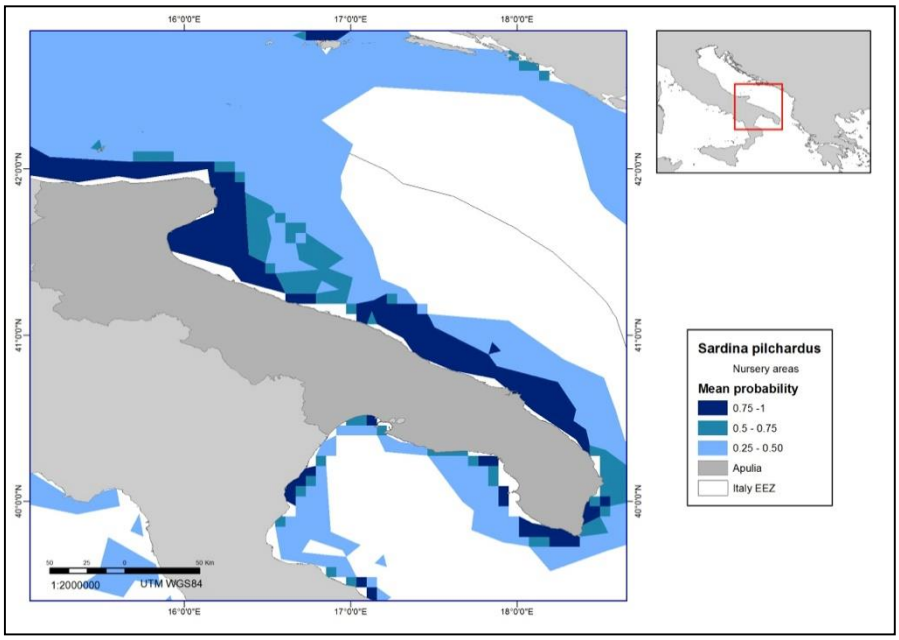


Figure 5-32 Sardina pilchardus. Mean probability maps of juvenile sardine habitat in the Mediterranean Sea for the period 2003-2008. (from the project MEDISEH MAREA)

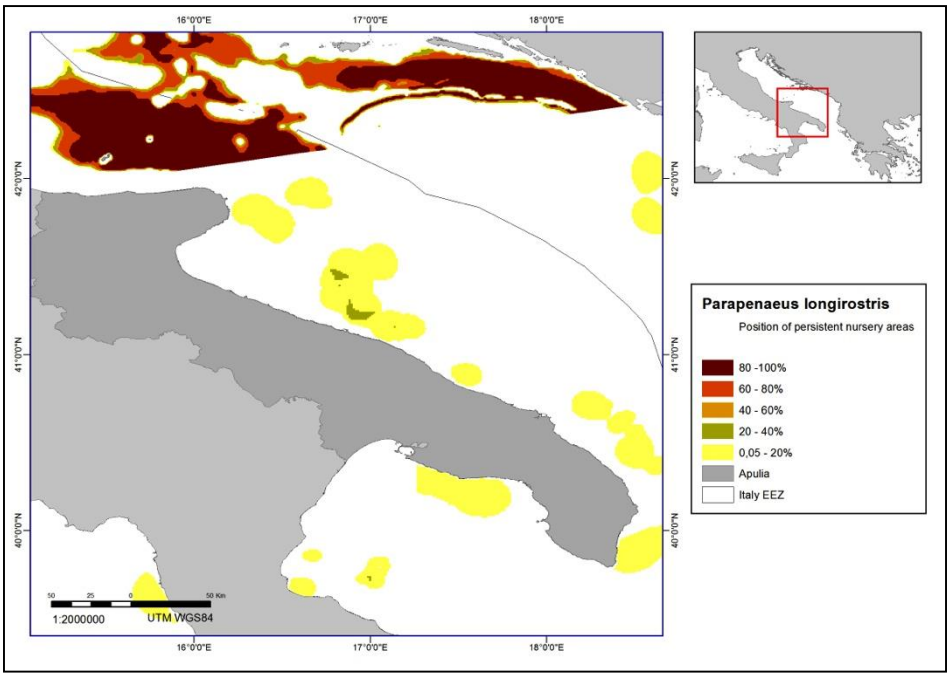


Figure 5-33 Parapenaeus longirostris. Position of persistent nursery and spawning areas of deep-sea pink shrimp (from the project MEDISEH MAREA)

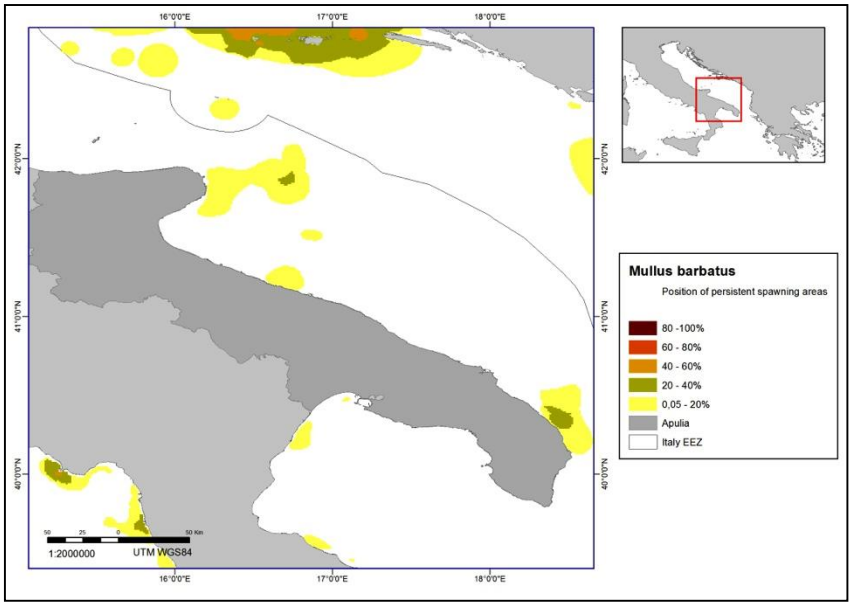


Figure 5-34 Mullus barbatus. Position of persistent spawning areas of red mullet (from the project MEDISEH MAREA)

5.4 D4 Food webs

M. Lipizer, P.K. Karachle, V. Vassilopoulou, S. Fraschetti, G. Farella, F. De Leo, S. Mezek

In order to achieve Good Environmental Status in terms of D4 Food Webs, all elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and at levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity. GES will be achieved when the indicators describing the various attributes of the descriptor reach the thresholds set for them. These should ensure that populations of selected food web components occur at levels that are within acceptable ranges that will secure their long-term viability. This descriptor addresses the functional aspects of marine food webs, especially the rates of energy transfer within the system and levels of productivity in key components. The interactions between species in a food web are complex and constantly changing, making it difficult to identify one condition that represents 'good' status. However, some changes in species' relative abundance in an ecosystem can have significant adverse effects on food web status. Good Environmental Status of food webs will be achieved when energy flows through the food web, and the size, abundance and distribution of key trophic groups/species, are all within acceptable ranges that will secure the long-term viability of all food web components in line with prevailing natural conditions. Three criteria have been proposed to evaluate GES, namely: productivity of key species or groups, proportion of selected species at the top of food webs and abundance of key groups/species. This descriptor is tightly related to other descriptors evaluating biological status of the ecosystem, such as D1 Biodiversity, D2 Non indigenous species, D3 Commercial fish stocks, D5 Eutrophication and D6 Sea floor integrity. As specific indicators for D4 Food webs are still being implemented, GES assessment is mainly based on indicators proposed for D1 Biodiversity.

5.4.1 Main threats

Food web integrity is threatened by several maritime uses, as well as it is subject to climate variation and other natural drivers making precise attribution of cause and effect difficult. The food web is a fully interconnected system, so pressures on one part of the system may have impacts elsewhere, which are not easily predictable and there may also be indirect consequences for a range of other species. Attributing the cause of change in food web structure or function is complex, and will be the result of pressures which act both directly and indirectly on different components of the ecosystem.

Alterations in food web integrity fall within the broader category of biological disturbance which comprises extraction of species (including non-target catches), NIS introduction, microbial pathogens and biodiversity loss, accordingly, effects of pressure on D4 - Food webs are assessed also by other descriptors (D1 Biodiversity, D2 Non indigenous species, D3 Commercial fish stocks, D5 Eutrophication and D6 Sea floor integrity). All maritime activities determining biological disturbance such as fishery, seafood and seaweed harvesting, aquaculture, tourism, commercial transport, dredging, sand extraction as well as land-based activities may adversely impact food web integrity. Among all, the most important pressures on food web integrity is regarded to derive from fishing activities which directly affect target species, and indirectly affect other non-target components of the ecosystem (SHAPE Final Report, 2013; EC Report, 2011). The main factors that affect food webs are removal of key species such as fish and mammals by fishing and by-catch. Assessments for the overall status of food webs are hard to define due to the complexity of several interlinking species over several different habitats.

At Mediterranean scale, with at least 25% fish stocks exploited beyond Maximum Sustainable Yield (MSY) (i.e. "over-exploited, depleted or recovering"), 44%-73% of fish stocks outside safe biological limits (SBL), significant numbers of threatened or even commercially extinct species, considerable declines in apex predators and alteration in food webs, D3 and D4 objectives were assigned at high risk of failure (Breen et al., 2011).

In the context of MSP, due to the complexity of interactions among food web components, to the different spatial and temporal scales of biological processes, the impact of planning proejcts should consider the main aspects of the food web structure, also in terms of the other strictly connected MSFD descriptors (i.e. D1, D2, D3, D5, D6) at the appropriate spatial and temporal resolution.

5.4.2 Main features at AIM scale

As will be presented in greater detail for D5 Eutrophication, the AIM is characterized by strong longitudinal and latitudinal trophic gradients, with mostly eutrophic – mesotrophic conditions in the north-western part of the Adriatic and oligotrophic conditions along the eastern Adriatic and in the Ionian Sea. Due to the large continental inputs, the North Adriatic is one of the most productive areas in the Mediterranean Sea and the whole basin is of paramount importance for Italian fishery, producing around 50% of all Italian catches (all species, Bombace and Cingolani, 1988) and 19% of Mediterranean anchovy catches (Stamatopulos, 1993). In the Adriatic Sea, expecially in its northern – central parts, several levels of the food webs are impacted by human activities. Large phytoplankton blooms occurred several times in offshore and coastal north Adriatic areas mostly during 1989-1992 and still characterize the Emilia Romagna Region coastal waters. In the 1980s-mid 2000, the northern Adriatic has been interested by wide mucous aggregate formations which, under special hydrographic and meteorological conditions, can accumulate and deposit on the sea bottom, thus adversely affecting the benthic flora and fauna by smothering and/or provoking oxygen depletion in the bottom layer and, in the most severe cases, mass mortality of benthic organisms (Giani et al., 2005). Mucus aggregates influence zooplankton temporal and spatial variability and can severely affect some species of fish which breed during the warm period of the year (Bochdansky and Herndl, 1995; Malej & Harris, 1993; Cabrini et al., 1992; Cataletto et al.,1996; Fonda Umani et al., 2005). Food web structure at the higher trophic levels is threatened by overfishing and high by-catch which represent a serious problem (UNEP/MAP, 2012). As a consequence of unsustainable exploitation through many years, many fish populations in the Adriatic have heavily declined in number. Among other alterations in food web structure, the Adriatic, in particular its northern part, shows signs of increasing jellyfish populations, with more frequent blooms in the last decades (Kogovsek et al., 2010), some of which have significant impact of fishing and tourism. Jellyfish are important elements in terms of consumption and production of trophic flows within the ecosystem and may threaten food web structure. Overfishing may be one of the causes of increase in jellyfish populations due to the removal of jellyfish predators and competitors (Brotz and Pauly, 2012).

Fishing down of marine food webs has been documented in Mediterranean using trophic indicators, like the “Marine Trophic Index” (MTI), the "Fishing in Balance” index (FiB) and the Pelagic/Demersal index (P/D) (EEA 2006). The mean trophic level of Mediterranean catches has declined by about one trophic level during the last 50 years. Following an increase up to the mid-80’s and the end of the fisheries expansion phase (especially offshore), the mean trophic level has declined (www.seaaroundus.org). The decrease of the FiB index and the rising of the P/D index may be interpreted as a result of a decrease in abundance of high trophic level species in the Mediterranean ecosystems and impaired food web functioning (Pennino, 2011).
There is conflicting evidence about the pressure exerted on key demersal fish species and particularly on high trophic level predators. It has been shown (Stergiou & Tsikliras 2011) that even though senior predators are still caught by fishermen, their size (between 1997 and 2006) has declined significantly following the paradigm of "fishing down the food web". On the other hand, Tserpes & Peristeraki (2002) have found that among 14 carnivore marine species only 1 presented a significant reduction, 6 showed a significant increase and 7 showed no significant change over time.

Regional (Mediterranean) estimates of large pelagic fish stocks (ICCAT) have shown that bluefin tuna, swordfish and stocks from other species have reached unsustainable levels, due

to the low biomass and the excessive mortality due to fishing. Despite the fact that the situation regarding e.g. the swordfish biomass seems rather stable over the past 20 years, this stability is maintained at levels of 60% lower that the biomass that was present prior to 1985.

Concerning the deep sea environment, the AIM is included within the main areas of ecological importance for selected Mediterranean mega-vertebrates, as provided by the CHOMP exercise (UNEP/MAP, 2012) (Critical Habitats of Mediterranean Predators) focused on marine top predators and charismatic species (cetaceans, monk seals, marine birds, marine turtles, sharks and large pelagic fishes), to detect location of special faunal importance Figure 5-35).

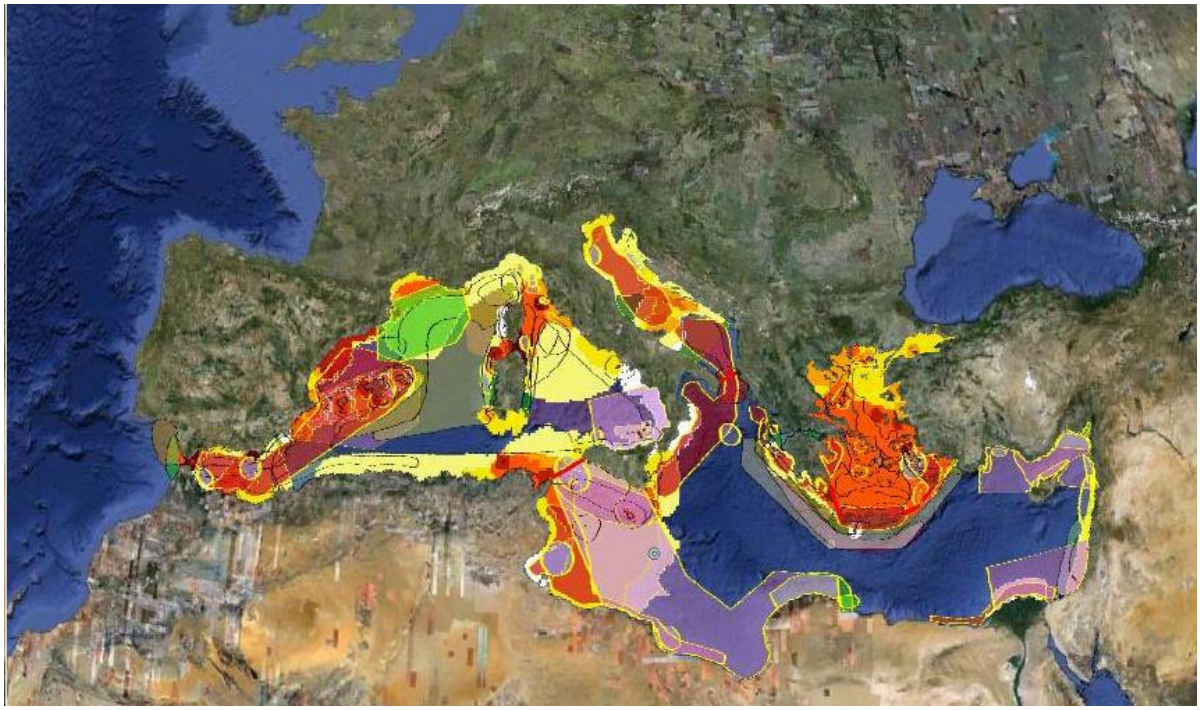


Figure 5-35 Map of the main areas of ecological importance for selected Mediterranean mega-vertebrates (UNEP/MAP, 2012).

A mass - balance food web model was developed for the Greek Ionian Sea ecosystem by Moutopoulos *et al*. (2013), in order to describe yearly biomass flows in the region's food web for the period 1998–2006. In terms of the flows and the energy required to support the fisheries, discards were found to be more important than landings due to the intra-gear negative effects that they cause which affect substantially the top organisms. The latter is of primary importance when considering the imposed discard been through the reformed CFP.

5.4.3 Specific features of Focus Area1:

In terms of food web integrity, issues concerning biodiversity conservation and fish stocks have been extensively treated in the previous sections (5.1, 5.3) while issues concerning trophic aspects such as eutrophication, algal blooms and integrity of benthic habitats are treated in the next sections (5.5, 5.6).

Concernign FA1, so far, not all relevant indicators have been developed due to lack of available data. Assessment of the status of marine food webs is currently based on the assessment of the status of groups that respond quickly to changes in the system and have fast turnover rates (mesozooplankton and true jellyfish). In the complex pelagic food webs, zooplankton represent an important link between phytoplankton and higher trophic levels of organisms, from fish to turtles and mammals. Therefore, besides phytoplankton, zooplankton are a key element affecting the productivity and health of marine ecosystems. Changes in zooplankton

biomass and composition have a significant impact on the whole food chain in the pelagic zone.

Concerning Slovenian waters, the status of the sea, assessed by the mesozooplankton biomass indicator, is good, so in this case the main aim is to maintain the status quo. For the evaluation of the environmental status under the Marine Strategy, metrics have been developed only at the level of the Slovenian Sea. It is necessary to carry out coordination on the level of the northern Adriatic, in cooperation with the neighbouring countries. True jellyfish are indictor consumers, which increased frequency of occurrence or increase in their biomass may represent a risk of failure to achieve a good environmental status. Data on the occurrence of moon jellyfish and comparison with long-term data indicate that the situation is at risk due due increase in frequency of massive occurences.

5.4.4 Specific features of Focus Area 2:

In this area overfishing is significantly reducing density and biomass of species. There are evidences that overfishing in the last years has selectively removed large-sized individuals (locally reducing reproductive potential of stocks), causing dramatic changes in the structures and functioning of food webs. In Apulia, Montenegro and Albania subtidal rocky reefs, trophic cascades often imply strong interactions among at least three trophic levels: (1) predators (e.g., fish, lobsters), (2) grazers (e.g., sea urchins), and (3) macroalgal assemblages. The trophic cascade model predicts flourishing macroalgal beds in the presence of abundant predators along with low densities of sea urchins (the most important grazers in temperate reefs). Conversely, when released from predation because of predator removal, sea urchins increase in density and overconsume erect macroalgae causing formation of barrens (i.e., bare rocks with encrusting algae) that are steadily increasing across this area. This is particularly evident from studies carried out in Marine Protected Areas, such as Torre Guaceto (Apulia). Protected locations supported higher density and size of the most effective fish preying on sea urchins (the sea breams *Diplodus sargus* and *D. vulgaris*) than unprotected locations. Density of sea urchins (*Paracentrotus lividus* and *Arbacia lixula*) was lower at protected than at unprotected locations. Here, the size structure of *P. lividus* was bimodal (a symptom of predation on medium-sized urchins) only at the protected locations. Coralline barrens were less extended at protected than at unprotected locations, whereas turf-forming and erect-branched algae showed an opposite pattern. Erect-unbranched and erect-calcified algae and conspicuous zoobenthic organisms did not show any pattern related to protection. Tethering experiments showed that predation impact on urchins was (1) higher at protected than at unprotected locations, (2) higher on *P. lividus* than on *A. lixula*, and (3) higher on medium-sized (2–3.5 cm test diameter) than large-sized (3.5 cm) urchins. Sea urchins preyed on by fish in natural conditions were smaller at unprotected than at protected locations. The analysis of sea urchin remains found in *Diplodus* fish stomachs revealed that medium-sized P. lividus were the most frequently preyed upon urchins and that size range of consumed sea urchins expanded with increasing size of *Diplodus* fish. These results suggest that (1) depletion and size reduction of predatory fish caused by fishing alter patterns of predation on sea urchins, and that (2) fishing bans (e.g., within no-take marine reserves) may reestablish lost interactions among strongly interactive species in temperate rocky reefs with potential community-wide effects.

In addition, there is widespread concern that this area may increasingly be dominated by jellyfish, because many of them are able to increase in abundance rapidly and adapt to new conditions following ecosystem regime shifts. Jellyfish include a polyphyletic invertebrate assemblage, mainly composed by cnidarian medusae and colonial siphonophores, ctenophores, pelagic tunicates (larvaceans, salps and doliolids), chaetognaths, polychaetes and other non-crustacean soft-bodied planktonic organisms. Jellyfish outbreaks (or blooms) can have important impacts on human coastal activities, such as fishing and leisure activities, but they can also represent a significant hazard to public health. More specifically increasing jellyfish outbreaks were recorded from 2009 to 2011 along the coasts of Salento (south Apulia) by means of the citizen science campaign METEOMEDUSE. 2,344 records of stinging jellyfish were

documented from 2009 to 2011 along Italian coasts. In the study area, the most common jellyfish stingers were the scyphozoan *Pelagia noctiluca* (61.81%), the cubozoan *Carybdea marsupialis* (26.57%); occasionally, the hydrozoan *Olindias phosphorica* (6.48%), and the scyphozoan *Chrysaora hysoscella* were locally abundant (5.11%). The scyphozoan *Cotylorhiza tuberculata* was also very common, but the stinging potential of this species is almost negligible.

Not only jellyfish are becoming increasingly abundant. During the spring of 2013, a citizen science study (http://meteomeduse.focus.it/), aimed at documenting the presence of gelatinous plankton in Italian waters, recorded about sixty sightings of *Salpa maxima* Forskål, 1775. The first, scattered records of salps arrived from the Apulian coasts in March 2013. Records increased in April and reached a peak in May. In April-May 2013, some of the authors had several chances to document the bloom, from both the coast, and from an oceanographic vessel during a cruise for the project CoCoNet (http://www.coconet-fp7.eu/), between 8–21 May 2013. In mid-May 2013 the colonies experienced massive degeneration and, in the following days, became stirred and stranded along parts of the Apulian coast where they formed foam belts, each several kilometers long.

On the whole, these blooms are expected to have important effects at ecosystem levels. Salps are gelatinous filter feeders; they are usually rather rare in Apulian waters, especially in coastal waters, and decades can pass without any salp observations. Records of salps in the scientific literature are rather scant, suggesting a similar pattern of occurrence also elsewhere.

The attention the 2013 salp bloom received in the media suggests that it is not likely that events of this magnitude occurred often in the past, since they would have been covered by the media as well. The surprise expressed by lay people and fishermen, indicates that, even if people are used to jellyfish, they are not used to salps, and the reason is simple: salps are rarely encountered in Italian waters. Such conspicuous animals do not pass unnoticed, and if they are around they are seen and recorded.

Salps have extremely high clearing rates and can feed on all sizes of phytoplankton, from viruses to protists, competing with crustacean filter feeders (Bone, 1998). The presence of a massive bloom of salps likely depletes phytoplankton production, impairing the phytoplankton-crustacea-fish larvae and juveniles pathway (see Boero *et al.* 2008). The match of fish recruitment with a salp proliferation, could lead to a decrease in fish reproductive success due to food depletion. If this phenomemon was not reported, it could result in fishery scientists who, after a few months, might record anomalies in the age classes of some fish species while being unable to link them to any particular cause.

Since salps tend to disgregate and precipitate as marine snow, they tend to fuel the detritus food chain on the sea bottom. Salp blooms, thus, might redirect the functioning of marine ecosystems in a sudden and dramatic way, leaving little evidence of the cause of changes that, indeed, might become apparent long after the end of the bloom.

As remarked recently by Boero (2013 b), the availability of records of unusual events such as this salp proliferation, might help us to understand anomalies in the population structure of some species or even anomalies in the functioning of whole ecosystems.

5.5 D5 Eutrophication

M. Lipizer, S. Fraschetti, G. Farella, F. De Leo, P.K. Karachle, A. Kokkali, V. Vassilopoulou, S. Mezek, S. Belošević

Eutrophication is a process driven by enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, leading to: increased growth, primary production and biomass

of algae; changes in the balance of organisms and water quality degradation. The consequences of eutrophication are undesirable if they appreciably degrade ecosystem health and/or the sustainable provision of goods and services. In order to achieve GES, human-induced eutrophication should be minimized, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters. Eutrophication is assessed according to three criteria: nutrients levels (concentrations and ratios), direct effects of nutrient enrichment, such as chlorophyll a concentration, water transparency, opportunistic macroalgae abundance, phytoplankton blooms, shifts in species composition, and indirect effects such as dissolved oxygen, perennial seaweeds and seagrasses abundance. The descriptor eutrophication is, thus, tightly connected to other descriptors such as biodiversity, commercial fish stocks, food webs, sea-floor integrity, hydrographical conditions and, due to possible enhancement of harmful algal blooms, also to contamination of seafood.

There is extensive literature on the use of several indicators of eutrophication in inshore and offshore waters. All methods include Chlorophyll a (Chl a) as an indicator of phytoplankton biomass, though the metrics are different. In the setting of the classification boundaries for 2000/60/EC Water Framework Directive (WFD) assessment, the 90th percentile of the chlorophyll a concentrations has been used for the NE Atlantic coast and the Mediterranean as indicators of phytoplankton biomass.

In the framework of Marine Spatial Planning needs, in order to map areas threatened by eutrophication, the hydrological classification defined according to the WFD is used, based on DIN, TP, chlorophyll a, dissolved oxygen concentration and saturation and the TRIX index (which combines all above mentioned parameters), as a synthetic trophic index.

5.5.1 Main threats

Considering the maritime uses in the AIM, eutrophication is mostly a consequence of land-based activities due to coastal, riverine and atmospheric inputs from agricultural, forestry run-off, municipal wastewater discharges, and of aquaculture. Additionally, it may be influenced by dredging, sand extraction and coastal engineering which mobilize the large amounts of nutrients present in sediment pore waters.

Eutrophication can both positively and negatively impact several relevant maritime activities for the AIM. The nutrient-driven increase in primary production, that is key to eutrophication, leads to increased harvest of fish or shellfish, but also to undesirable consequences, such as damage to fishery due to mortalities of exploited fish stocks and of benthic fauna consequent to water de-oxygenation, and to tourism due to accumulation of algal foam on beaches. Water quality degradation consequent to eutrophication may include: 'aesthetic' effects such as the appearance of Red Tides or excessive foam; decreases in water transparency caused by greater phytoplankton biomass and decreases in bottom-water oxygen content because of the decay of increased organic matter. Furthermore, changes in the balance of organisms might also include more frequent occurrences of toxic algal blooms. Eutrophication, therefore, directly impacts both water column and sea-bed habitats, determining increased abundance of opportunistic macroalgae, shifts in floristic composition and in benthic to pelagic balance.

5.5.2 Main features at AIM scale

The Adriatic Sea is composed of three regional basins (North, Central and South), differing in latitude, bathymetry, physiography, biogeochemical and trophic features. The northern basin profoundly differs from the rest of the Adriatic as it presents shallow depths and significant freshwater inputs by the main Italian rivers, which are the main sources of nutrients and organic matter for the whole Adriatic basin (Figure 5-36). Among the rivers along the Italian coasts, the Po river is by far the largest Italian river and, according to total annual discharge, basin size and nutrient loads, is one of the ten largest rivers of the Mediterranean (Ludwig et

a., 2003) and accounts for about one- third of the total runoff in the Mediterranean (Ludwig et al., 2009).

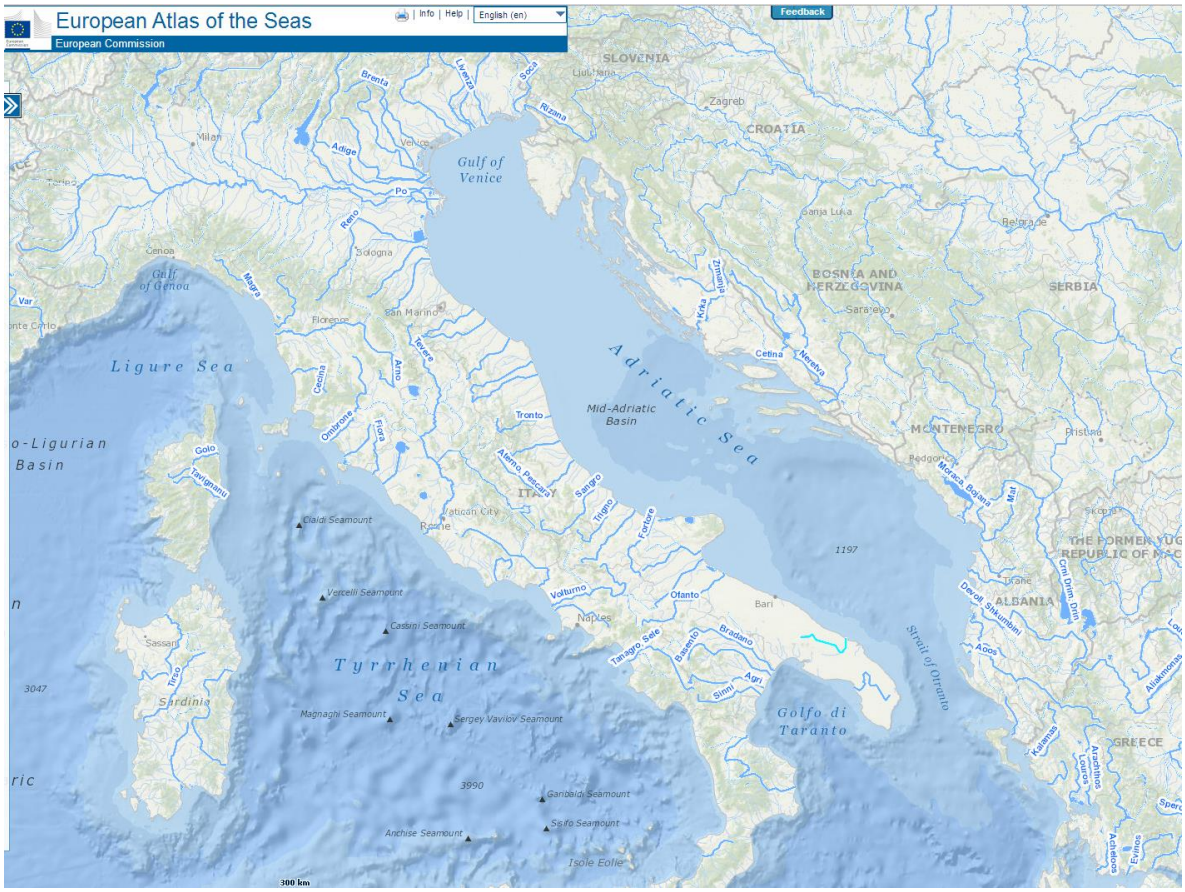


Figure 5-36 Main rivers discharging into the AIM (JRC, European Atlas of the Sea).

A main frontal system, mostly visible in winter, divides the offshore from the coastal waters, the latter containing the freshwater contributions of the Po and other minor rivers which are, thus, mainly confined within the Western Adriatic Coastal Current (WACC) flowing southwards along the Italian coast (see section 5.7 Hydrographic conditions, Figure 5-53). Strong longitudinal and latitudinal trophic gradients characterize the Adriatic basin, with mostly eutrophic – mesotrophic conditions in the area of the Po River mouth and a significant nutrient decrease towards the centre of the basin and the eastern coast. The trophic gradient is clearly evident in the 90th percentile of the chlorophyll a concentrations and in the climatological distribution of surface nitrate (Figure 5-37, 5-38).

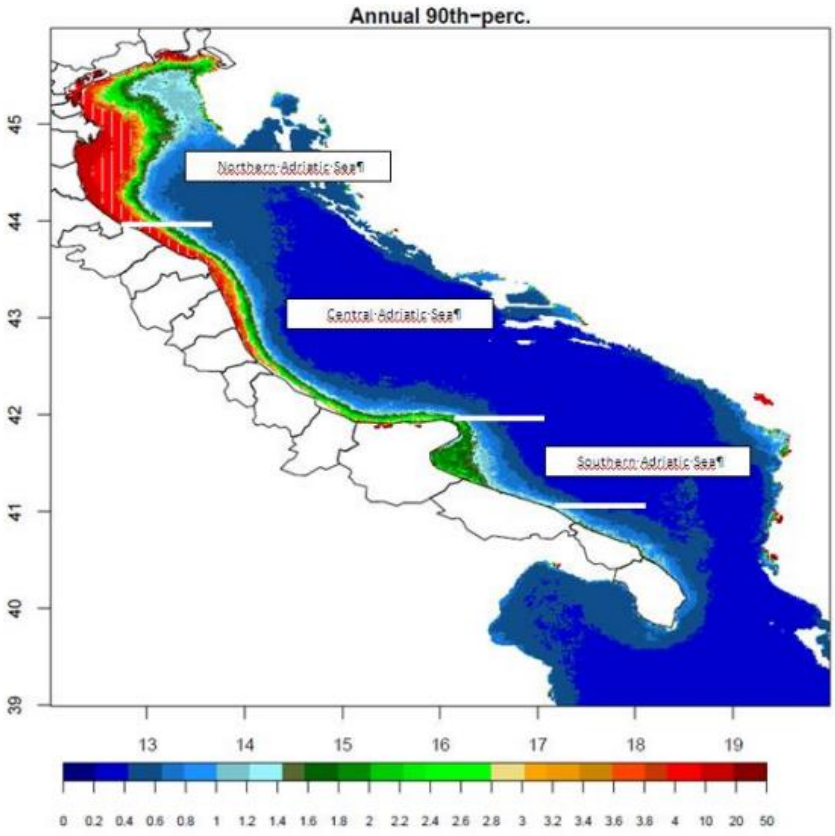


Figure 5-37 Distribution of 90° percentile of chlorophyll a distribution (mg/m3) from satellite data MERSI, MERIS-MODIS (Plantek s.r.l., from ISPAR, 2012).

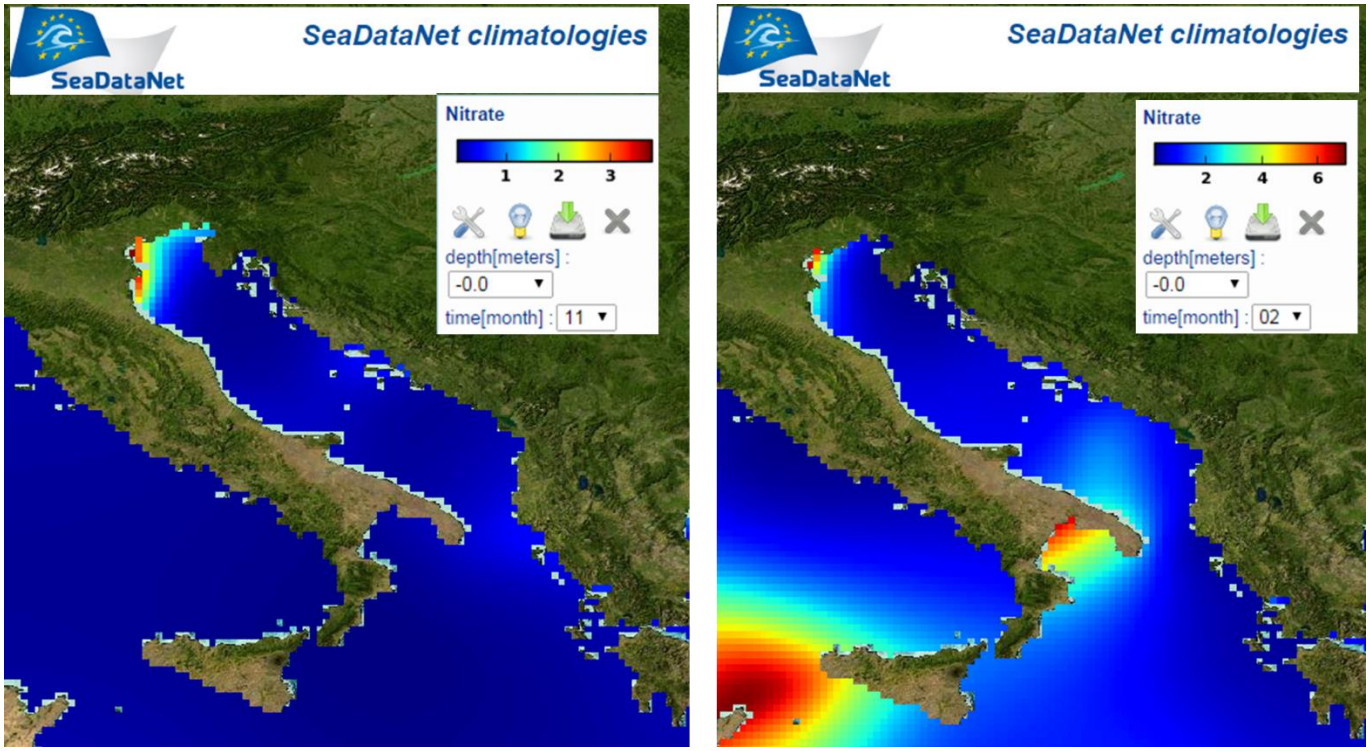


Figure 5-38 Climatological map of surface nitrate concentration in November (left) and Febraury (right) (Seadatanet).

Besides river inputs, nitrogen and phosphorus introductions into the Mediterranean Sea are mostly due to agriculture, aquaculture, fishing, land-based industry, tourism and recreation. Nitrogen comes mainly from widespread sources and consequently loads to the sea increase during rainy years and their concentration in the sea can be very variable. Highest concentrations are usually reached during winter and lowest during summer due to lowered riverine discharge and to primary producers' uptake.

The contribution from point sources, like urban waste water treatment, livestock farming and metal industry, is less relevant and in the Adriatic these are mainly located along the eastern coasts.

In the Adriatic estimates suggest that every year approximately 270,000 t of nitrogen are discharged (UNEP, 2002) with Po river contribution of over 100,000 t/y of nitrogen; contribution of water treatment plants discharging into the Adriatic is instead approximately 8,000 t/y.
Important areas for nitrogen load from widespread sources are:

- The north western area, which includes some important Italian rivers: Po, Adige Livenza, Piave, Brenta-Bacchiglione;
- The south eastern area in Albanian and Montenegrin coastlines.

NO3 is the most abundant nitrogen form almost anywhere in each season and reaches maxima at the surface along the western coast, a clear signature of the river discharge (Russo et al., 2012).

Regarding phosphorous the whole Adriatic approximately receives a yearly load of 24,000 t /y(UNEP, 2002), with Po river contribution of over 7000 t/y and the main phosphorous sources in the Adriatic are:

- The north western area, which includes some important Italian rivers: Po, Adige, Livenza, Piave, Brenta-Bacchiglione and Reno;
- The south eastern area in Albanian and Montenegrin coastlines.

Values of orthophosphates at the surface are typically very low everywhere but in the northern area, especially in the proximity of the river Po, due to the amount of river discharge. Along the Emilia Romagna Region coasts, phosphorous can be nevertheless considered as the key element which limits and controls eutrophication phenomenon in the area.

The offshore central and southern Adriatic show clearly oligotrophic characteristics (Vilicic et al.,1989) with the primary production cycle regulated by the nutrient supply to the euphotic zone from the deep part of the water column by different upwelling and mixing pro-cesses (Polimene et al., 2006).

The EEA (2006) stated that eutrophication is a very common problem, however limited to sheltered marine water bodies such as harbours and semi-enclosed bays mainly in the vicinity of coastal towns of the Mediterranean, and it is not expected to be of concern in the next two decades (Knights et al., 2011). At Mediterreanean scale, conversely, due to low nutrient inputs and the large area of the basin, it is not expected that the basin will be seriously threatened by eutrophic pressures over the next 2 decades (Karydis & Chatzichristofas, 2003), and the UNEP 2010 Outlook for the Mediterranean Sea is recorded as Moderate (http://www.liv.ac.uk/media/livacuk/odemm/docs/ODEMM,Deliverable,1.pdf , Knights et al., 2011).

The coastal waters of the southern Adriatic-Ionian area are generally characterised as oligotrophic. However, in estuarine areas there is localised enrichment by nutrients and organic matter as rivers carry agricultural runoff. As a result primary production increases possibly leading to algal blooms. In the open sea there is no evidence of eutrophication.

The levels of nitrogen in the Ionian assessment area (MSFD initial assessment for the Ionian Sea, ISPRA, 2012) range from 0.03 to more than 6.00 µmol N/l (NO3+NO2) in the surface coastal waters (Figure 5-38b). As a general trend, in the euphotic zone nitrogen concentrations are lower than 1 µmol N/l increase with depth. However, dissolved organic nitrogen (DON) exhibits the opposite trend.The levels of phosphorus in the water column in the assessment

area range from 0 to 0.24 µmol P/l. Phosphorus concentrations increase with depth, whereas surface values are generally very low, <0,05 µmol P/l. Phosphorus is the limiting factor for phytoplankton growth in eastern Mediterranean.

The dominating trend shows that nutrients levels increase with depth. As far as the temporal trend is concerned, winter exhibits comparatively higher concentrations than the summer ones, depending on dominating climatic conditions.

The concentrations of dissolved organic carbon (DOC) in the assessment area range from 36 to 82 µmolC/l. Surface waters present increased concentrations whereas the minimum values are measured in the deeper waters. Chlorophyll concentrations vary from 0.03 to 0.18 µg/l and dissolved oxygen concentrations range from 4.1-5.32 ml/l with minimum values in deep waters (500-1000m).

Concerning the Croatian coastal waters, the values of total phytoplankton density in the Dubrovnik - Neretva County in 2006 were generally very low, much lower than the previous year, with the exception of the areas of the mouth of the river Neretva. In the Split-Dalmatia County values of total phytoplankton were considerably lower than in 2005.

The values of total phytoplankton in Zadar County during 2006 remained at the same level as the previous year, and a declining trend was not recorded. The analysis of the results of many years of research indicates that annual fluctuations in total phytoplankton abundance in this area do not follow trends in abundance in southern counties. The values of the total density of phytoplankton in the area of Primorje-Gorski Kotar County during 2006 were in ranges typical of oligotrophic coastal seas. At all stations dinoflagellates dominated the phytoplankton community. In Primorje-Gorski Kotar County during 2006 total phytoplankton density values were lower than typical for the eastern part of the open waters of the northern Adriatic, which is occasionally affected by eutrophic waters of the river Po. During 2006, the Po river influence was significantly lower than normal, given the extremely low flows throughout the year. The ratio of diatom and dinoflagellate markedly shifted in favour of the diatom that dominate phytoplankton populations.

Considering dissolved oxygen saturation of the upper part of the water column (0-10 m), values recorded at the station in front of Rovinj (station OC18) and in Šibenik Bay (station OC09) do not indicate the occurrence of eutrophication.

During 2012, mean annual concentrations of dissolved inorganic nitrogen (nitrate + nitrite + ammonium) were in the range of 1.25 (OC19 station located 5 miles outside of Rovinj) to 7.14 mmol/m3 (OC15 in Bakar Bay). This range is very similar to the ranges established during 2011 (1.06 to 7.43 mmol/m3) and 2010 (0.66 to 6.30 mmol/m3), and significantly lower than in 2009 (0.82 to 14.0 mmol/m3). At five stations relatively low concentrations of inorganic nitrogen (0-2 mmol/m3) were found, at five stations moderate concentrations (2-4 mmol/m3), and at two became elevated (> 4 mmol/m3). The same pattern was observed during 2011. The only exception relates to Bakar Bay, which, in 2011, was classified as at moderate concentrations of inorganic nitrogen, and in 2012 belongs to a class with elevated concentrations of inorganic nitrogen. The reason for this are probably differences in hydrological conditions during 2011 and 2012 since the major sources of inorganic nitrogen in the Bay of Bakar are submarine springs of fresh water. In the category of stations with elevated concentrations of inorganic nitrogen is the station OC09 in Sibenik port, which is strongly influenced by the Krka river, but also part of the waste water of the city of Sibenik. Although the concentration of inorganic nitrogen in these two becomes significantly more compared to the other stations, though they should not be classified as typical indicators of eutrophication because on both stations as the main factors of inorganic nitrogen enrichment occurring freshwater inflows (naturally rich in nitrogen compared to seawater) and to a lesser extent wastewater.

Results of sea bathing water quality assessments, determined on the basis of criteria defined by Regulation on Sea bathing water quality (OG 73/08) and the EU Directive on management of bathing water quality No 2006/7/EC, for year 2014 are presented in the following figure

which indicates that more than 93% or samples are in excellent status and only less than 2% are in sufficient or poor status.

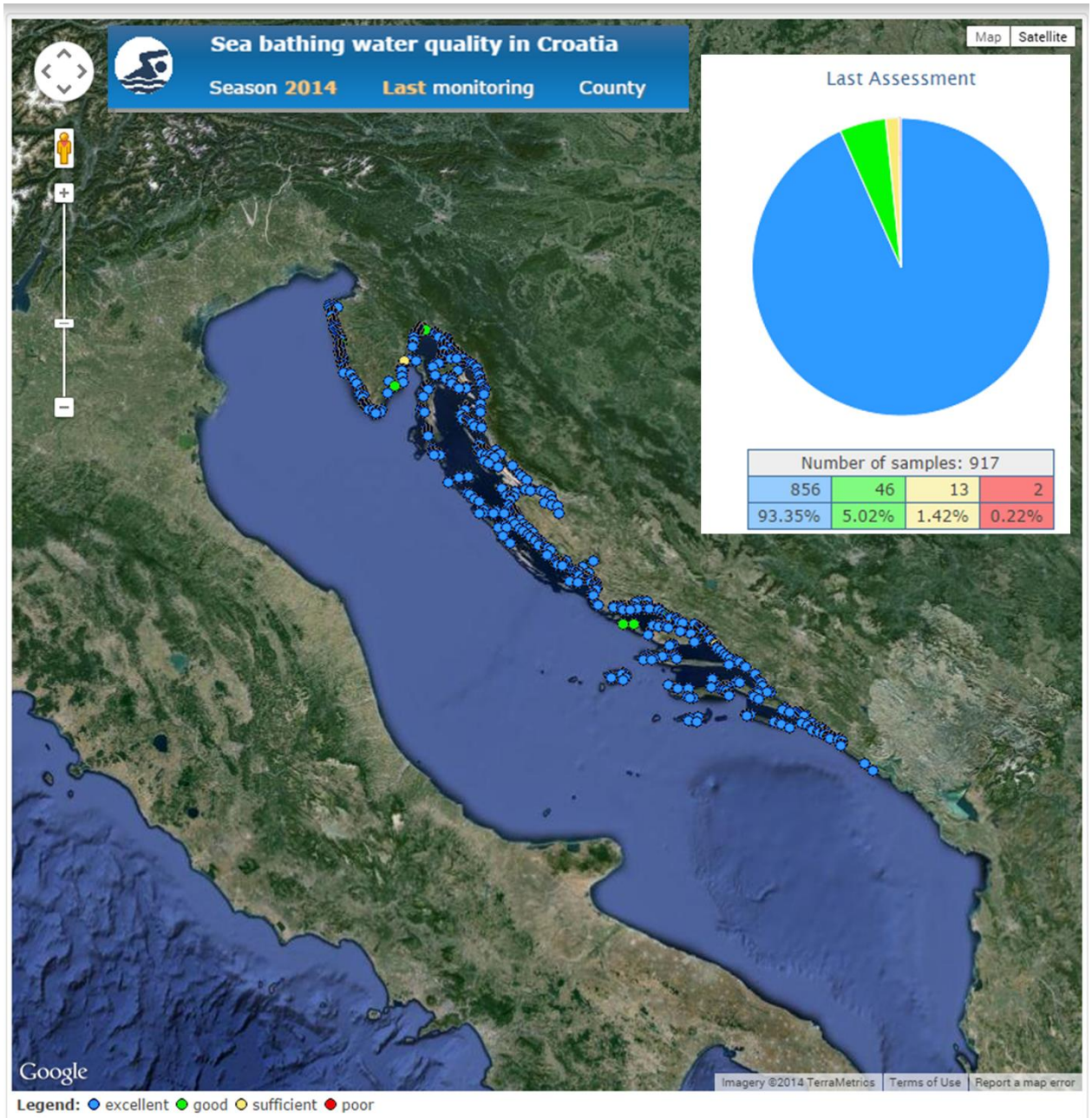


Figure 5-39 Sea bathing water quality in Croatia.

As far as the Ionian Sea is concerned,aAccording to Ludwig et al, 2009 (based on 1998 data), the input load of nitrogen in the Ionian Sea from riverine fluxes is 42000 tonnes per year and the equivalent input load for phosphorus is 1900 tonnes. The degree of such an impact can be estimated by the ratio between the surface areas of the terrestrial watershed to that of the marine basin into which such discharges are emptied. For the Ionian Sea this ratio is the smallest, 0.37 (it is 0.55 for the whole Mediterranean). In addition, an estimated 800 tonnes of nitrogen enter the Ionian sea due to aquaculture affecting the marine environment locally.

As a whole, the Ionian Sea is oligotrophic and well oxygenated. The general state of the assessment area is good so the extent to which the ecosystem is affected by nutrient and organic matter enrichment is limited. The main anthropogenic activities taking place in the

area altering nutrients and organic matter levels are land-based activities; agriculture, livestock farming and waste water treatment plants.

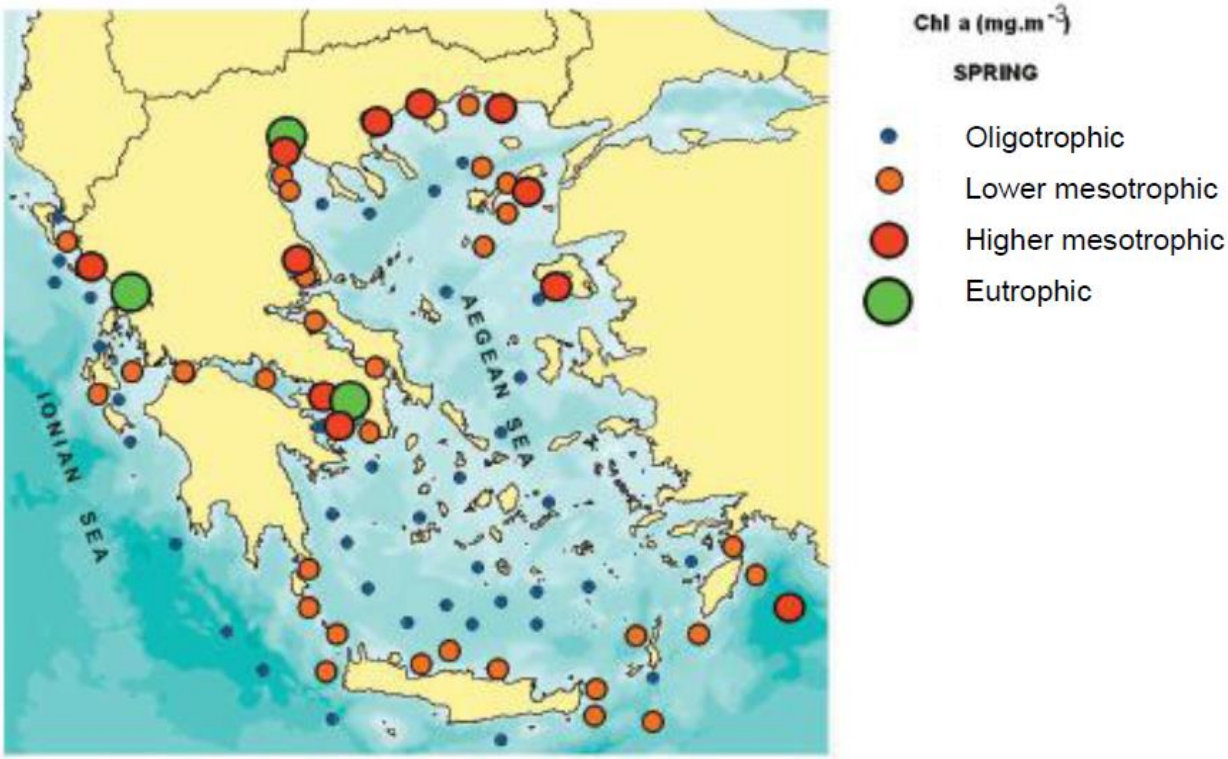


Figure 5-40: Classification of coastal and pelagic sea bodies according to levels of chlorophyll a at spring (from Gotsis-Scretas & Ignatiades 2005)

5.5.3 Specific features of Focus Area 1:

Terrestrial inputs and atmospheric deposition contribute to the largest amount of nutrients in Northern Adriatic and Kaštela bay. The reduction in riverine discharge is also causing a reduction in nutrient inputs, particularly strong for phosphorus, mainly due to policies enforced in Italy to reduce phosphorus containing compounds in detergents. In addition, a relevant part of those nutrients derive from waste water treatment plants. The generally high nutrient inputs from North Adriatic rivers has caused in the past widespread event of anoxia in the shallow bottom layers. The frequency of those events, as well as average chlorophyll concentrations, in the area have significantly decreased, while the N/P ratio in nutrient stocks has increased. A similar trend has been observed also in Kaštela bay. The Northern Adriatic is then becoming a site of oligotrophication dendency (Mozetic et al., 2010) and alteration of nutrient ratios. To date, robust evidence of the impact of such changes on the trophic regime of the basin is still lacking but long term effects might occur. This certainly makes the Northern Adriatic a very interesting system to monitor ecosystem responses to perturbations. A wider analysis (Socal et al., 2008) of the north Adriatic focused on the years 2003-2006, has shown that the sub basin ranges from mesotrophic and episodically eutrophic conditions in the western coastal area, and from mesotrophic to oligotrophic conditions in the central and eastern part of the basin. In the northern Adriatic, the most extensive nutrients come mostly from the extensive freshwater inflow of nutrient rich waters from Po River (de Wit, 2002) which accounts for 75% of the total nitrogen and phosphorus load to the Adriatic Sea (Degobbis and Gilmartin 1990). The highest nitrogen concentrations are detected at the surface in the North Western part of the basin, with the lowest values during summer. Highest concentrations are confined within the western coast also in the sub-surface layer, however with lower concentrations. Close to the bottom, higher values are detected in spring in the central part of the basin, mainly due to organic

matter mineralization processes near the seabed. In the bottom layer southward of the Po River outflow, the combined effect of oxidation of the large loads of organic matter delivered by the river, the large primary production and of the strong and prolonged haline stratification of the water column which limits ventilation of the bottom layer (Artegiani et al., 1997b; Russo et al., 2012) determine an area of low dissolved oxygen concentration which in summer occupies a wide part of the northern shelf almost reaching the eastern coast (Lipizer et al., 2014). In this area, during the 1970s and 1980s hypoxic episodes were frequent in the western North Adriatic and close to the Po River mouth and few anoxia events were reported also at the sub-basin scale in 1977 (Degobbis et al., 1979) and 1989 (Ott, 1992; Degobbis et al., 2000; Giani et al., 1992). However in the last two decades, only few cases of dissolved oxygen saturation lower than 20 % have been observed and only in the area directly affected by Po River inputs (Socal et al., 2008; Solidoro et al., 2009).

Recent results suggest that the north Adriatic is experiencing an overall oligotrophication in terms of phosphate, ammonia and chlorophyll-a concentrations (Mozetic et al., 2010; Giani et al., 2012) mainly ascribable to phosphate banning in the detergents and to reduction in river discharge. According to the MSFD Initial Assessment, based on nitrate and chlorophyll-a concentrations, the north western Adriatic, in particular the area of the Po river delta and the Emilia Romagna Region coastal waters are likely the most critical areas concerning eutrophication, as directly influenced by the riverine discharge of land-derived nutrients (Degobbis and Gilmartin, 1990; Zavatarelli et al., 2000) (Figure 5-41)

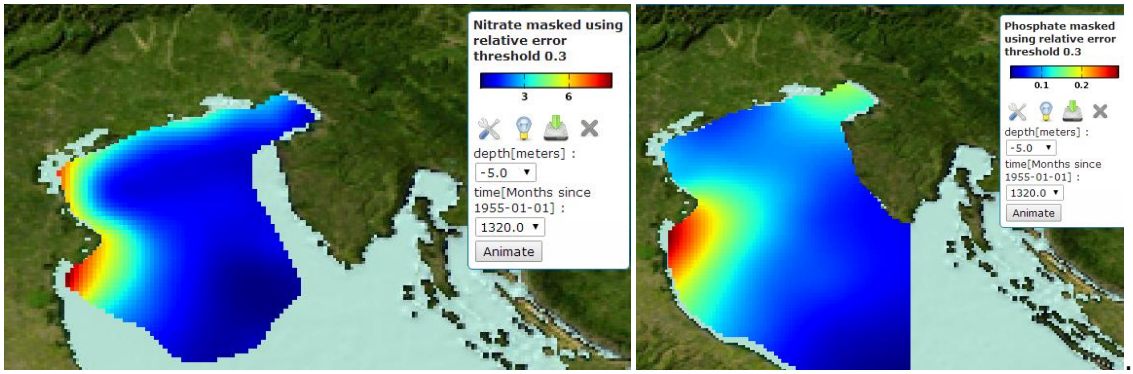


Figure 5-41: Climatological map or surface nitrate (right) and phosphate (left) concentration during spring in FA1 (Seadatanet climatology).

Considering the TRIX index, along the coastal areas average TRX values exceed 4.5 which indicate an area of high eutrophication risk (Figure 5-42). This is particularly true along the Emilia Romagna Region coasts (TRIX > 5), while the Gulf of Trieste profoundly differs from the rest of the western coasts, with values typical of oligotrohic environments (TRIX < 4) (ISPRA, MSFD Initial Assessment).

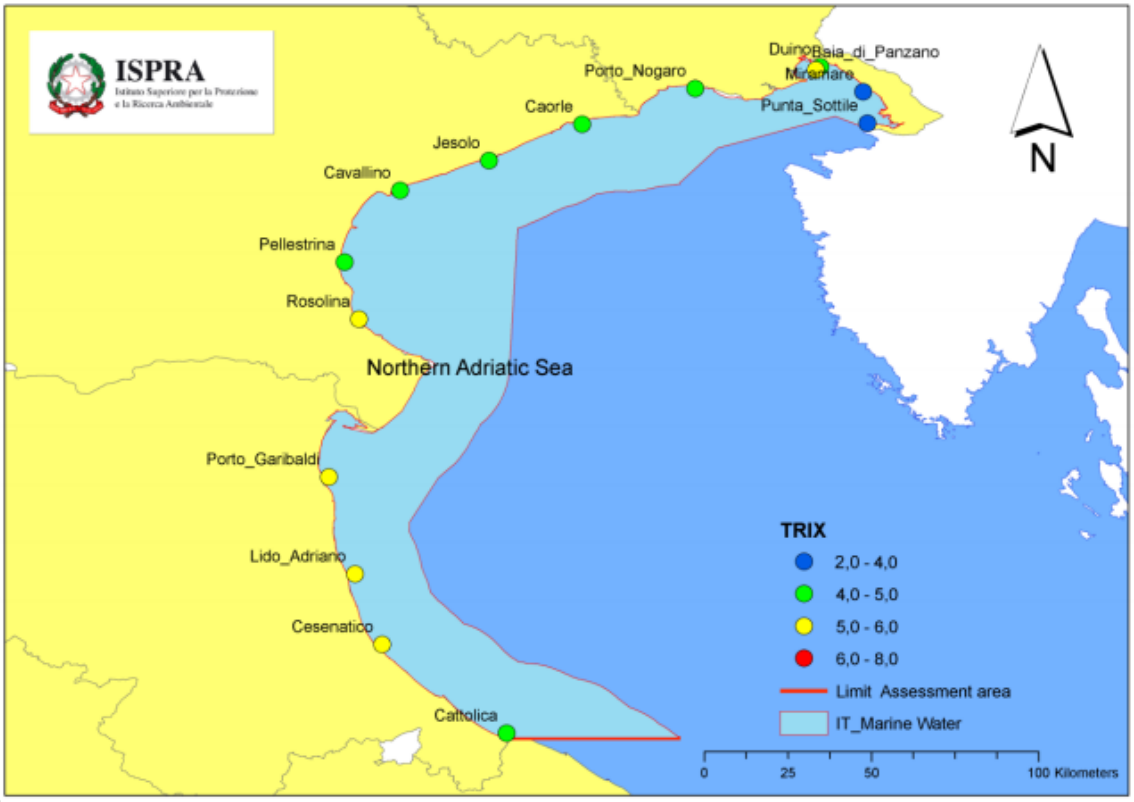


Figure 5-42 TRIX average for the period 2001-2009 (Banca dati Si.di.Mar. MATTM).

In the Slovenian sea, the impacts of eutrophication differ between the littoral zone and the high seas; therefore, the environmental status is determined separately. In the open waters, the status is determined on the basis of the concentration of chlorophyll a, frequency of phytoplankton blooms in the water column and oxygen content in the layer at the bottom. In the littoral zone, eutrophication effects are observed to the depth of marine vegetation, i.e. about 8-10 metres. On the soft bottom, the effects are determined by the state of marine meadows, while on the rocky bottom, the status is determined by the species composition of microalgal communities. An additional indicator of the sea status is the concentration of nutrients in the water. At present, the status of the Slovenian sea is rated as good by all indicators; however, here and there macroalgae and phanerogams point to an excessive load of nutrients in the littoral zone.

Eutrophication in the Northern Adriatic Sea has caused hypoxic and anoxic conditions, during the 1970-1980s, leading to large benthic mortalities. Therefore, dissolved oxygen concentrations in the bottom layer in over 20 metres deep areas are used as indicators of risk of hypoxia (Figure 5-43).

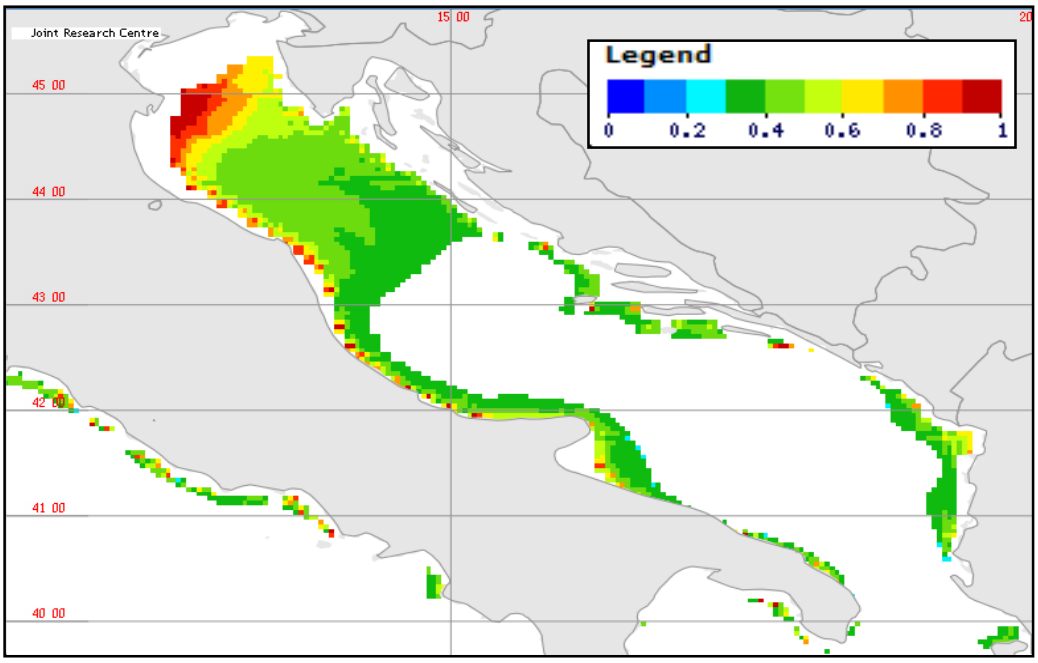


Figure 5-43 Map of Oxygen Depletion Risk Index (Climatology) - September (EMIS, JRC)

5.5.4 Specific features of Focus Area 2

The coastal waters of the southern Adriatic-Ionian area are generally characterised as oligotrophic. However, in estuarine areas there is localised enrichment by nutrients and organic matter as rivers carry agricultural runoff. As a result primary production increases possibly leading to algal blooms. In the open sea there is no evidence of eutrophication.

The river called Buna in Albania and Bojana in Montenegro partially forms the border between the two countries and provide the primary freshwater inflow to the southeastern Adriatic region. In the southeastern Adriatic, in addition to the flow from the Buna/Bojana river, several additional rivers contribute to the Buna/Bojana watershed making the southeastern Adriatic counterpart to the Po river in the northwestern Adriatic. The Buna/Bojana ROFI area contains higher nutrient concentrations and higher Si/DIN ratios compared with the Po river plume, yet near surface chlorophyll concentrations appear to be similar. The combination of natural and anthropogenic nutrients in the river discharges from the southeastern Adriatic, although different in magnitude of flow and concentration of inorganic nutrients from the northwestern Adriatic, have similar effects on the coastal phytoplankton communities and the ensuing nutrient recycling that occurs along the coast (Marini, et al., 2010).

The sediment analyses provided contrasting informations if compared with those of the water column suggesting the presence of areas characterized by eutrophication processes deserving careful monitoring. The Adriatic and the Ionian coasts show different trophic conditions: the total quantity of organic matter and of organic carbon is higher in the Ionian sector than in the Adriatic sector, while the quantity of the labile carbon is higher on the Adriatic coast. So the two areas are potentially exposed to different eutrophican typologies.

Along 250 km of the Apulian coasts, a large-scale study, including 99 stations, belonging to 33 transects, was carried out in 2000. The investigated area covered a wide range of anthropogenic impacts (industrial ports, tourist harbours, areas affected by power plants and industrial wastes, mariculture areas). Other sites, including marine protected areas (i.e., without any apparent impact), were used as "controls". Water column and benthic variables provided different indications and classifications of the trophic state of this coastal marine systems. Phytopigment content of the sediments changed in response to all different sources

of anthropogenic impact and resulted in a useful descriptor of the trophic state and environmental quality. Highest sediment chlorophyll-a concentrations, indicating conditions of increasing eutrophication, were found in areas impacted by the discharge of heated waters from a power plant, in Brindisi. Differences in trophic conditions were evident both in terms of quantity (i.e., total organic matter content) and quality (i.e., biochemical composition) of sediment organic matter. In particular, sediment protein concentration appeared to be a good descriptor of the trophic state of the benthic systems at different spatial scales. Multivariate (MDS) analysis allowed identifying areas characterised by hypertrophic, eutrophic and meso-oligotrophic conditions and to define relative threshold levels (Figure 5-44).

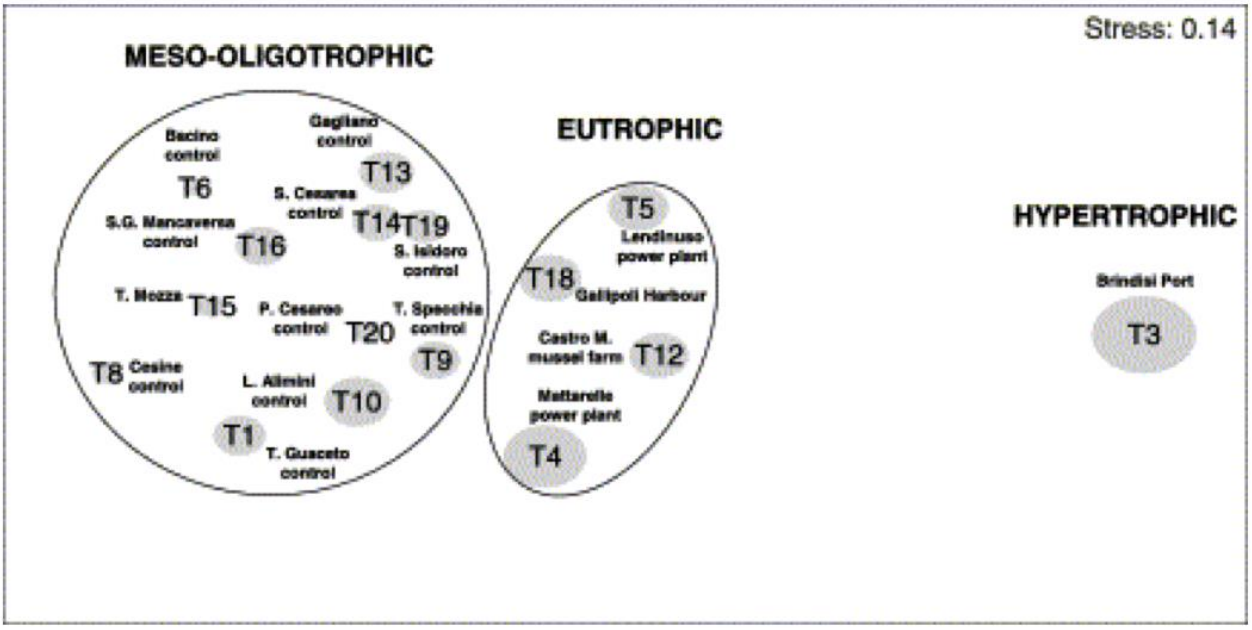


Figure 5-44 MDS showing the different trophic state od sampling stations in Apulia

Phytopigment concentrations (chlorophyll-a and phaeopigments), labile organic matter (proteins, carbohydrates and lipids), bacterial density and frequency of dividing cells were analysed in the sediments of a large coastal area covering the southern Adriatic continental shelf between Italy and Albania in order to describe the trophic status of coastal marine sediments. On average, sediments of the Italian coast displayed the highest phytopigment and biopolymeric carbon concentrations compared to sediments of the Albanian coast and indicated an increased nutritional status of this coastal ecosystem. Different trophic conditions were evidenced in terms of biopolymeric composition of sedimentary organic matter as an increase in protein and a decrease in the carbohydrate contributions to total biopolymeric carbon was observed moving from the Albanian to the Italian coast. Using a benthic approach for the evaluation of trophic status shallow Italian sediments (0–50 m) were mainly classified as eutrophic and were subjected to stronger anthropogenic disturbance. This was particularly evident in areas in front of city harbours (Brindisi and Barletta) that were classified as hypertrophic and displayed the highest biopolymeric carbon (BPC) concentrations and protein to carbohydrate ratio (PRT:CHO on average >1). In contrast Albanian sediments as well as deeper Italian stations (>50 m), resulted mainly in meso-oligotrophic and displayed lower BPC and PRT:CHO ratio (on average <1). The study of bacterial variables provided an improved approach for the conceptual definition of trophic state using benthic biochemical measures. An inverse relationship occurred between the nutritional contents and the bacterial density within meso-oligotrophic sediments. This may reflect an increase in ecosystem organization and complexity (i.e. increased abundance of the higher trophic levels) which may determine a reduction of the bacterial density at increasing trophic conditions. In contrast a positive

correlation was found within eutrophic and hypertrophic sediments suggesting that at high organic matter concentrations the ecosystem is no longer capable of further organization.

Based on the 2012 results of the national monitoring of the Ecological Quality Status (EQS, according to the Water Framework Directive), most of the water bodies included in the Greek part of Focus Area 2 present "high" and "good" EQS with the exception of the Kalamas River Delta and Amvrakikos Gulf water bodies presenting "moderate" and "poor" EQS respectively.

The EQS evaluation was based on the Biological Quality Elements (BQEs, according to the Water Framework Directive). The biotic index BENTHIX was used for the macro-invertebrates, the EEI for the macro-algae and chlorophyll concentration for the phytoplankton. The evaluation of the chemical status was based on nutrient concentrations at the surface layer and heavy metal concentration in the sediments and the water column. Surface waters have high quality status indicating that there is low/negligible human pressure except from two cases: waters adjacent to the east coasts of Corfu that have a good status and norther of Igoumenitsa where human pressure is higher resulting in a moderate status of surface waters (Figure 5-45).

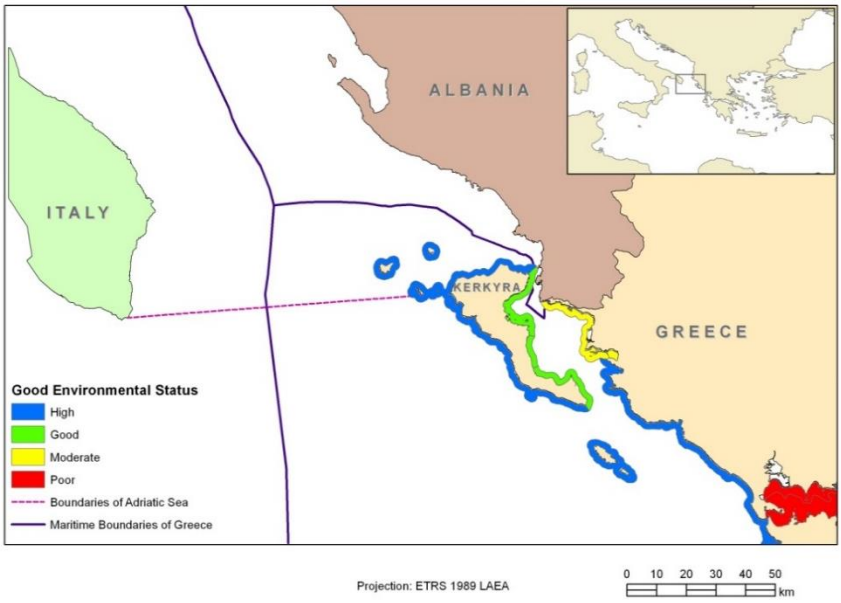


Figure 5-45 Water Quality classification according to WFD Directive

5.6 D6 Sea-floor integrity

A. Correggiari, P.K. Karachle, V. Vassilopoulou, S. Mezek

According to the Marine Strategy Framework Directive ("MSFD Task Group 6 Report Seafloor integrity" Rice et al 2010) GES according to descriptor 6 is achieved when:

- Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected. *Sea Floor* is interpreted as including both the physical and chemical parameters of seabed - bathymetry, roughness (rugosity), substrate type, oxygen supply etc; and biotic composition of the benthic community. *Integrity* is interpreted as both covering spatial connectedness, so that the habitats are not unnaturally fragmented, and having the natural ecosystem processes functioning in characteristic ways.

In the ocean, the sea-floor is a key compartment for marine life, since it is a high biomass productivity area, especially in shallow waters. A great diversity of sea-floor types can be encountered depending on the substrate, the depth and the local environmental conditions.

They form different kinds of habitats for fixed or mobile marine species that live on, inside and above the sea bottom. Human activities may impact the structure (for instance the species composition of the benthic ecosystem) by damaging large or fragile species or modifying their functioning and favoring opportunistic or scavenging species that may profit from disturbance of the bottom and availability of dead organisms. A particular attention has to be paid to some remarkable habitats that, in spite of their reduced spatial extent, play an important role in marine ecosystems dynamics and biodiversity (e.g. biogenic reefs, cold corals, maerl beds).

Maintaining sea-floor integrity is therefore necessary to preserve marine biodiversity and living resources. Due to the large variety of seafloor types, it is necessary to define indicators and standardized methods that can give a good image of the status of benthic ecosystems (i.e. living on the sea floor) and of their alteration by pressures from human activities.

One of the most important attribute to evaluate the sea floor integrity is the "seabed substrate" that comprises a large variety of substrate types. And in the definition of sea bed substrate the geological setting and the recent evolution of the basin in an important knowledge.

5.6.1 Main threats

The range of threats to sea-floor integrity varies in nature and severity across the different regions of AIR. The degree of impact varies from sub-lethal effects on individuals or populations (e.g. from hazardous substances), to lethal effects on individuals or populations (e.g. from fishing), community-level effects (e.g. from nutrient enrichment, introduction of non-indigenous species) and habitat-level effects (e.g. damage from physical disturbances to the seabed; loss from land claim and placement of structures on the seabed). Due to this range of threats, Descriptor 6 has links to all the pressure-related descriptors (D2, 5, 7, 8, 9 and 10)

The main causes of physical loss for the entire AIM: construction and maintenance of ports and other coastal developments, land claim, tourism, beach regeneration, oil and gas installations, cables and pipelines, aquaculture and artificial reefs.

The main causes of physical damage summarize for AIM: bottom-trawling fisheries, aggregate extraction, waste dumping, coastal defence, ports and navigational dredging, construction works, mussel dredging, hydraulic activities and shipping. Bottom trawling is often cited as causing the most extensive damage. Fishing is the principal human activity affecting marine substrata in the entire AIM with other activities primarily acting on local scales.

5.6.2 Main features at AIM scale

A synthetic geological mapping provides the basis for any applied environmental or natural resources study by making basis information available to wide range of end users. We must improve knowledge about the marine environment in order to understand the impact of human activities on the sea and to ensure that various human projects are implemented in a sustainable way. Most European countries have extensive geological mapping projects for their offshore Exclusive Economic Zone EEZ.

The Geological mapping project of the Italian Seas (PI F. Trincardi), done within a collaboration between ISPRA (Servizio Geologico d'Italia) and CNR ISMAR Bologna, has produced 6 sheets in the entire italian portion of the Adriatic basin with the surficial and the subsurface geology maps (Figure 5-46 and 5-47).

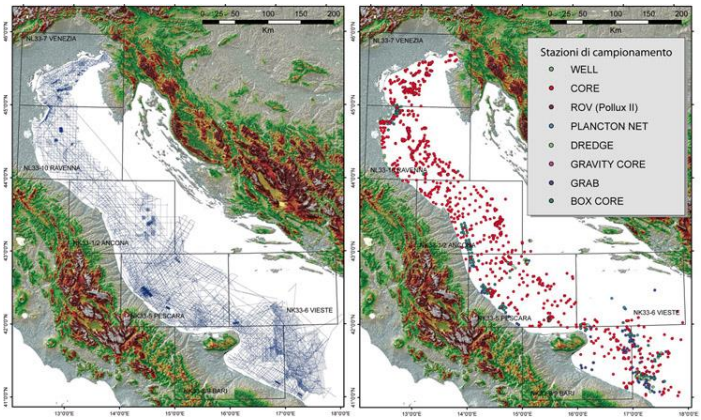


Figure 5-46 Distribution of geophysical sediment cores data acquired by CNR ISMAR and used for the preparation of the geological mapping project (Geological Map of the Italian seas in scale 1:250000 - Trincardi et al. 2011)

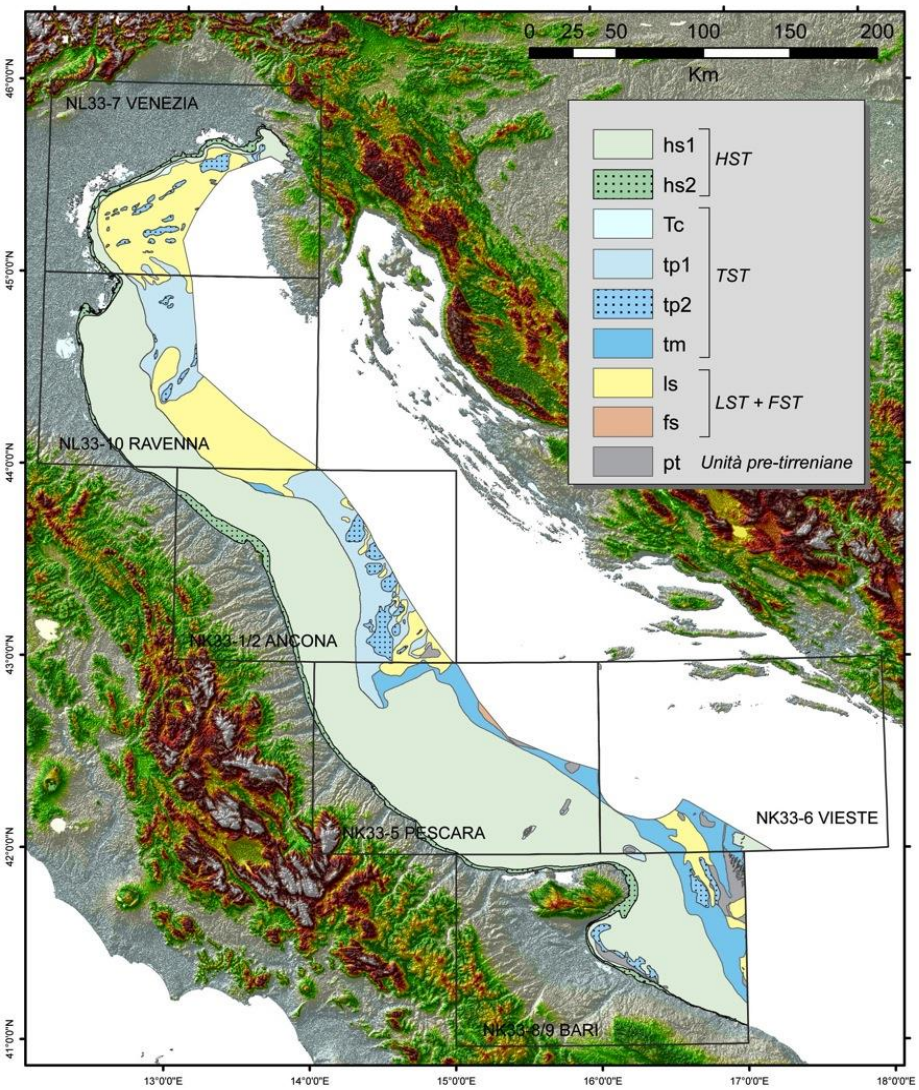


Figure 5-47 The project CARG and in accordance with Law 183/89, CNR- ISMAR - Bologna and the Geological Survey of Italy - ISPRA, have produced the first 6 sheets of the Geological Map of the Italian seas in scale 1: 250,000. The map provides a synthetic representation of the distribution of surface geology in the platform of the

Italian Adriatic basin and describes the late-Quaternary deposits divided according to the main phases of the last glacio - eustatic cycle, in: a) highstand systems - HST (last approx. 5500 years approx.) hs1 , complex, sandy beach and submerged hs2 complex pelitic of prodelta; b) transgressive systems - TST (range 18000-5000 years) consisting of two transgressive paralic complex tp (tp1 mudstones and sandy mudstones environment of transition, tp2 well unsorted sands of submerged beach) and transgressive marine, tm; c) ls, lowstand system track LST- fs sealevel fall (range 25000-18000 years), FST (125000-25000 years interval) d) pt pre-thyrrenian units (Geological Map of the Italian seas scale 1:250000 - Trincardi et al. 2011).

The modern Adriatic sea is a narrow epicontinental basin (ca 200x800 km; (Figure 5-48). The northern Adriatic has a low longitudinal topographic gradient (ca 0.02°), whereas the maximum shelf gradient along the central Adriatic is on the order of 0.5°. The central western Adriatic is characterised by a narrower shelf and localised bathymetric irregularities that are the expression of structural highs onshore Punta Penna, the Tremiti Islands and the Gargano promontory, and reaches a maximum depth of 260 m in two remnant slope basins aligned in a SW-NE direction. The southern Adriatic, beyond the Pelagosa sill, reaches a depth of ca 1200 m and is fanked by a steep slope and narrow shelf except in the area just south of the Gargano promontory, where the shelf broadens to about 70-80 km The Adriatic sea is conected to the Ionian Sea and Eastern Mediterranean through the Strait of Otranto. This strait has a minimum with of 75 km and sill depth of 800 m. This strait has a very important effect on the dinamics of water exchange between adriatic and Ionian Sea and consequentely on the circulation and the heat balance of the Adriatic sea. (Figure 5-48).

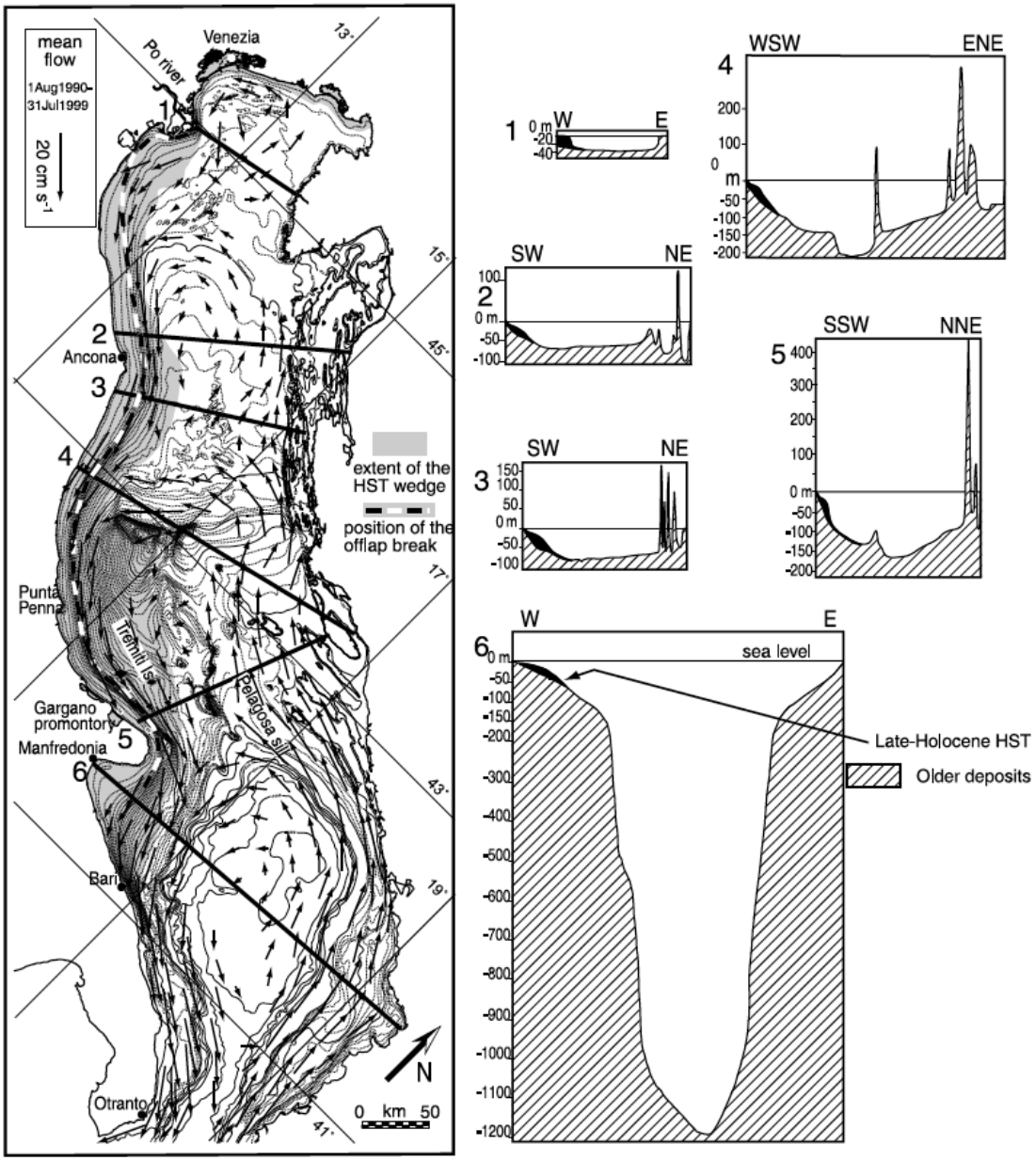


Figure 5-48 Bathymetry of the Adriatic sea (5-m contour on the western side of the basin) with arrows indicating surface circulation (averaged during the years 1990-1999; Poulain, 2001) ; extent of the late-Holocene Highstand Systems Tract wedge (HST; grey pattern see Figure 5-47); and morphological sections (1-6) indicating the extreme diversification of the Adriatic basin area between the north and south and even between the Western and Eastern domain. (from Cattaneo et al. 2003 mod).

Adriatic sea occupies the foreland of the Apennine and Dinaric thrust belts, originated by the collision of the African and the European plates, with a continental crust ca 35 km thick. Adria is a N-S-elongated continental domain which is fringed on it's eastern, northern and western flanks by Alpine s.l. fold-and-thrust belts, but opens southward into the oceanic Ionian Sea which is of early Mesozoic age. Basinal and shallow water carbonate sediments characterize the Mesozoic successions of Adria, that represents the only undeformed remnant of the southern Tethyan margin. (Argnani, 2006). The relatively undeformed areas of the foreland correspond to the Istria and Apulia carbonatic domains. The western side of the northern and central Adriatic is a foredeep basin, Plio-Quaternary in age, that represents the most recent of a series of foredeep basins formed during the Apennine orogenesis and migrated eastwards.

The Plio-Quaternary Adriatic foredeep has an arcuate shape with two distinct depocentres separated by a structural high in the area of Ancona (Ori et al., 1986; Argnani and Gamberi, 1997).

During the late Quaternary, the Adriatic basin was flled mainly from the northwest in an axial direction, as testified by seismic refection studies (Ori et al.,1986; Ciabatti et al., 1987). During the late Pleistocene-Holocene relative sea level rise (between ca 17 and 5.5 kyr BP; Fairbanks, 1989), a wide portion of the northern and central Adriatic alluvial plain of the glacial time was progressively drowned, with an eight-fold widening of the shelf area of the Adriatic (Trincardi et al.,1994; Correggiari et al., 1996a,b; Cattaneo et al. 2003; Cattaneo et al 2004).

One of the most importan feature in the Adriatic basin is the late Holocene prodelta. Prodeltas are large shallow-marine features, located seaward of river mouths, that are characterized by significant mud accumulation at water depths below the level that storm waves can destroy. Prodelta deposits up to tens of meters thick are extensive, shore-parallel, and mud-dominated. These deposits formed approximately 5 kyr under the influence of fluvial supply and marine processes and constitute shallow areas of rapid sediment accumulation and intense exploitation (e.g., trawling, mussel cultivation, cables, pipelines, platforms).

Several project have been carried out in the Adriatic (Eurodelta, Eurostrataform) to understand the oceanic processes that erode, transport and deposit sediment in the margin system, including short-term (i.e., hours to weeks) processes that produce event beds and the longer-term variability (e.g., seasonal, interannual) of those processes.

Comparison of seismic stratigraphic records (ca. last 5500 yrs) and sediment-accumulation rates over the last century (based onshort-lived radionuclide data) shows that the largest absolute accumulation rates are encountered offshore the Po delta and just updrift of the Gargano promontory,while the offshore component of dispersal is greater in areas of flow divergence located downdrift of the coastalbulge of the Gargano promontory (Figure 5-49) (Cattaneo et al., 2003, 2004; Eurodelta final Report Trincardi et al. 2003).

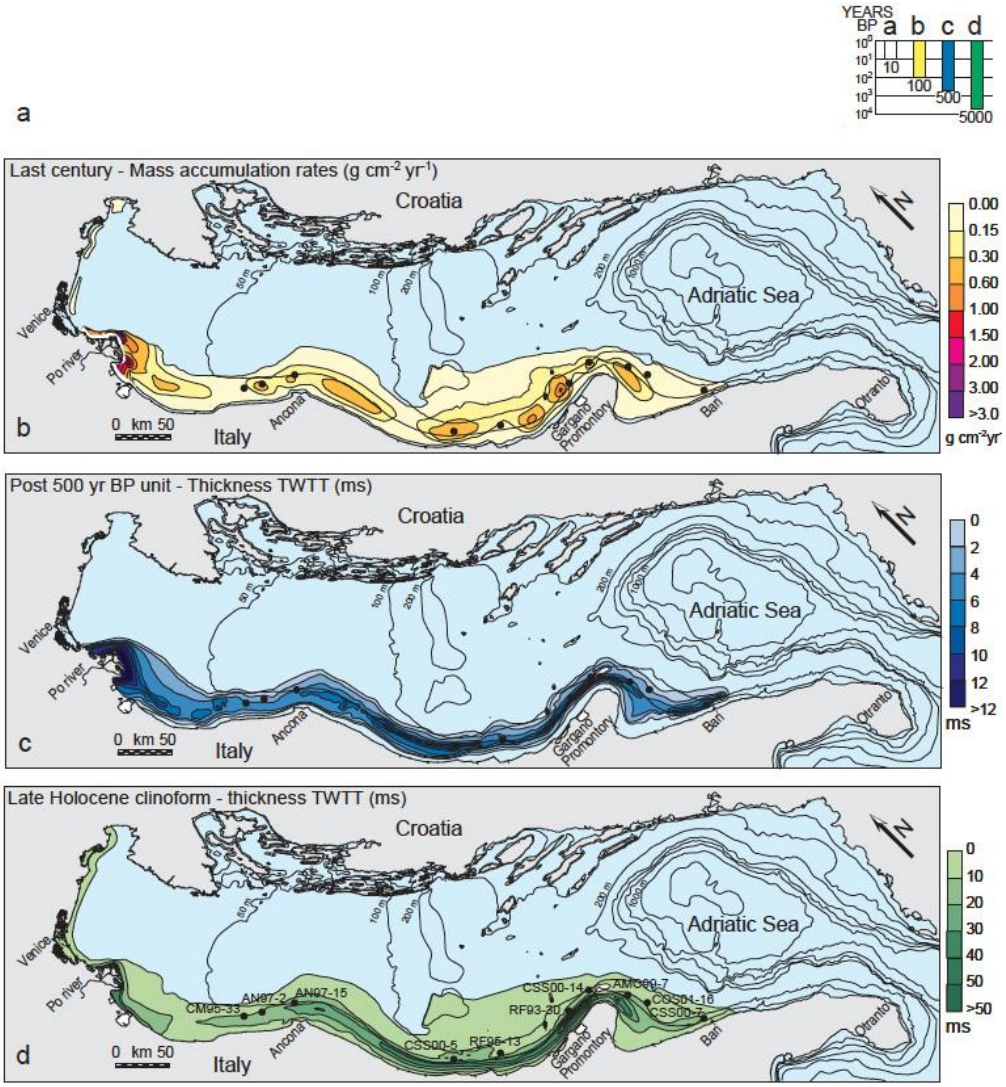


Figure 5-49 Maps of the Adriatic Sea show information on the shelf clinoform at complementary time scales ranging from ca. 10 to 5500 years before present. Contour map of ^{210}Pb-based mass-accumulation rates (last century) showing maximum accumulations off shore of the Po delta and along a narrow belt parallel to the coast (redrawn from Frignani et al.,2005). (c) Thickness map from seismic reflection profiles of the upper sedimentary unit of the shelf clinoform depositedin the last 500 yr and encompassing the Little Ice Age (dated ca. 500 to 100 years before present). (TWTT = two way traveltime; with a rough estimate of 1500 m s-1 for sound speed in water and superficial sediment, 10 milliseconds correspondto 7.5 m.) (d) Thickness map from seismic-reflection profiles of the whole shelf clinoform deposited during the last 5500 years with location of key sediment cores (black dots). As a whole, the shelf clinoformhas three distinct areas of maximum sediment accumulation: off shorethe Po delta, along the central Adriatic margin, and eastwards of the Gargano promontory. All scales of observation show consistently that sediment is efficiently redistributed in a shore-parallel direction following the counter-clockwise circulation of the Adriatic. (Cattaneo et al. 2004 mod).

The knoledge of prodelta evolution and clinoform formation has important practical implications such as facilitating better predictions of where and how much river-borne pollutants tend to accumulate near-shore. Environmental studies in the near-shore areas are intensive and time consuming. A better understanding of catchment dynamics, oceanographic

processes and prodelta architecture is necessary to define factors controlling the natural behaviour of coastal-zone systems and project on their future evolution the impact of human activities.

The lack of data for the synthetic surface geology of southern and eastern part of the AIR influences the representation of the more recent deposits for the entire area of interest.

5.6.3 Specific features of Focus Area 1:

The North Adriatic Sea, included under the Barcelona Convention for the Protection of Mediterranean Sea and in the Habitat Directive, is populated by benthic, demersal and pelagic species of ecological and commercial interest. Furthermore, the north Adriatic Sea holds several coastal and shallow water habitats (e.g. sand sea floor, recent mud prodelta, lagoons, coralligenous concretions) considered of natural and international interest.

The north Adriatic epicontinental shelf, that with the central part of the basin represent the widest continental shelf in the Mediterranean, is sediment-starved and subject to episodic high energy oceanographic regime.

The northern Adriatic is shallow (<40 m) and the shelf has a very gentle slope (about 0.02°).

The modern sediment dispersal determines two distinct morphological domains: south of the Po delta and close to the western coast where the shelf foor is smooth and dip gently seaward; futher offshore a rugged surface shows a variety of sediment mounds and redges that are a few metres in relief and several kilometres in extent. This irregular sea floor extent close to the modern surface north of the Po delta and shows evidence of smaller scale bedforms of varied orientation and geometry originated during the last portion of the late quaternary sealevel rise as a reworking of drowned coastal lithosome (Trincardi et al. 1994; Correggiari et al 1996, Carta Geologica dei Mari Italiani Foglio NL33-7 Venezia, 2011).

The bathymetry, surficial geology with the offshore sand deposit areas are shown in Figure 5-50 (a,b). The grain sizes mapped (Figure 5-50, c) using geostatistical analysis of available data by Goff et al. (2006) highlights values distribution with fine sediment near the Po Delta (recent sedimentation), and extending toward offhore the northeast (reclict transgressive fine grain deposits) and in the prodelta mud belt confined close to western and northern coast by a cyclonic thermoaline circulation (Malanotte Rizzoli and Bergamasco 1983, Harris et al 2008).

Several peculiar submarine rock outcrops located in patchy features in all the northern shallow Adriatic sea have been detected since the first marine reserches in the basin (Stefanon, 1979). With recent sudies the genesis of these deposits has been ascribed to of methane-related carbonate cementation of marine sediment and macroalgal coralligenous assemblages (Gordini et al. 2012, 2010, see section 5.1, Figure 5-4).

These rock outcrops are characterized by a rich community of associated flora and fauna and thus represent a unique hotspot of biodiversity in the seabed of the northern Adriatic and they play an important role for the marine ecosystem (Gordini et al. 2012).

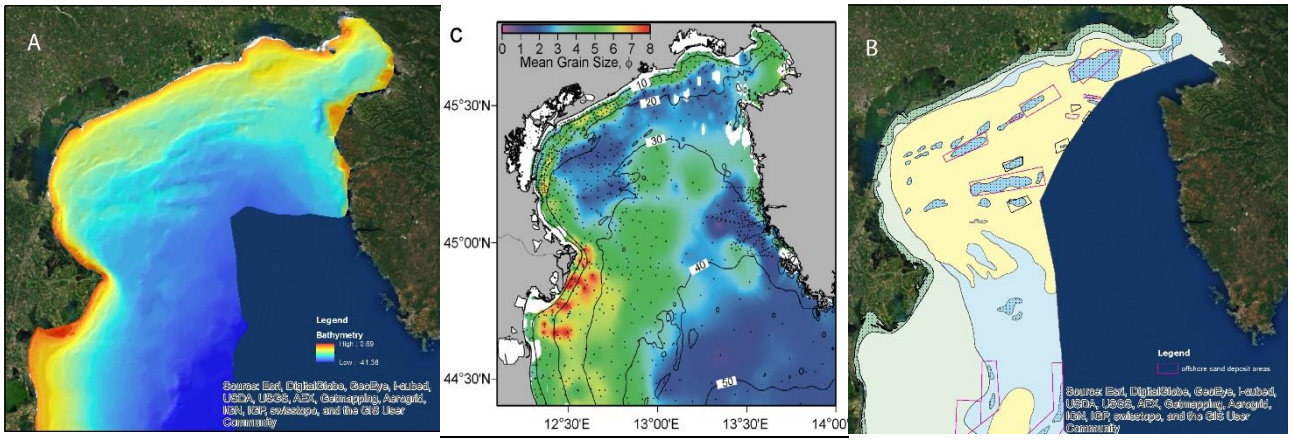


Figure 5-50 a) Bathymetry of a portion of northern Adriatic sea (single beam data Trincardi et al. 2014). b) Surficial geology and location of offshore sand areas (Carta Geologica dei Mari Italiani Foglio NL33-7 Venezia, 2011, Foglio NK33-10 Ravenna 2001). c) Surficial sediment grain size distribution (modified from Goff et al 2006 and Harris et al. 2008).

Concerning Slovenian waters, on the basis of the indicators assessing benthic community condition, such as species diversity and richness, and proportion of opportunistic to sensitive species, the status has been rated as good, but the assessment only applies to the littoral zone (infralittoral sedimentary area). A large part of methodologies for the assessment by this indicator is still under development (for mediolittoral and circumlittoral zones), so a full and proper assessment can be made only when applied.

5.6.4 Specific features of Focus Area 2:

Some recent papers documented the morfological settings in terms of the relevant role of seafloor geomorphology in influencing habitat vulnerability in the sourthern part of the AIM.

The Apulian ridge extends from Apulia to offshore Greece and separates the southern Adriatic Basin, at the southern edge of the Otranto Channel, from the deeper Ionian Sea; and is a part of the present foreland system of both the Apennine Arc to the west and the Hellenic Arc to the east controlling the large-scale morphology of the margin. Overall, sedimentation is basically characterized by mass-wasting deposits, likely associated with the local high seismicity of the margin (Favali et al.1993, Savini & Corselli 2010; Argnani et al. 2001).

Along isobaths of 600–1,000 m in depth living and sub-modern Madrepora-dominated coral communities have recently been identified within the study area and are referred to as the "Santa Maria di Leuca (SML) CWC (Cold water Coral) province" influenced by a core of cold (= 12.92°C), less saline (38.64%), and oxygenated water of Adriatic origin flows from the Otranto Channel.

Complex deep-water sessile megabenthic communities, best known by Cold Water Coral (CWC)-dominated systems such as for example *Lophelia*-reefs, are recorded to date at many sites in the Mediterranean Sea (Taviani *et al*., 2005, 2011a, b; Freiwald *et al.*, 2009; Gori *et al*., 2013, Fabri *et al*., 2013, with references therein). However, vast areas of this basin are still virtually unexplored in this respect. It further suggests an almost uninterrupted, patchy, belt of CWC sites all along the south-western Adriatic margin from Bari to Otranto, in practice connecting the Adriatic populations to the well known Ionian Santa Maria di Leuca coral province (Taviani *et al*., 2011). These new occurrences are, therefore, significant in the general frame of understanding the connectivity among discontinuous deep-water coral grounds in this sector of the Mediterranean basin (Angeletti et al. 2014) (Figure 5-51).

In the context of the growing societal interest for deep-sea marine resources, the valuable

megabenthic communities described in this study, some of which have been qualified as vulnerable marine ecosystem (Fabri *et al*., 2013), certainly merit attention and sound management. (Angeletti et al. 2014).

The examples for the focus area 2 presented here (Savini et al 2014 and Angeletti et al. 2014) provides a realistic estimate of CWC coverage information at scales relevant for MSP to address the management requirement, an urgent need exists for the development of robust methods for mapping marine ecosystems in order to establish their geographical location, extent, and condition.

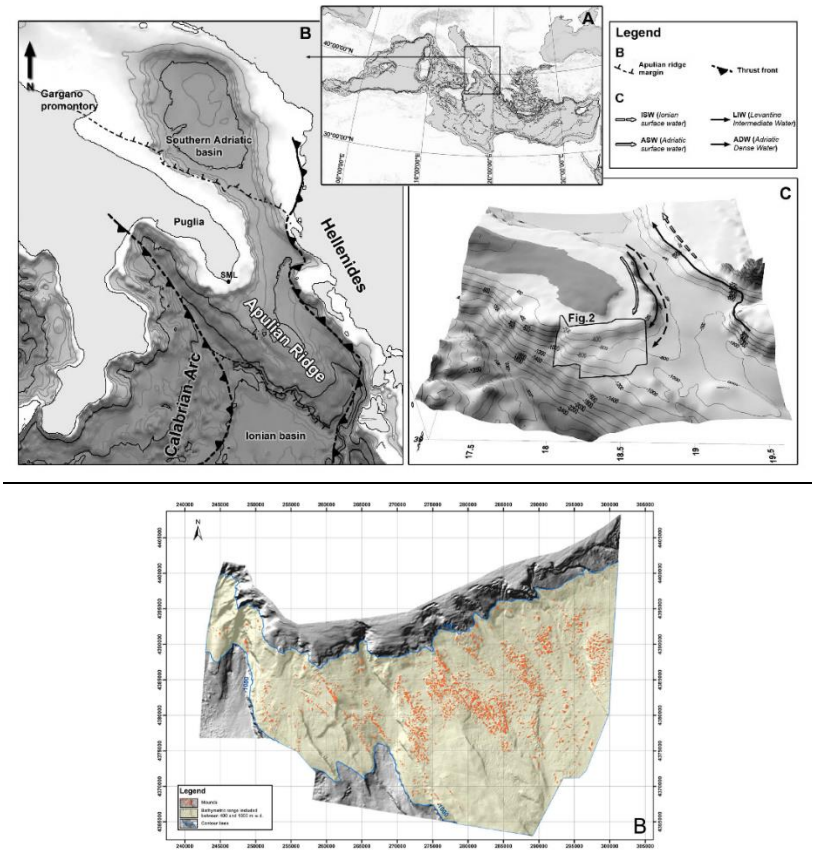


Figure 5-51 The geographic, geomorphological, and oceanographic framework of Focus Area 2 (modified from Savini & Corselli 2010 savini et al. 2014). A: The geographic framework of the study area within the Mediterranean Sea. B: The geological setting showing the Apulian Ridge as the foreland system of both the Appennines and Hellenic fold-and-thrust belts. B: The oceanographic setting showing ASW (Adriatic Surface Water), LIW (Levantine Intermediate Water), and ADW (Adriatic Dense Water) within the area. Below the mutibeam referred in Figure c and the coral moud extention. (see Savini et al 2014 doi:10.1371/journal.pone.0087108.g001).

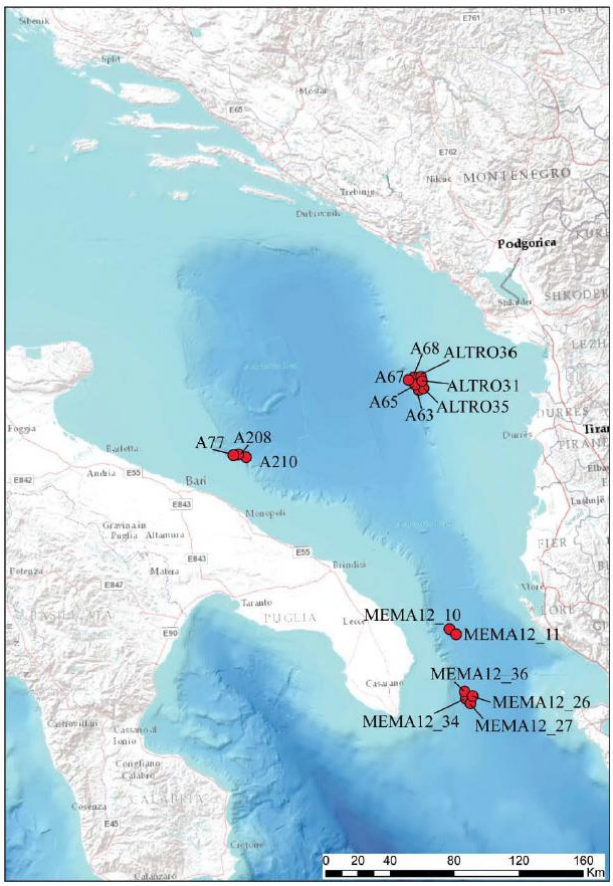


Figure 5-52: Location of exploration and bottom sampling in the southern Adriatic Sea (Apulian and Montenegrin margins) resulted in the discovery of cnidarian-rich deep-sea habitats in the depth range of ca. 400-700 m. (Angeletti et al. 2014) (Bathymetry from EMODnet (European Marine Observation and Data Network) Hydrography portal (resolution 500 m) (http://www.emodnet-hydrography.eu).

5.7 D7 Hydrographical conditions

R. Mosetti, C. Ferrarin, P.K. Karachle, S. Mezek

Salinity regimes, changes in the tidal regime, sediment and freshwater transport, current or wave action and changes in turbidity, all can cause an alteration in the hydrographical conditions. All these changes may lead to modifications of the physical and chemical characteristics of the marine waters and consequent affects on marine ecosystems. These types of changes are normally triggered by building activities, such as extension of the coast, building of artificial islands or other infrastructural works in the marine environment (such as outfalls from power stations, bridges to islands, offshore installations). The reference to the example outfalls from power stations suggests that the Directive addresses pressures from industrial and other activities on land which may affect the marine environment, in this case hydrological processes in marine waters. This is coherent with the treatment of chemicals, nutrient enrichment or marine litter. Typically, any permanent installation on the seabed or alteration of the shoreline (e.g. flow control modifications, ports, marinas) will lead to some changes in water flows. The degree of change and the period over which such change occurs varies considerably, depending on the type of modification. Assessment of the degree of change can be related to both the water column and the sea-floor, and consequently to their biological communities including migratory species. To determine GES, one needs to take account of the scale of the changes (spatial, temporal) and the severity of change in relation to the ecosystem component and the cumulative effects from all permanent alterations together

with impacts from other pressures. In order to achieve GES, permanent alteration of hydrographical conditions should not adversely affect marine ecosystems. Alterations are determined according to two criteria, i.e. in terms of spatial characterization of the area where significant, regional scale changes in currents, waves, bottom shear stress, salinity and temperature occur or are expected, and in terms of impact of permanent hydrographical changes, which is assessed through changes in habitats and, in particular, in the functions provided (e.g. spawning, breeding and feeding areas, migration routes of fish, birds, mammals). This descriptor is meant to address large-scale and permanent alterations in hydrographical conditions. The interpretation and the scope of this descriptor is, however, still heterogeneous among the countries. In some countries, alterations in hydrographical conditions are mainly assessed in terms of coastal engineering, coastal erosion and aggradation, coastline artificialization and civil works (Micheli et al., 2013; Perseus, 2013; OSPAR, 2012), while in other countries alterations are interpreted in terms of variations in hydrological (temperature, salinity, currents) conditions (ISPRA, 2012; Perseus, Deliverable 5.2, 2013). Alterations in hydrographical conditions are strongly linked with the Descriptors 1, 4 and 6 covering Biodiversity, Food Webs and Sea Floor Integrity. Hydrographic alterations may have, both, a very localized effect, close to the source of the pressure and should therefore considered at small spatial scale, as well as a large scale, due to alterations in water properties which have a much wider effect.

5.7.1 Main threats

Large-scale human activities such as coastal defence works, damming of large rivers, land reclamation projects, structures in coastal or open sea, such as wind farms, offshore airports, port infrastructures and operations, ocean energy device arrays, submarine cables and pipelines, dredging and large scale aquaculture facilities may permanently influence the hydrographical regime of currents, waves and sediments. Besides, several land-based activities (e.g. agricultural, domestic, industrial discharges) affect hydrological conditions through coastal, riverine and atmospheric inputs, which may also adversely impact environmental status in terms of other descriptors, namely D5 Eutrophication and D8 Contaminants. These alterations take place against a background of much broader scale hydrographical changes, both human induced and natural, such as climatic changes, ocean acidification, etc. The Adriatic – Ionian Macroregion is characterized by a large degree of coastline artificialization, mostly along the western coasts, which represents the main threat to GES achievement according to this descriptor.

5.7.2 Main features at AIM scale

The Adriatic – Ionian Macroregion is characterized by large differences in hydrological conditions due to differences in latitude, bathymetry, physiography and biogeochemical features. The Adriatic Sea is composed of three regional basins (North, Central and South). The northern Adriatic basin presents shallow depths and significant freshwater inputs by the main Italian rivers, mostly from the Po River, which strongly affect the physical and biogeochemical properties of the area, as well as those of the entire basin. The large freshwater contributions are mostly confined along the western coasts by a main frontal system (Figure 5-53), which divides the offshore waters, less influenced by continental inputs and generally characterised by a lower degree of winter stratification from the Western Adriatic Coastal Current which is observed all along the Italian coast, passing the Gargano Peninsula. In the northern Adriatic Sea the intense wind regime triggers modifications of hydrological properties by altering thermohaline stratification and vertical stability and by changing the physical features of the basin in general. In the northernmost part of the basin, dense waters (Northern Adriatic Dense Water, NADW) are generated locally during cold winters, when water temperature drops below 12 °C. These cold, saline and oxygen-rich waters sink and flow southward along the western Adriatic side close to the bottom until they reach the Ionian Sea through the Otranto Strait. This process is the most energetic deep water renewal mechanism, ventilating the bottom layers and limiting water residence time in the northern part of the Adriatic. The southern and central basins of the Adriatic Sea are influenced by the intrusion of

high salinity waters entering through the Otranto Strait (Modified Levantine Intermediate Water, MLIW) which partly re-circulates within the southern and central basins and partly flows northwards along the eastern Adriatic coast. The southern basin is a site of dense water formation (Adriatic Deep Water, AdDW) through deep convection hich influences the hydrological properties of the Ionian and the Eastern Mediterranean. The Ionian Sea is characterised by an oscillating mode of circulation which occurs approximately at a decadal scale and enhances advection of, respectively, Modified Atlantic Water (MAW) or Levantine/Eastern Mediterranean Water (LIW) thus altering physical, chemical and even biological properties in the waters entering the Adriatic. The Adriatic is characterized by the presence of several lagoons and coastal lakes which are particularly sensitive to alterations in hydrographic properties.

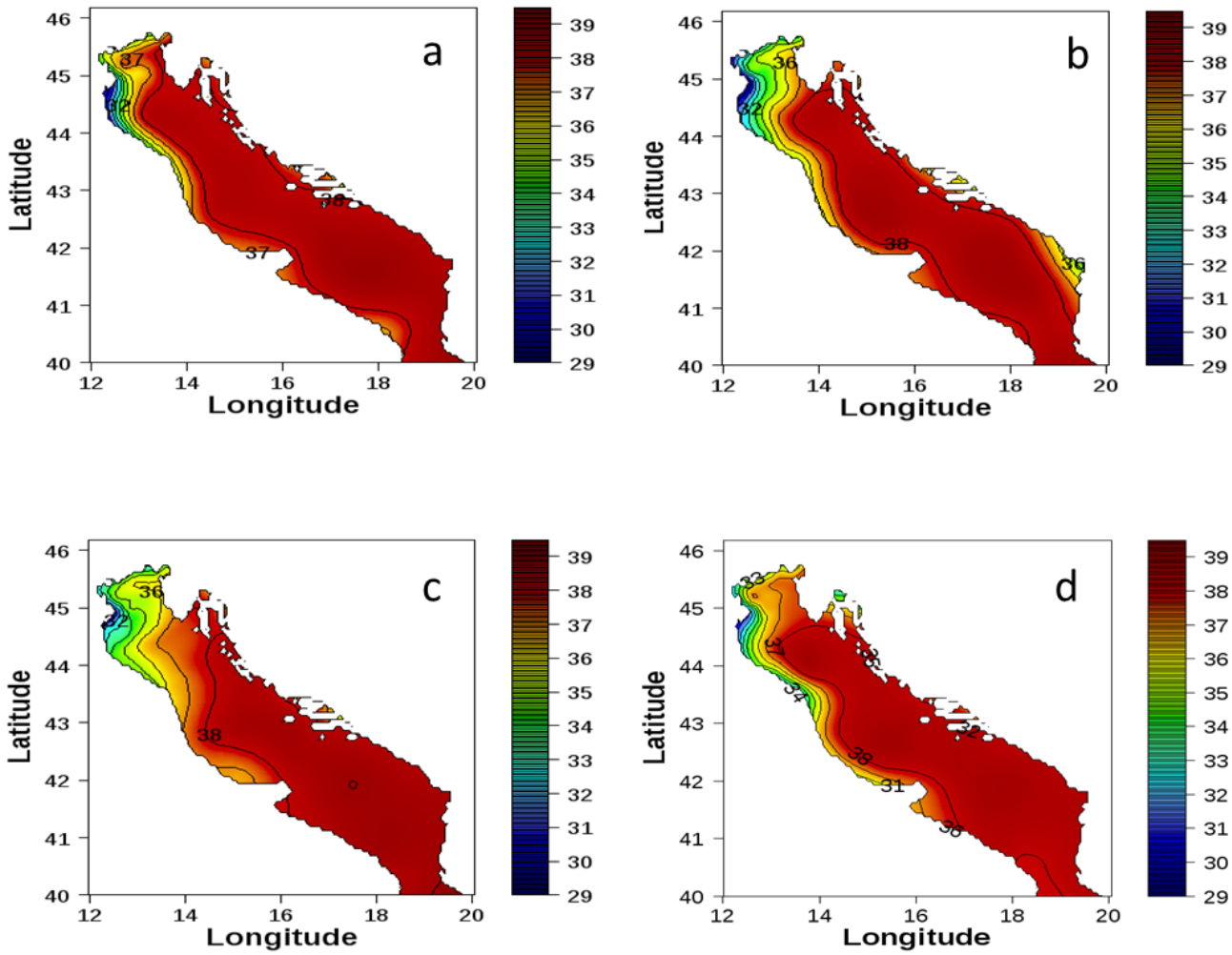


Figure 5-53 Seasonal climatological maps (1900-2009) of surface salinity (a: winter, b: spring, c: summer, d: autumn) (Lipizer et al., 2014).

Considering the coastal morphology, the AIM is characterised by large areas of coastal erosion, mostly in the central Adriatic and along the coasts of Calabria, Basilicata regions and some areas of coastal aggradation, mainly in the northern part (Figure 5-54). The intense coastline artificialization, mostly along the Italian coasts, combined with predicted sea-level rise and intensification of strong meteorological events such as severe storm and waves make this area at risk of modifications in erosion and deposition processes, and of hydrographic alterations in terms of currents, waves and sediment transportation.

At AIM scale, areas sensitive to hydrographic alterations are close to the main rivers' outflow, lagoons and corresponding to extensive coastline artificialization. In terms of permanent alteration due to "elevated temperatures" or "saline intrusion or alterations", according to the Italian Initial Assessment (ISPRA, 2012), the coastal areas of the Adriatic sub-region are not affected.

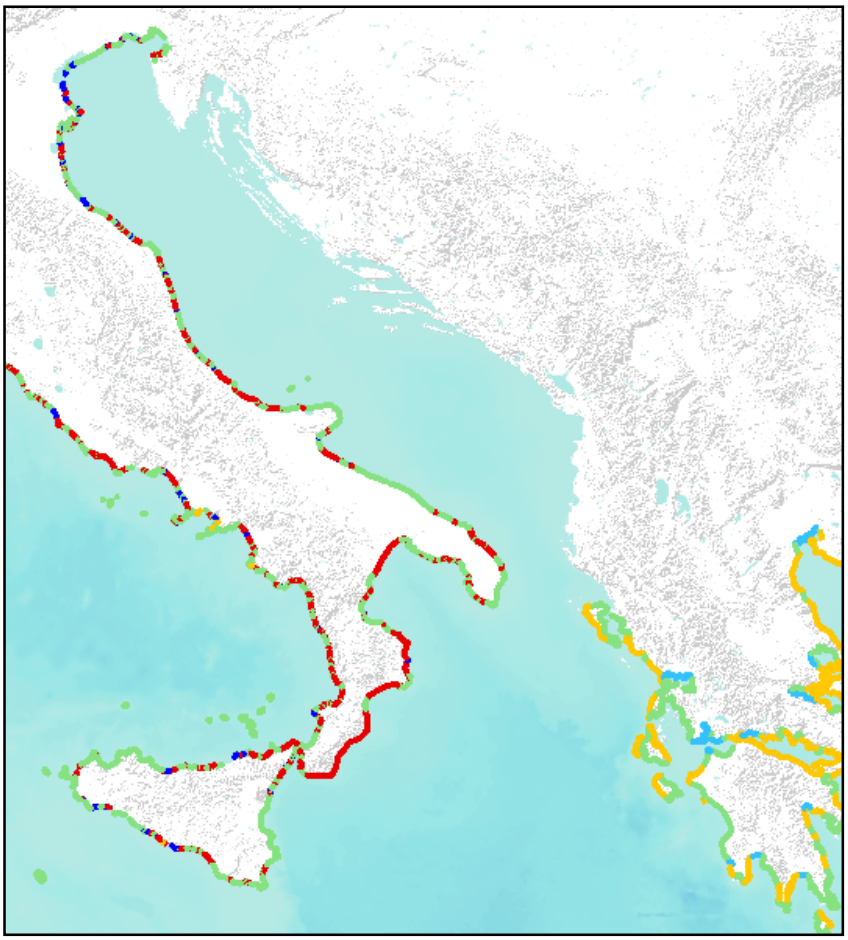


Figure 5-54 Coastal erosion (JRC Atlas)

Detailed description of the hydrographic conditions of the Adriatic sea are given in SHAPE IA as well in ISPRA documents on the marine strategy. Here we want to stress the points subjected to critical changes which implies changes in the future of the maritime uses.

Seasonal changes in the temperature, salinity and density were found to be typical for the region, dependant on air-sea fluxes (air-sea heat flux, air-sea water flux and air-sea buoyancy flux) and Po River discharge rate. Analysis of annual means indicated that there were no trends in temperature, salinity and density changes in the region. Interannual density changes were ruled by salinity changes in the surface layer and by both temperature and salinity changes in the bottom layer. (N. Supic, B. Grbec, I. Vilibic, and I. Ivancic, 2004).

Sea waves govern most of the dynamics of both offshore and coastal processes, there is a need to determine the extent to which climate change could affect the frequency and magnitude of extreme events. Thus, the prediction of wave state changes is of crucial importance to assist coastal decision-makers with climate adaptation, and for assessing the risk level in marine structure design and for the operation of offshore facilities. When evaluating the impact of climate change on the design of new marine structures and on the safety of existing ones, the design wave based on past events seems to lead to conservative conditions for a future scenario (Benetazzo et al., 2012; Figure 5-55).

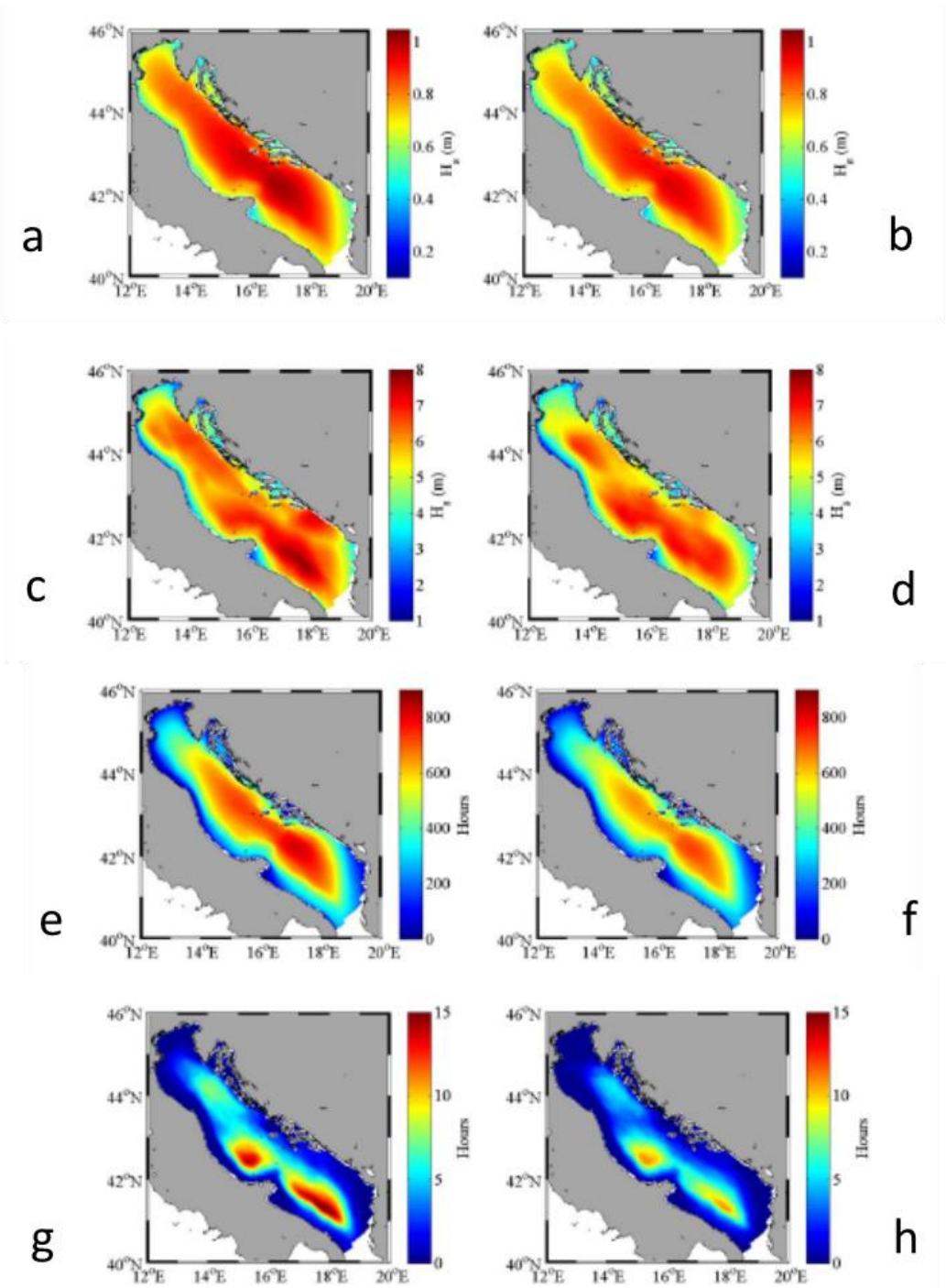


Figure 5-55 From Benettazzo et al., 2012: average wave height in meters (a, b), maximum wave height (c, d), yearly average wave hours with wave height higher than 2 m (e, f) and yearly average wave hours with wave height higher than 5 m (g, h). Plots on the left handside show present climate and on the right handside future scenarios.

5.7.3 Specific features of Focus Area1:

Intense inter-annual, seasonal, shorter-term and even long-term variability of hydrological properties characterizes the North Adriatic due to its shallow depths, from few meters along the Italian coast up to about 70 m in the centre of the basin and close to the Croatian coast, to

significant freshwater inputs by the main Italian rivers (Po River alone represents one - third of the total runoff in the Mediterranean, Ludwig et al., 2009) and to strong meteorological forcing (Grisogono and Belusic, 2009). The North Adriatic can, thus, be regarded as an example of a region of freshwater influence (ROFI; Simpson, 1997), which is subject to highly dynamic patterns in buoyancy, water column stratification, thermohaline fronts and to inputs of dissolved and suspended matter which modify trophic characteristics and turbidity of the area.

The North Adriatic coast is a representative example of a coastal zone subject to a multitude of significant and rapidly evolving pressures from natural and anthropogenic drivers that are recurrent in the Mediterranean coastline (Simeoni and Corbau, 2009). It holds high ecological, cultural and economic value and includes major centers of population and agriculture. Specifically, the area comprises Friuli Venezia Giulia and Veneto regions and runs along the Adriatic Sea from the national border between Italy and Slovenia to the mouth of the southern tributary of the Po Delta system (i.e. Po di Goro) with an overall length of about 286 km. Friuli Venezia Giulia includes three provinces and eight coastal municipalities from the Slovenian border to Tagliamento River mouth. From north-east to south-west, between the Slovenian border and the Timavo River mouth, the coast is high and rocky with few narrow beaches. The overall continuity of the coast is interrupted by several river outlets (e.g. Tagliamento, Isonzo, Timavo) and lagoons (i.e. Marano, Grado). Veneto region includes two provinces and ten coastal municipalities, from Tagliamento to Po River mouth. From north to south, the Veneto coast is characterized by lowlying beaches and by two important lagoons (i.e. Venetian and Po River Delta lagoons). Moreover, it includes the rivers Livenza, Piave, Brenta, Adige and Po that flow into the North Adriatic Sea with an estuary, except for the Po River that flows with a delta, which is the largest wetland area of Europe. The main coastal activities of the case study area are petrochemical industry, tourism, fishing, seaport/port activities and ship traffic. On the whole, the Northern Adriatic Sea coast comprises a very precarious coastal environment subject to continuous morphological changes that can be appreciable even over short geological time scales (Gambolati and Teatini, 2002). Moreover, erosion is still active in many areas, both on the coastal sea floor and on the beach, since many areas, particularly the Venetian Lagoon and around the Po River Delta, are also located below the mean sea level and affected by natural or man-induced subsidence (Pirazzoli, 2005; Carbognin et al., 2009). Particularly, sites in northeastern Italy are subsiding at rates of 0.5–1mmyr−1 with a projection for 2100 at about 135mm (Lambeck et al., 2011). Furthermore, the municipality of Venice has been experiencing an increase of high tide events with consequent flooding of the city (Tomasin and Pirazzoli, 2008). Moreover, the historical observations and future projections of isostatic and tectonic movements show that the North Adriatic coast (particularly Venetian, Grado and Marano lagoons) is particularly vulnerable to future sea level rise (Lambeck et al.,2011). Observed sea level rise trends from tide gauge data between 1993 and 2005 showed also a general rise in the Adriatic Sea level, which ranges from 2.9 to 5.7 cm (Umgiesser et al., 2010). When compared to satellite measurements of the Mediterranean mean (2.17 cm), the global mean (3.3 cm) and IPCC data (3.1 cm), these data indicate that the Adriatic Sea showed a higher rate of sea level rise in the period 1993 to 2005 (Umgiesser et al., 2010). Therefore, climate change and the related consequences of sea level rise, storminess and coastal erosion are a prominent issue for the case study area, both considering the vulnerability of fragile ecosystems, such as coastal lagoons, and the concentration of cultural and socio-economic values. (Torresan et al., 2012) (Table 5-3, Figures 5-56 – 5-58). Due to the high vulnerability of North Adriatic coastal areas and to the intense currents, several coastal defence structures have been relized along the western coasts (Figure 5-59).

Table 1. Vulnerability matrix applied for the assessment of coastal vulnerability to sea level rise inundation (a), storm surge flooding (b) and coastal erosion (c) in the coastal area of the North Adriatic Sea. Dark grey cells represent pathway factors, grey cells susceptibility factors and light grey cells value factors.

Receptors \ Impacts	Beaches	River Mouths	Wetlands	Terrestrial Biological Systems	Protected Areas	Urban Areas	Agricultural Areas
Hydrodynamic IMPACTS							
Sea level rise inundation (a)	– Elevation – Artificial protections – Protection level	– Elevation – Artificial protections – Protection level – Urban typology – Agricultural typology	– Elevation – Artificial protections – Protection level – Wetland extension	– Elevation – Artificial protections – Protection level – Vegetation cover	– Elevation – Artificial protections – Protection level – Urban typology – Agricultural typology	– Elevation – Artificial protections – Protection level – Urban typology	– Elevation – Artificial protections – Protection level – Agricultural typology
Storm surge flooding (b)	– Elevation – Distance from coastline – Artificial protections – Vegetation cover – Coastal slope – Geomorphology – Dunes – Protection level	– Elevation – Distance from coastline – Artificial protections – Vegetation cover – Coastal slope – Geomorphology – Protection level – Urban typology – Agricultural typology	– Elevation – Distance from coastline – Artificial protections – Vegetation cover – Wetland extension – Protection level	– Elevation – Distance from coastline – Vegetation cover – Coastal slope – Protection level – Vegetation cover	– Elevation – Distance from coastline – Artificial protections – Vegetation cover – Coastal slope – Protection level – Urban typology – Agricultural typology	– Elevation – Distance from coastline – Artificial protections – Coastal slope – Urban typology – Protection level – Urban typology	– Elevation – Distance from coastline – Artificial protections – Coastal slope – Agricultural typology – Protection level – Agricultural typology
Coastal erosion (c)	– Artificial protections – Vegetation cover – Coastal slope – Geomorphology – Dunes – Sediment budget – Protection level	– Artificial protections – Vegetation cover – Geomorphology – Sediment budget – Mouth typology – Protection level	– Artificial protections – Vegetation cover – Sediment budget – Wetland extension – Protection level		– Artificial protections – Vegetation cover – Sediment budget – Protection level		

Table 5-3 Vulnerability matrix for the coastal area of the North Adriatic Sea.

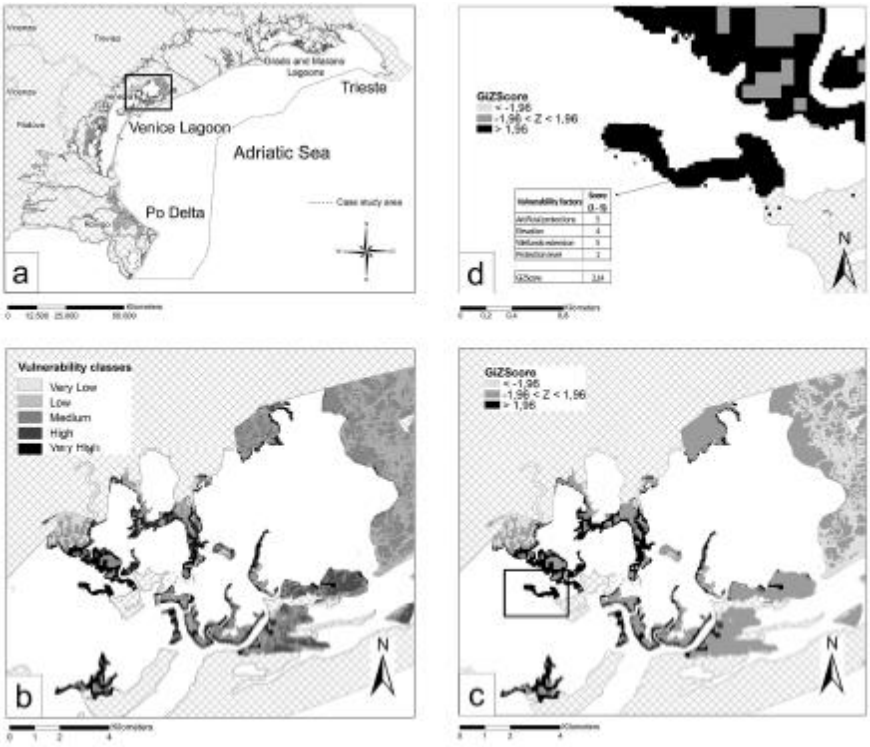


Figure 5-56 Vulnerability map for the wetland receptor to the sea level rise inundation impact on the North Adriatic coast (a) and in the northern Venetian Lagoon (b). Maps representing the hot spots analyzed in the northern Venetian Lagoon (c) and a detailed hot spot with its contributing vulnerability scores (d).

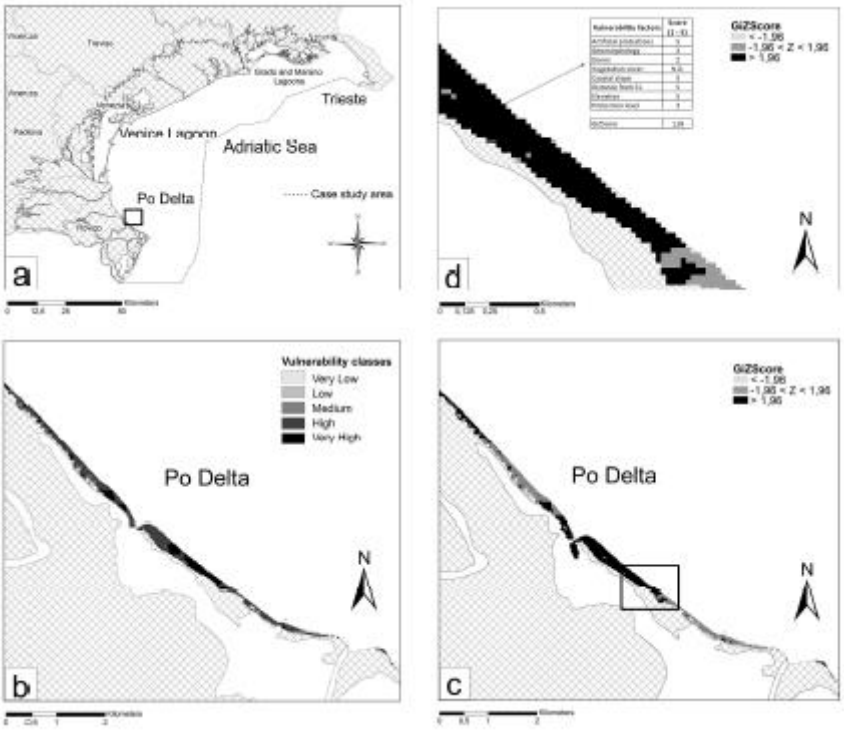


Figure 5-57 Vulnerability map for the beach receptor to the storm surge flooding impact on the North Adriatic coast (a) and in a specific area of the Po River Delta (b). Maps representing the hot spots analyzed in the zoomed area of the Po River Delta (c) and a detailed hot spot with its contributing vulnerability scores (d).

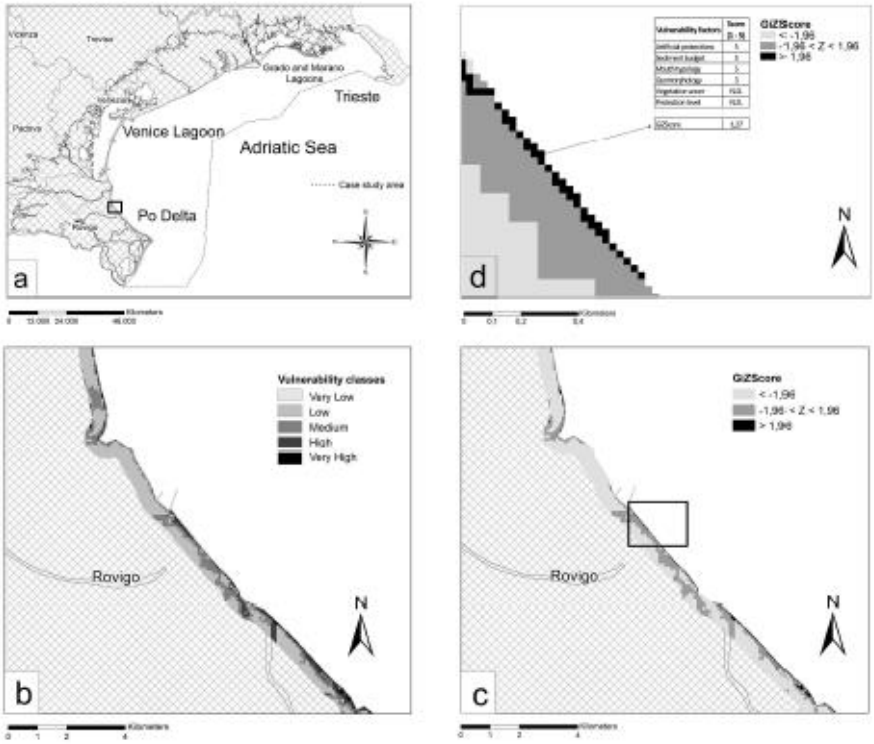


Figure 5-58 Vulnerability map for the river mouth receptor related to the coastal erosion impact on the North Adriatic coast (a) and in a specific area of the Po River Delta (b). Maps representing the hot spots analyzed in the zoomed area of the Po River Delta (c) and a detailed hot spot with its contributing vulnerability scores (d).

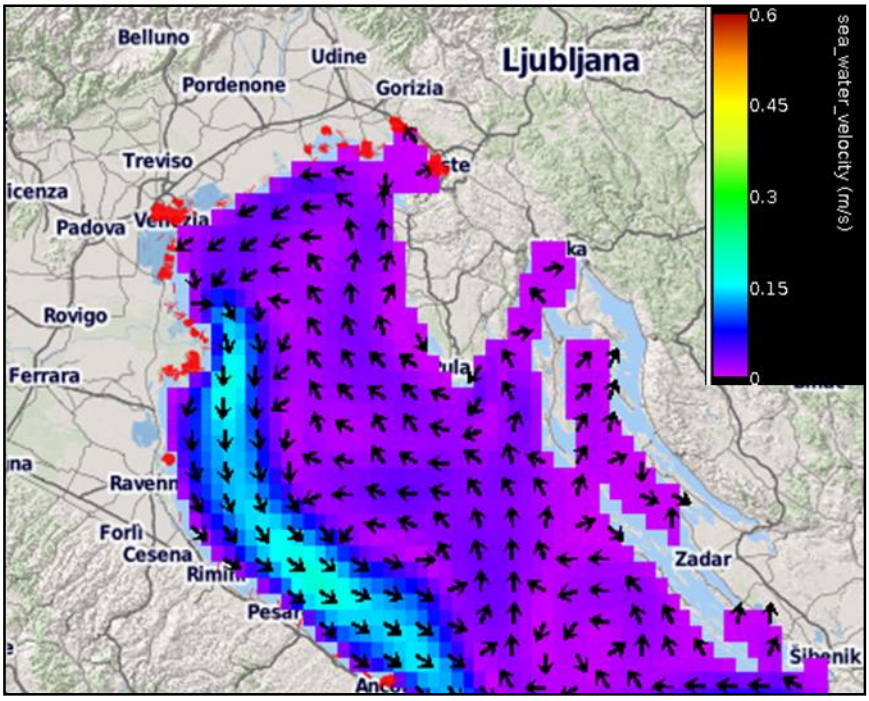


Figure 5-59 Average current velocity and coastal defence structures (red areas) (SHAPE Atlas of the Sea)

5.7.4 Specific features of Focus Area 2:

Since the 1980s the temperature and salinity of the Mediterranean are increasing, and these increases are expected to continue in the twenty-first century. These trends have been attributed to human activities: the temperature increase has been attributed to the –planetary scale– anthropogenic greenhouse effect, while the salinity increase has been attributed both to global and regional scale anthropogenic activities, the latter consisting of damming the major rivers of the Mediterranean and the Black Seas. The above interference is extended throughout the Mediterranean. The current intensity of this interference is low; however, it is considered of great long-term importance.

Further interferences exist at a very local, coastal level. Amvrakikos Gulf, a small portion of the Ionian Sea, exhibits dysoxia / anoxia in its bottom layer in the past 20-30 years (Ferentinos et al., 2010; Kountoura and Zaharias, 2011). However, this phenomenon has been attributed more to fertilizers, extensive fish farming etc. and no so on interferences with the hydrological budget. Furthermore, another coastal basin, the Etoliko lagoon, has been historically been reported as naturally anoxic.

The temperature and salinity increasing trends directly impact the local vertical stratification of the water column, and that can modify the overturning circulation of certain regions of the Mediterranean. However, as the Ionian Sea is not a region of intermediate or dense water formation, the temperature and salinity changes recorded (partly attributed to human activities) have not resulted to dramatic biological impacts as in the Aegean. During the Eastern Mediterranean Transient event of the early 1990s, new Aegean Dense Water filled the deeper basin of the Ionian in the vicinity of the western Cretan Straits, and thus introduced higher oxygen and low nutrients in the bottom layer. During this process the old Eastern Mediterranean Deep Waters were uplifted to deep-intermediate layers, thus their high nutrient – low oxygen signature moved to shallower layers. From the mid-1990s to mid-2000s the new, Aegean-originated bottom waters progressed toward the west, gradually mixing with the old EMDW water mass. Despite the strong physical and chemical signals of the phenomenon, the biological response was probably insignificant. Also, in the Ionian Sea the signs of tropicalization of the Mediterranean (through mostly the identification of Lessepsian species) are minimal.

The Eastern Mediterranean Transient event, potentially partly caused by human interference to the heat and salt budget of the Mediterranean Sea, appears to have had no significant physical, chemical and biological impacts on the seabed of the Ionian Sea, as there is no such bibliographic information – except maybe of a thermal history retrieved through temperature profiles through the sediment (Della Vedova *et al*., 2005).

Activities causing pressure within the assessment area may be burning fossil fuels, interderence with water cycle and thermal and saline pollution. However, it should be pointed out that there are no recorded examples of significant local disturbances of the hydrological processes in the Ionian Sea.

5.8 D8 Contamination

D. Cassin, S. Fraschetti, G. Farella, F. De Leo, P.K. Karachle, S. Mezek

Contaminants are defined in the European legislation as: "substances (i.e. chemical elements and compounds) or groups of substances that are toxic, persistent and liable to bio-accumulate and other substances or groups of substances which give rise to an equivalent level of concern".

Examples of such substances found in the marine environment include pesticides, anti-foulants, pharmaceuticals and heavy metals, radionuclides among others. Contaminants can arise from numerous anthropogenic sources such as land-based industrial activity, pollution by ships, atmospheric deposition, oil, gas and mineral exploration and exploitation and riverine inputs. Human activities affect the marine environment through the release of chemical contaminants, which degrade the state of marine waters and can cause serious damage to its functioning. Contaminant inputs to marine waters may be diluted with the sheer size and volume of the ocean, and therefore pollution incidents may not become apparent immediately after release and changes may not be detected until the appearance of effects due to chronic exposure. In addition to the degradation of the state of marine waters, a consequence from the contamination of seas is that organisms themselves or biological processes may be adversely affected.

Pollution effects are defined as direct and/or indirect adverse impacts of contaminants on the marine environment, such as harm to living resources and marine ecosystems, including loss of biodiversity, hazards to human health, the hindering of marine activities, including fishing, tourism and recreation and other legitimate uses of the sea, impairment of the quality for use of sea water and reduction of amenities or, in general, impairment of the sustainable use of marine goods and services.

The toxic effects of a given cocktail of chemicals on marine organisms depend on the toxicity profile of the chemicals, their synergetic or antagonistic effects, bioavailability and persistence as well as the ability of marine organisms to take up, accumulate and metabolize the chemicals. It also depends on the status of the considered ecosystem: there is growing evidence that contaminants may be partly responsible in outbreaks of diseases or endocrine effects, which adversely affect individuals, or populations of marine organisms.

This descriptor is intended to ensure that the presence of contaminants in the marine environment and their biological effects remains within acceptable limits, or rather concentrations of contaminants are at levels not giving rise to pollution effects.

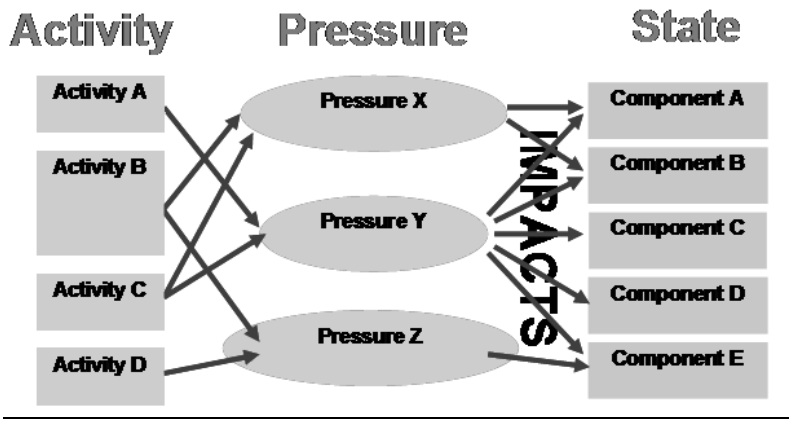


Figure 5-60 Relationship between human activities, the pressures they exert on the environment and the consequent state of the environment, taking account of the impacts (adverse effects) from the pressure

For the implementing Descriptor 8 under the MSFD the following environmental target levels are being recommended:

- Concentrations of contaminants in water, sediment and/or biota are below environmental target levels identified on the basis of ecotoxicological data;

- Levels of pollution effects are below environmental target level representing harm at organism, population, community and ecosystem level;

- Concentrations of contaminants in water, sediment and/or biota, and the occurrence and severity of pollution effects, should not be increasing (JRC 2010).

The chemical indicators selected for Descriptor 8, i.e. concentrations in water, sediment and/or biota would be expected to increase in response to an increasing degradation gradient. Exceptions would include those chemical contaminants which are readily metabolised by some target organisms (mainly vertebrates). In such case, the degradation gradient may be only weakly reflected by some indicators.
The biological effects indicators available for Descriptor 8 will show a progressive change along a chemical degradation gradient (provided that the indicator is responsive to the chemical showing the gradient). The change in biological response may be either positive or negative, depending on the response concerned. For example, PAH exposure would lead to increases in EROD activity, but decreases in Neutral Red Retention Time.

5.8.1 Main threats

With regard to the introduction in the envoronment of synthetic and non-synthetic substances and compounds (contaminants pressure) different types of sources can be identified, both point and diffuse.

A list of the main sources is presented below:

A) Land Based - Point and diffuse sources pollution from land: discharge point in the hydrographic network from industrial plants authorized; point discharges into the sea from industrial plants authorized; harbour; inputs of contaminants from the main rivers (for which are known and reliable the annual average flow); input of pollutants from agriculture (run-off).

B) Sea Based - Point and diffuse sources pollution into the sea: point discharges of produced water from offshore oil and gas platforms; accidental pollution (pollution events, oil spill); input of contaminants as a result of shipping activities; sediments; dredging activities.

C) Air Based - Point and diffuse sources pollution from atmosphere: pollutants and radionuclides fall-out.

5.8.2 Main features at AIM scale

The most extensive analysis of the level of concentration of pollutants and their impact on Italian coasts, is carried out by ISPRA 2012. Below the main features are presented[198].

A) Land Based Sources

A significant number of important industrial centres are located along the western Adriatic coast (Figure 5-61). Data of point source discharges from industrial plants authorized for Italy refer to the period 2007- 2010; quantitative data relating to the type of substances released are transmitted by the owners of plants at Ispra and the competent authorities (Art. 5 of Reg no.166/2006/CE and article 4 of Presidential Decree n.157/2011). These industrial zones are characterized by important releases of different types of pollutants (heavy metals, PCB, hyrocarbons), depending on main activities placed in the areas.

There aren't, however, known discharges from unauthorized installations, as well as those facilities authorized but with characteristics of productive capacity and emissions below the quantitative thresholds set out in the legislation, whose contribution, however, is indirectly inferred on the basis of estimates of the contributions spread of contaminants to some major waterways.

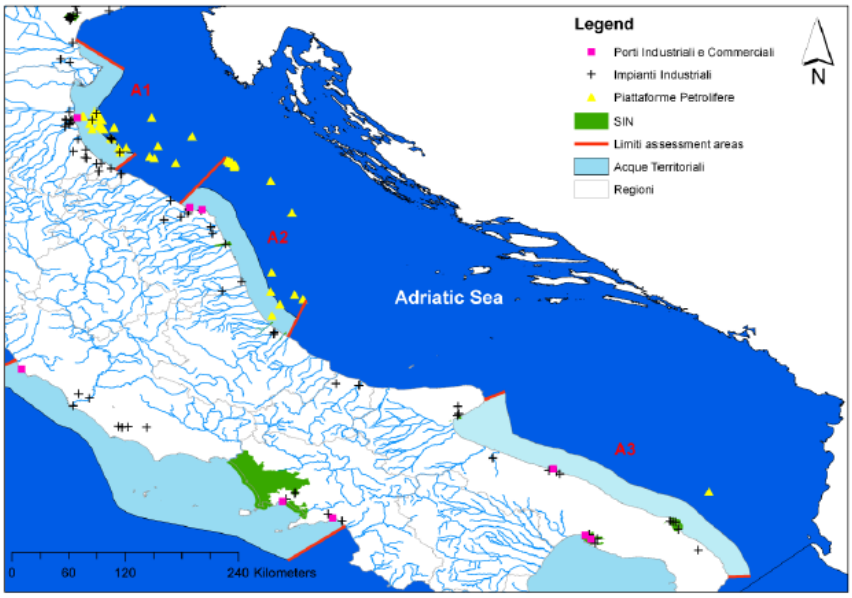
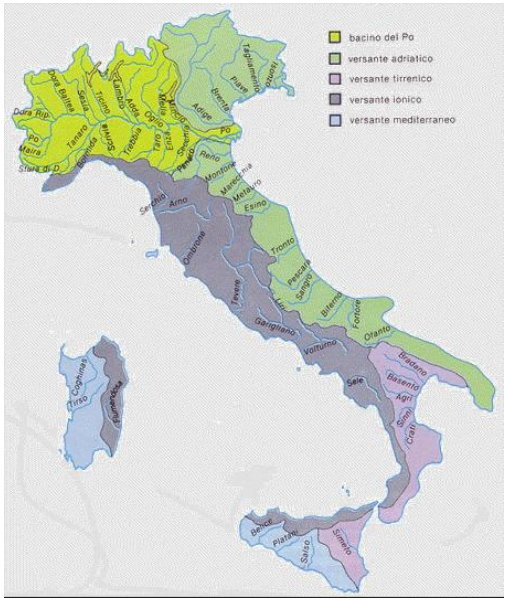


Figure 5-61 Map of the ports and industrial plants in the area (source: ISPRA 2012)

[198] The data of contaminants in the water are for the years 2009 - 2010 and mainly come from two different monitoring networks. The first network is related to national monitoring coastal marine, carried out in accordance with Law 979/82, in 2009, in addition to sediment and biota matrices, has been investigated also the matrix water, the results of which were collected in the database SIDIMAR (MoE). The second network is that of the WISE - SOE to bring together data on the chemical classification of water bodies under the Water Framework Directive (2000/60/EC).

The data of concentration of contaminants in sediments derived from several sources and are for the 2006-2010 period. Specifically, the reference database are related to different Research Programs conducted by ISPRA and characterization of sites of national interest; SIDIMAR to the database on the network of national monitoring coastal marine carried out in accordance with Law 979/82, the network of WISE - SOE to bring together data on the chemical classification of water bodies under the water Framework Directive (2000/60/EC) and its transposition, to data held by the Ministry of the Environment in response to requests authorization for the movement of the seabed (dredging, laying of cables and pipelines, etc.). monitoring programs / characterization funded by the Emilia Romagna and Veneto.

About fluvial inputs, data on pollutant loads are related to the main rivers in the area for which they are known and reliable flow. The concentration data coming from monitoring networks, institutional, and data flow are derived from the hydrological records and information provided by the Regions and Basin Authority (Figure 5-62). Contributions of contaminants from agriculture run-off are, so far, not known.



Fiume	m³/s
Po	1.540
Adige	235
Isonzo	170
Piave	125
Reno	95
Brenta	93
Livenza	85
Tagliamento	70
Aterno-Pescara	57
Sile	55
Metauro	21

Figure 5-62 Map of the main italian river and table with average daily flow of the main tributaries of the Adriatic Sea

B) Sea Based Sources

Information on point and diffuse sources into the sea is quite scant and quantitative information is available for point discharges of produced water from offshore platforms.

However, the Adriatic Sea is an important maritime transport route used by merchant ships in international and national trade (Section 4.1-2) and maritime traffic can cause the release of pollutants in the sea. The intensive maritime transport in the Adriatic Sea basin implies a significant risk of accidents and consequently a potentially strong impact on the marine environment. Given the enclosed nature of the Adriatic Sea basin, the impact of a single accident even though accidents are rare can be highly disastrous.

The release of hydrocarbons (as fuel, crude oil, or oil products) could in specific areas interfere with the environmental status of the marine ecosystem. The formation of oil slicks through accidental or continuous release of oil and oil products should be quantitatively assessed under an appropriate descriptor. Currently assessments are being carried out using aerial surveillance or satellite imagery rather than within traditional monitoring programmes. Constituents of the oil slicks, such as polycyclic aromatic hydrocarbons, are covered under the currently proposed criteria for Descriptor 8 whether arising from oil or combustion sources. Possible sites of Sea based sources are illustrated in Figure 5-63.

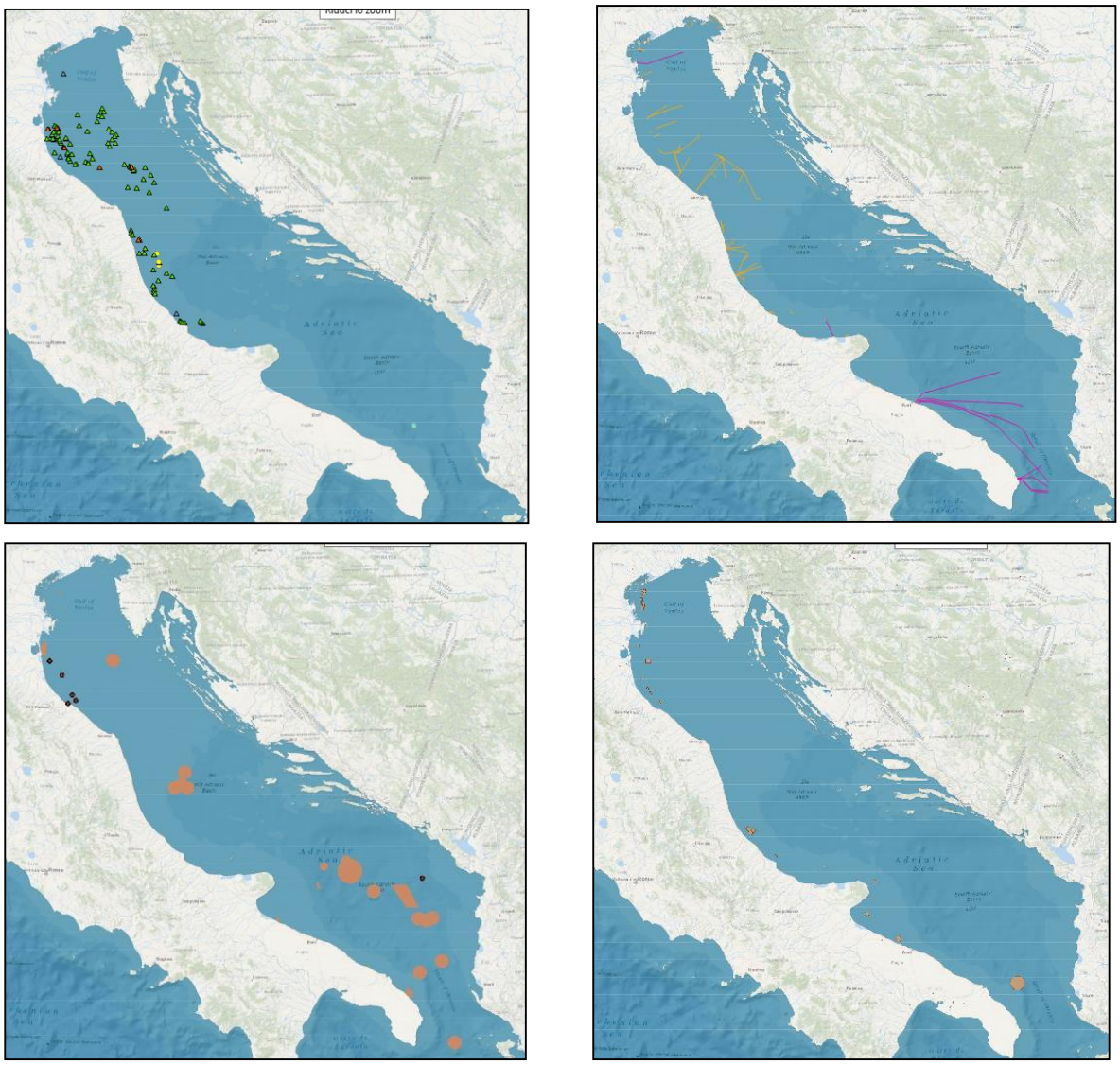


Figure 5-63 Platform for hydrocarbons extraction, pipelines, remanents of war and dumping sites in the Adriatic Sea (source: IPA-SHAPE Project, Maps of Adriatic use)

C) Air Based Sources

Information on the inputs of contaminants from atmospheric deposition can be inferred from the maps of deposition, available on the website of EMEP (European Monitoring and Evaluation Programme). From the maps, drawn on cells of 50 km to the side, it is possible to derive ranges of deposition, where the most recent data refer to estimates for 2009 related to heavy metals and persistent organic compounds. Total yearly setting values registered for the coastal areas for some pollutants are the followings (ISPRA, 2012):

- Lead: minimum <0.1 kg/m^2/y, maximum >3 kg/m^2/y;
- Cadmium: minimum <1 kg/m^2/y, maximum >100 kg/m^2/y;
- Mercury: minimum <1 kg/m^2/y, maximum >303 kg/m^2/y;
- Benzo(a)pyrene: minimum <1 kg/m^2/y, maximum >100 kg/m^2/y.

(for dioxins, furans and persistent organic compounds the data is not available for the sea surface, but only for coastal areas).

Ar regards Radionuclides for the Adriatic main potential impact from Land Based sources derives from point sources discharging into rivers (mainly the Po river and its tributaries), where a significant fraction of radionuclides is temporarily trapped (Figure 5-64). The most impacted area from these sources is then the Po river mouth. When ^{137}Cs is considered, even assuming that the whole annual total amount (0.5 Gbq/y) is discharged directly into the sea, this would be one order of magnitude lower than present atmospheric deposition over the region due to global fallout. The authorized discharges of ^{137}Cs and ^{90}Sr, are limited and almost constant with time. Input might slightly increase in the future in connection with decommissioning of nuclear power plants. By Air Based sources the main source of anthropogenic radionuclides is the fallout from atmospheric weapon testing and the Chernobyl accident. The cumulative deposition of 137Cs from atmospheric weapon testing is considered uniform in all the sub areas considered. The deposition from the Chernobyl accident was quite patchy, ranging in Italy between 0.7 (southern area) to 15 KBq m-2 (northern area), corresponding today to 0.4-8 kBq m-2, respectively. Only traces were de-posited as consequence of the Fukushima accident. Present input, corresponding to a total load in the subregion of approximately 4 GBq y-1, does not show significant spatial or temporal variation.

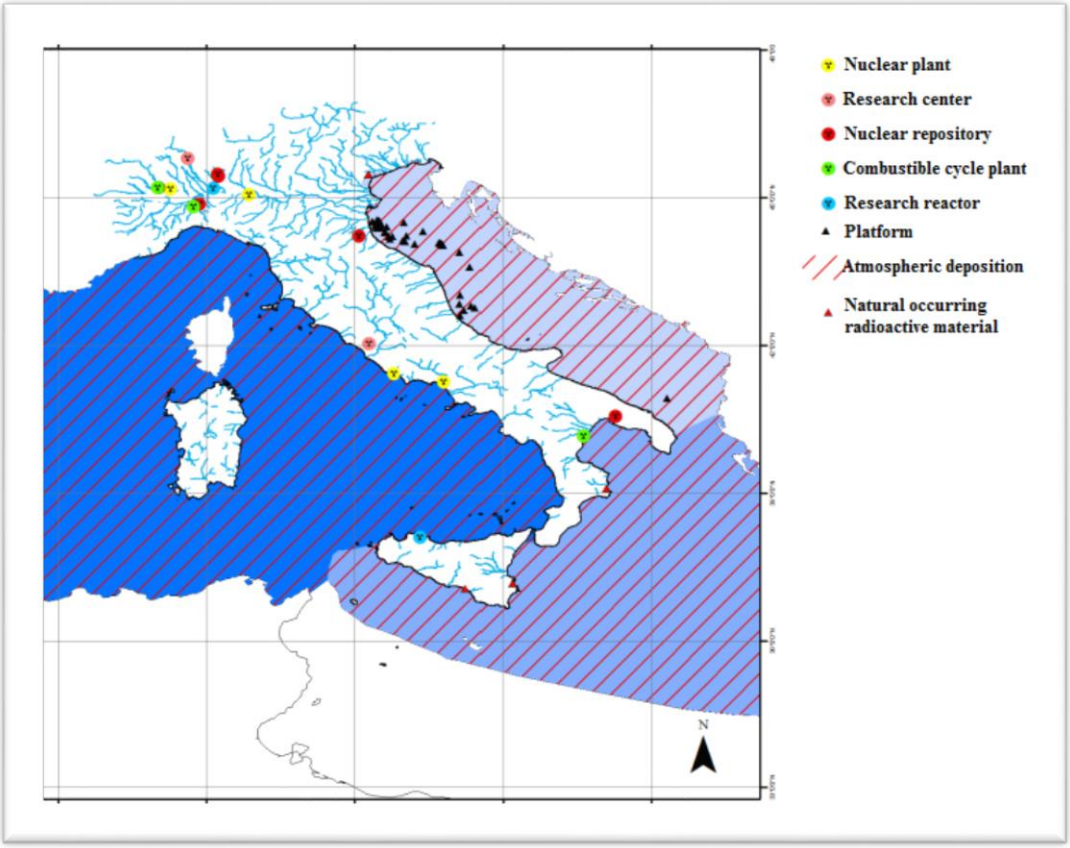


Figure 5-64 Possible input loads of radionuclides (source: ISPRA 2012)

Impact

Although contaminants will affect processes from molecular to ecosystem level, the contaminant specificity of detection methods is inversely related to complexity. There is rarely a direct relationship between tissue levels of contaminants and their effects (except in special cases with high exposure levels), and there is limited understanding of the effects of mixtures of contaminants and of interactions between contaminants and other environmental stressors.

The toxic effects of chemical contaminants on marine organisms depend on their toxicity profile, bioavailability and/or persistence, as well as the ability of organisms to accumulate and metabolize specific contaminants, then An understanding of causal relationships between

contaminants and any observed effects, but also the ability of methods to separate between contaminant effects and natural processes, is crucial in the effective management and restoraton of marine ecosystems.

With regard to the evaluation of the biological effects on biota is important to point out that the biological markers are normally divided into markers of exposure and markers of effect. For biomarkers of exposure are considered, in general, all responses of an organism that indicate exposure occurred to a class of chemical compounds without giving any indication on the actual toxicological effects on the organism. The biomarkers of effect are represented by the answers, at different levels of structural complexity of the organism, which indicate both the exposure to a toxic compound that its toxicological effects.

The data on the effects of contaminants in biota, connected to the list of predominant habitats, derived from several sources and are for the 2006-2010 period. Specifically, the reference database are related to some programs for research conducted by ISPRA; database SIDIMAR on the network of national monitoring coastal marine carried out in accordance with Law 979/82 for 2009 only. The data are being processed and at the time the information is partial.

Hot Spots

Marine pollution hotspots, or areas which receive severe pollution loads, are a known menace that often has disastrous effects. Found mainly in enclosed and/or semi-enclosed bodies of water like bays and river mouths, these areas are associated with highly urbanized and densely populated cities. They pose a constant threat to public health, coastal resources, and the integrity of coastal ecosystems.

Although some site-specific effective management has been achieved, progress to reduce the effects of pollution being hampered by the rate and scale of pollution we face. Thus, marine pollution hotspots are currently being prioritized in order to concentrate management efforts.

The following maps (Figure 5-65 – 5-70) are examples of such areas in the macro region arising from the analysis by source EEA Report No 4/2006.

As regards Italy, Major environmental problems are caused by urban and industrial wastewater, agricultural run-off and shipping. Urbanisation and concretisation of the coastline is also occurring because of tourist infrastructure development. Finally, he river Po is a very important pollution vector in the area transporting urban and industrial wastewater as well as agricultural run-off from its drainage basin to the Adriatic Sea. In Particular, harbours of Trieste, Venice, Genova, Livorno, Naples, Taranto, Brindisi, Ancona, Augusta-Priolo-Melilli, Milazzo, Ravenna and Gela: show petroleum hydrocarbon contamination because of intense maritime traffic (41% of the Mediterranean oil transport takes place through Italian ports) and refineries' oil losses (150 oil slicks were recorded in 2000)

Figure 5-65 Coastline of Italy with areas of major environmental concern and pollution hot spots (Source: EEA, 2006).

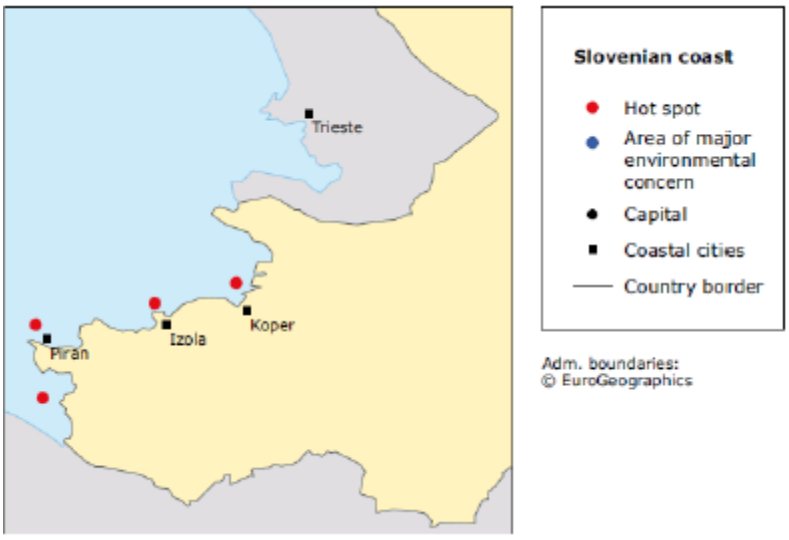


Figure 5-66 Slovenian coast with areas of major environmental concern and pollution hot spots (Source: EEA, 2006).

Figure 5-67 Coastline of Bosnia and Herzegovina and Croatia with areas of major envi-ronmental concern and pollution hot spots (Source: EEA, 2006).

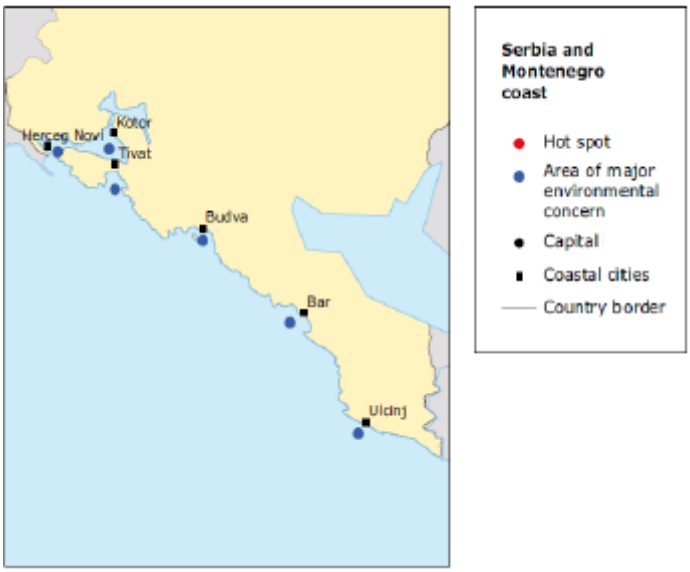


Figure 5-68 Montenegro coast with areas of major environmental concern and pollution hot spots (Source: EEA, 2006).

Figure 5-69 Albanian coast with areas of major environmental concern and pollution hot spots (Source: EEA, 2006).

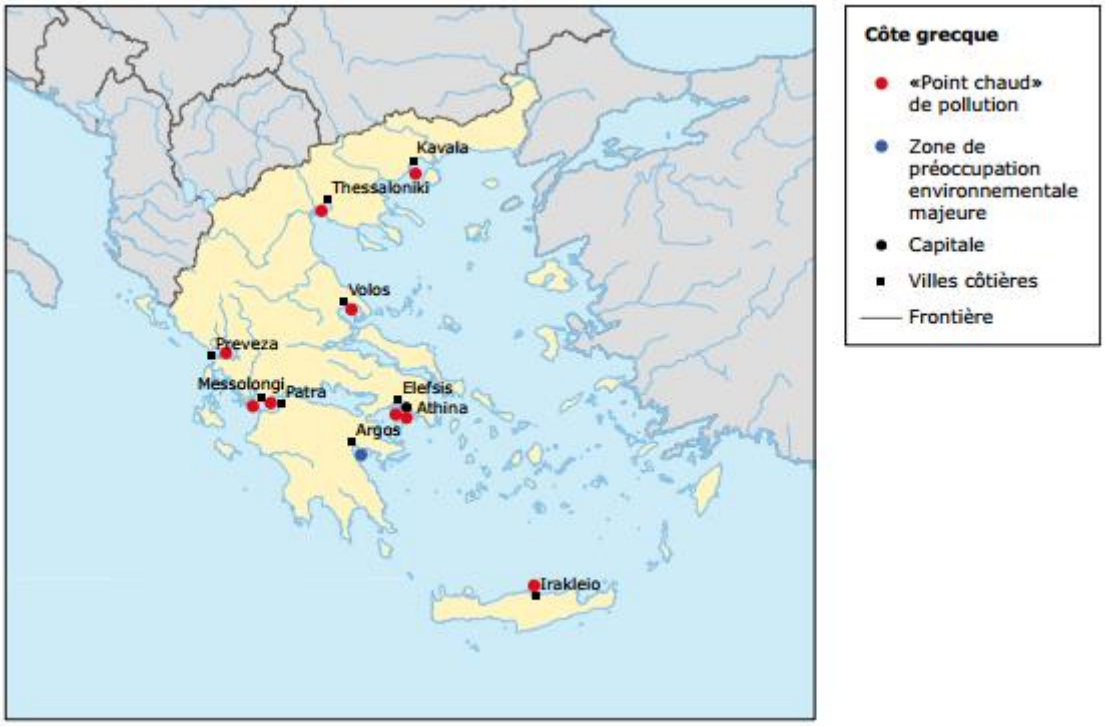


Figure 5-70 Greek coast with areas of major environmental concern and pollution hot spots (Source: EEA, 2006).

Major pollution problems of croatian coasts include urban wastewater, and urbanisation. For example Kastela Bay (Split) shows metals and organohalogen compounds in the sediment due to the discharge of untreated urban andindustrial wastewater. Rijeka, Zadar, Pula, Sibenik and Dubrovnik show untreated urban and industrial wastewater; in Primorsko-Goranska County the Adriatic Pipeline System is located.

5.8.3 Specific features of Focus Area 1

The Po River, the largest Italian river, drains a very industrialized as well as an intensively cultivated area, and exerts its influence over the whole basin. The other rivers, much less important, may be meaningful on a local scale, mainly in coastal areas. This area is characterised by both intense human use and high natural value. Main uses are related to maritime transportation and connected (industrial, commercial and tourist) port activities. In addition, the central area of the northern Adriatic basin has been subjected to the dump of waste processing (eg. bauxites, phosphorites and fluorine) from the industrial area of Porto Marghera. These dumps, started in the prewar period, were regulated only since 1970. From an approximate calculation shows that, between 1970 and 1984, have been sversate into the sea about 16x106 tons of these materials (Brambati 1984)

The following figures (Figure 5-71 – 5-72) show two examples of maps of the concentration of pollutants (mercury and lead) in the sediments along the coast of Emilia and Veneto respectively.

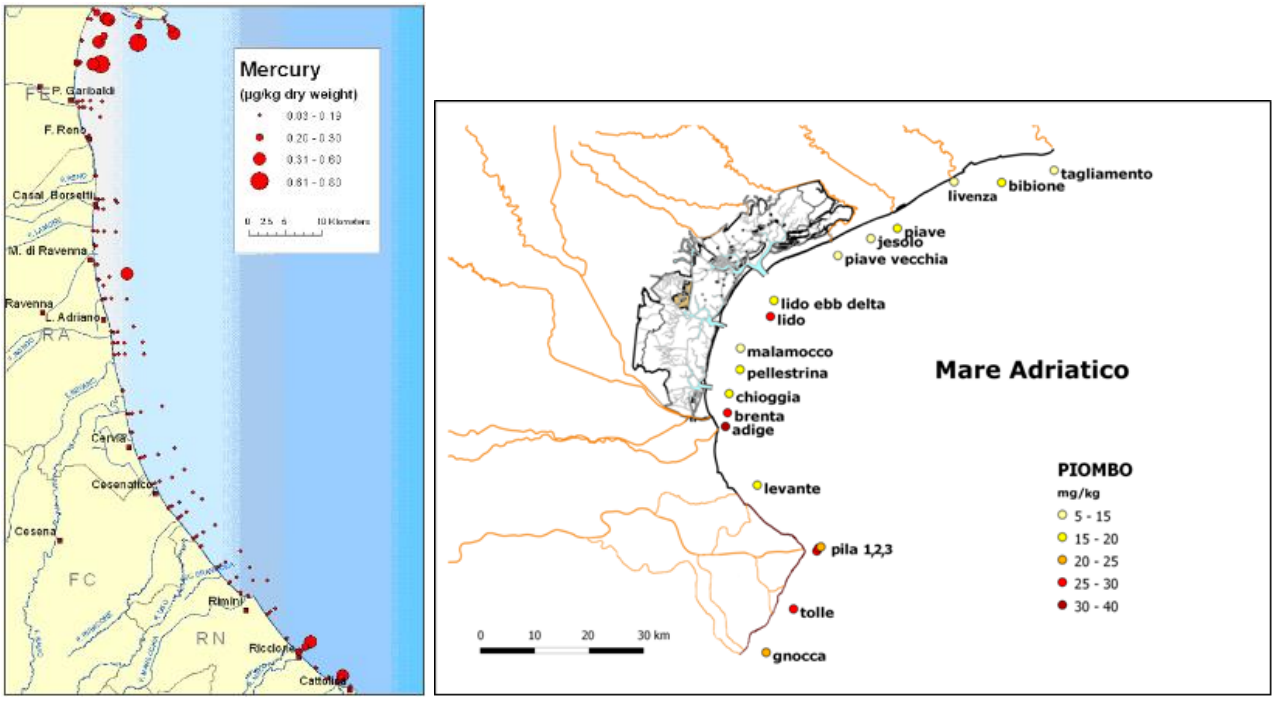


Figure 5-71 Maps of concentration of pollutants (Mercury and Lead) in sediments of North Adriatic coastline (source: SHAPE(b)2013, CNR 2011)

In this case, the data show the impact of riverine inputs, and in particular of the river Po and Adige, on the concentrations of these pollutants.

In this regard, Figure 5-72 shows a zoomed on the concentration of some pollutants on the sediments of the area of the Po prodelta.

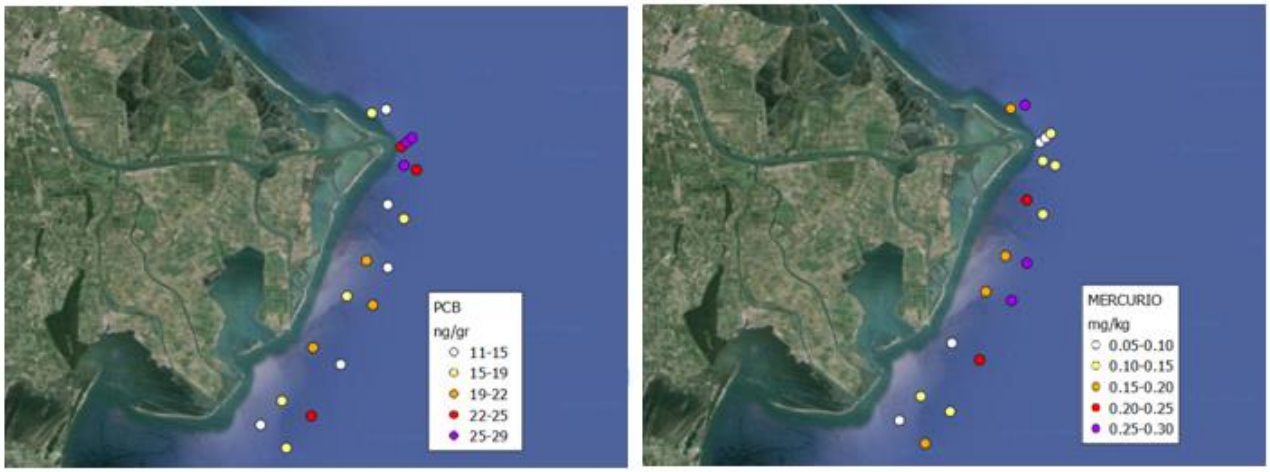


Figure 5-72 Maps of concentration of pollutants (Mercury and PCB) in sediments of Po prodelta (source: Ritmare Project - 2013, Data of First survey on the prodelta Po)

The analysis of the data shows relatively high concentrations of PCBs (always above the threshold limit values set by the Italian legislation - 8 ng / g for PCBs). It is evident the influence of the plume on the enrichment of the concentration of these pollutants in sediments. Conversely, mercury exhibits very low concentrations and always below the limit (0.3 mg/kg).

The plume of the Po seems to have (in this case) an effect of "dilution" of the concentration of this metal in the sediments.

The "background issue"

The European legislation requires achievement of good ecological and chemical status both in waters and sediments of coastal and transitional water bodies. To this purpose, it establishes Environmental Quality Standards (EQS) for priority substances, including some heavy metals (As, Cd, Cr, Hg, Ni, Pb) of well recognized environmental importance and ecotoxicological effects. However, the use of these single EQS has the disadvantage of not taking into account the natural geochemical variability which is dependent on the sedimentary matrix. False anomalies may then arise because metal values tend to vary with mineralogy and grain-size, higher concentrations being associated with finer-grained sediments.This issue is well evident in the area of the northern Adriatic too (Figure 5-73).

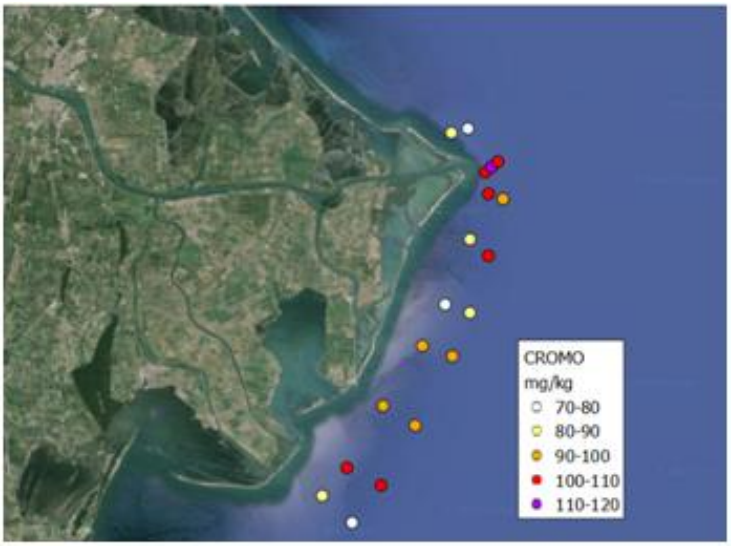


Figure 5-73 Maps of concentration of chromium in sediments of Po prodelta (source: Ritmare Project - 2013, Data of First survey on the prodelta Po)

As with PCBs, chromium also show high levels of concentration in the sediments of the prodelta. The high content of this element is, however, due to the enrichment in sediments caused by the docks where there are sedimentary ophiolite complexes (rich in Cr and Ni), which appear in the Western Alps and in some areas of the Apennines in Piacenza and Parma zone (high natural background).

Normalization is the attempt to compensate for the natural variability of trace metals in sediments so that any anthropogenic metal contributions may be detected and quantified. Grain size and provenance then are the two most significant parameters which must be compensated for by any normalization procedure. Normalization carried out using simple linear regression of metal content versus a grain-size proxy element has been demonstrated to be an useful approach in defining regional metal background values, taken into account local mineralogical characteristics and grain-size variability.

Considering the pollutant content, the state of the Slovenian sea is mainly good. The concentrations of various organic pollutants and metals in seawater are under the statutory limit values or even below the detection limit of the applied analytical methods. The only problem are organotin compounds (precisely, TBT) , which are often present in excessive concentrations. Appropriate limit values for sediments have not been set yet. As regards the pollutants in organisms, the situation is mainly good. It should be noted that the available data are relatively modest for many pollutants.

The main objective is to maintain a good state, existing in the case of most parameters. Regarding the organotin compounds, it is necessary to reduce the concentrations to achieve a good state. Therefore, it is necessary to identify the sources of pollution by these compounds.

In the case of non-synthetic pollutants, it would be needed to determine their natural background.

The effects of pollutants on microorganisms can be seen from the levels of macromolecules to populations. For the assessment of the situation, data were collected on the biological effects of contaminants in mussels, fish and snails. The response of target species to pollutants at some sampling points along the Slovenian coast indicates a greater load of various pollutants. It is necessary to upgrade the knowledge about biological impacts in order to set the thresholds for determining the impacts of pollutants at the regional level. The objective of good environmental status is to prevent harmful impacts of pollutants on the health of marine organisms (changes in physiological processes, reproductive disorders, etc.).

Considering the pollutant content, the state of the Slovenian sea is mainly good. The concentrations of various organic pollutants and metals in seawater are under the statutory limit values or even below the detection limit of the applied analytical methods. The only problem are organotin compounds (precisely, TBT) , which are often present in excessive concentrations. Appropriate limit values for sediments have not been set yet. As regards the pollutants in organisms, the situation is mainly good. It should be noted that the available data are relatively modest for many pollutants.

5.8.4 Specific features of Focus Area 2

On the coastline of Montenegro, the concentration and accumulation of trace metals (Co, Ni, As, Cd, Pb and Hg) were measured in seawater, sediments and marine organisms. The obtained results of trace metals in sea grass and mussels were compared with those found in the water column and sediment and could serve as a baseline for future assessments of anthropogenic effects in this marine ecosystem. The heavy metals analyses of seawater, sediment, *Posidonia oceanica* and *Mytilus galloprovincialis* identified the harbor of Bar as the most Hg-contaminated site, Zanjice as the most As-contaminated and Sveta Stasija as the most Pb-contaminated areas of the Montenegrin coastal area. In Albania, the results of an Interreg project pointed out the weakness to the Vlora Gulf ecosystem from several sources, including the (1) heavy human impacts on the natural coastal evolution, resulting in coastal erosion and/or accretion; (2) considerable influence of the input of suspended mud from the Vjosa River, causing conspicuous degeneration phenomena on the benthic habitats (e.g., on the *Posidonia oceanica* meadow; and (3) conspicuous urban and industrial water discharge, producing diffuse pollution related to the presence of heavy metals (mercury, among others) in the sediments of the gulf area.

The distribution of six PCB congeners were investigated in surface sediments (0-2 cm) from the coastal waters of the Middle and South Adriatic. The lowest concentration was found at the "off-shore" reference station Stoncica, indicating the absence of an anthropogenic influence at the investigated area. The highest concentration was obtained at the area of the Kastela Bay (Split), as the result of long-term urban and industrial wastewater discharges. The most abundant higher-chlorinated congeners PCB 138 and PCB 153 were present at higher concentrations in the entire investigated area than the lower-chlorinated ones. The obtained results showed that the PCB levels in the sediments depend primarily on local pollution sources and environmental characteristics, as well as, on the geochemical characteristics of the sediment.

In Apulia, marine sediments from the Mar Grande and Gulf of Taranto were analysed for 17 parent PAHs, with molecular weight from 128 to 278 Daltons. Total PAHs content in sediments ranged from 464 to 12522 mu g kg(-1) dry wt for Mar Grande and from 593 to 72275 mu g kg(-1) dry wt for Gulf of Taranto. The analytical results were compared with the published results for other coastal areas in the Mediterranean Sea. PAHs levels in the Gulf of Taranto sediments were the highest in the Mediterranean sea, while PAHs concentrations in Mar Grande were higher than the ones reported in the Adriatic and Cretan Sea and with the same order of magnitude of the ones known for coastal areas of the Western and the Eastern Mediterranean Sea. PAHs concentration ratios were consistent with the main source of these compounds, in most areas, being pyrolysis. Based on the comparison of both the individual

and the total PAHs concentrations with proposed sediment quality guidelines, the acute biological effects on the marine organisms were probable, especially for the Gulf of Taranto, in which almost all PAHs concentrations in sediments were higher than the guidelines limit values.

Concentrations of metals (mercury and methylmercury, selenium. cadmium, lead), chlorinated pesticides and polychlorinated byphenyls (PCB) have been determined in tissues and organs of Stenella coeruleoalba dolphins beached along the Adriatic and Ionian coasts of Apulia (Southern Italy). The results obtained confirm that in Mediterranean dolphins the accumulation of contaminants is higher than in similar species living in the Atlantic.

Data are available also for tributyltin (TBT) and its derivatives, defined as the most toxic compounds deliberately released into marine environments by man. The presence of these chemicals in marine environments is mainly due to a massive use of antifouling (AF) paints incorporating TBT as a biocide. TBT-based AF paints are recognised as being the most effective coatings in protecting boat hulls against the settling of fouling organisms, and not surprisingly, since their introduction on the market, in the late 60s, they have gained popularity, especially for application on recreational boats. The negative effects that organotin compounds cause to non-target marine organisms (Terlizzi et al., 2001) have forced many governments to contain their use. To date, in Italy, as well as in all EU countries, USA, Australia, and New Zealand, the use of TBT is severely restricted, although not completely banned. Since the introduction of these regulations, efforts have been made to adequately assess their effectiveness in reducing TBT contamination. A study carried out in 10 Marine Protected Areas along the coast of Italy showed that very low values were recorded at Tremiti Islands, Torre Guaceto and Porto Cesareo, along the coast of Apulia.

Knowledge gaps:

Knowledge of the levels of contaminants in the marine environment has not yet reached adequate levels . The Water Framework Directive provides relevant information about the partial matrices environmental and analytes to be investigated. The chemical classification of water bodies is carried out with respect to values of environmental quality standards (EQS) set up at European level for the water matrix, the Member States are free to define EQS in other matrices and perform the monitoring function of these. Italy in particular, is the only country so far to have defined EQS for marine and coastal sediments (DM 260/2010), although the regions have the opportunity to choose the matrix environment with which to classify the water body. Therefore the latter is in fact classified on the basis of the analysis performed only on a matrix . In addition, the current monitoring programs are lacking for what they relate from the evaluation of the biological effects of contaminants , as understood by the MSFD.

In general, the main information gaps are as follows:

- the absence of data on discharges of petroleum hydrocarbons resulting from maritime traffic;
- insufficient information of atmospheric deposition in the sea;
- insufficient information on the concentration of contaminants in water, it is hoped the planning of monitoring specific to the needs of the MSFD;
- the absence of data regarding the presence of contaminants in the benthic communities associated with the predominant habitats; insufficient information relating to the bioaccumulation of contaminants in bivalve; practically no information on effects (biomarkers) the presence of contaminants in organisms associated with predominant habitats;
- insufficient information regarding the presence of contaminants in the majority of species belonging to the functional groups listed in the Directive; practically no information on effects (biomarkers) the presence of contaminants in organisms associated with functional groups.

Consideration on temporal and spatial scale

The temporal scale selected for assessing against GES under Descriptor 8 should allow a representative evaluation, i.e. the sampling strategy should minimise bias through short term variations and natural variability and it should allow the observation of trends of contaminant concentrations over an appropriate time scale.

In marine regions and sub-regions, covering large areas and with contaminant inputs being buffered by large watersheds, changes can often only be observed on longer temporal scales. Annual mean contaminant concentrations can be examined for possible time trends using appropriate statistical techniques.

In many instances, there are variations in contaminant content by season due to several abiotic (temperature, lighting, waves, currents) and biotic (qualitative and quantitative changes in the available food, growth rate, reproduction) parameters. Particularly for lipophilic organic contaminants in biota, as an example, the lipid content. In order to minimise the impact of such changes, sampling of fish and shellfish should take place annually, at the same time each year and outside the spawning period. Further reduction in variance may be obtained by expressing concentrations on a lipid-weight basis. Depending on the selected matrix for monitoring, seasonal changes in hydrometeorology, such as effects arising through seasonal patterns of enhanced rainfall may need to be taken into account.

There can be substantial variability between contaminant concentrations in individuals of the same species, particularly when uptake is age- or size-related. In order to obtain robust estimates of the mean concentration of a contaminant and the variability, a number of individuals of a species should be taken from a single location to form a sample. Tissues from these can be analysed individually or pooled, homogenised, and a subsample analysed.

The spatial scale of assessment and reporting of environmental status are of major importance. The scale may be different among the descriptors as the affected environmental compartments may differ. It will be important that the scale allows the observation of the functioning of ecosystems at the level where it might be compromised.

While certain aspects of GES under Descriptor 8 are being affected at very large scales, as e.g. the pollution by long range transport of persistent pollutants, other impacts occur at a more local scale. It is well known that point sources of contamination exist in marine waters. Hot spots, e.g. drill cutting sites, mining sites, dredge spoil disposal sites, munition waste sites or other locally impacted areas will, due to their small spatial extension of typically no more than only few kilometres, not influence an assessment at subregional scale. Their assessment can be of importance in order to examine the pressures deriving from them at larger spatial scale.

Links with other descriptors

The various descriptors of Good Environmental Status (GES) are closely linked with each other. Descriptor 8, dealing with effects caused by contaminants, has its closest links with Descriptor 9 on seafood as contaminant concentrations in marine species may give rise to concern not only for human consumption, but also to broader aspects of ecosystem integrity.

Descriptor 10 on marine litter is related to Descriptor 8 as litter may release contaminants, or due to the interaction between pollutants and litter, and also as the distinction between contaminants and litter may not be immediately clear for certain types of waste. Chemical pollution may affect biodiversity (Descriptor 1), the integrity of food webs (Descriptor 4) and sea-floor ecosystems (Descriptor 6), which are therefore closely linked.

5.9 D9 Contaminants in seafood for human consumption

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Descriptor 9 considers the presence of hazardous substances (i.e. chemical elements and compounds) or groups of substances that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances which give rise to an equivalent level of concern,

in wild caught fish, crustaceans, molluscs, echinoderms, roe and seaweed harvested in the different (sub) regions destined for human consumption against regulatory levels set for human consumption (Task Group Report, 2010). The methodology for Descriptor 9 is mostly based on Commission Regulation EC 1881/2006, which sets up maximum levels for certain contaminants in food stuffs (including fish and seafood). Good Environmental Status is achieved if all contaminants are at levels below the levels established for human consumption or showing a downward trend (for the substances for which monitoring is on-going but for which levels have not yet been set). Assessment is based on the levels, number and frequency of contaminants (Criteria 9.1), on the actual levels of contaminants that have been detected, on the number of contaminants which have exceeded maximum regulatory levels (indicator 9.1.1) and on the frequency of regulatory levels being exceeded (indicator 9.1.2).

Because the occurrence of human health effects would probably also involve a major pollution effect, there is a direct link with descriptor 8 (Contaminant concentration) and thus indirectly, all descriptors influencing descriptor 8 might also touch on Descriptor 9. According to the Italian reporting for Initial Assessment, information on contaminants in seafood is still very scarce and scattered.

5.9.1 Main threats

As reported for descriptor 8, contaminants in the marine environment can derive from numerous anthropogenic sources such as land-based industrial activity, riverine inputs, pollution by ships, atmospheric deposition, oil, gas and mineral exploration and exploitation, dredging and dumping of unwanted munitions. Contaminants can enter marine food webs and can undergo processes of bioaccumulation, as their concentration increases in living organisms as they take in contaminated air, water, or food, as well as biomagnification, as substances become concentrated in tissues or internal organs as they move up the food chain. Therefore, there is rarely a well-defined established simple quantitative link between levels of contaminants in marine environment and levels in fish and other seafood.

According to a regional environmental assessment of risk in achieving Good Environmental Status (Breen et al., 2012), D9 represents a low risk for GES in the Mediterranean as a whole, which means either that "levels of contaminants in edible tissues do not currently exceed regulatory limits anywhere in the Mediterranean region" or that "regulatory levels are rarely exceeded in large areas of the Mediterranean region". Taking into account temporal trends in heavy metals, according to the UNEP report on The State of the Marine Environment (UNEP/GPA, 2006), the flows of industrial heavy metals, such as mercury, which increased by 300 per cent between 1950 and 1990 (unep/map/medpol 2003), now show falling levels for cadmium, mercury and lead in blue mussels and fish (eea2003), as determined over the past 15 years.

5.9.2 Main features at AIM scale

In general, the Adriatic Sea is relatively unpolluted to moderately polluted at specific areas such as the coastal zone of larger cities (Venice, Split), industrial/mining areas (Gulf of Trieste) and river mouths (Po, Neretva). Large cities are critical sources of pollution, since most of the hazardous substances and "hot spots" are located in their neighbouring sediments. In particular metal industries accounts for major emissions of several heavy metals, such as air emissions of cadmium, lead or chromium and emissions to water of cadmium, nickel and zinc; chromium to water is instead mainly emitted by oil refining followed by the fertilizer and tanning industry (SHAPE, 2013). Metal concentrations in the sediments and marine organisms of the Adriatic are affected by the vicinity of land based pollution sources, such as the major urban and industrial agglomerations and the discharge of the major rivers (Po, Neretva). In the Venice lagoon (Italy) contamination mainly originates from the activities of the industrial district of Porto Marghera and the domestic sewage of the city of Venice (Pavoni et al. 1998).

Among the most relevant contaminants, mercury is the most widely studied. It is generally acknowledged that the Mediterranean Sea represents a geological hot spot for mercury (Hg): about half the world's Hg resources are located in this area, with abundant deposits in sites facing the Italian seas (Covelli et al., 2012; Grassi and Netti, 2000; Martinez-Frias et al., 1998; Moldenhauer et al., 2008) (Figure 5-74). Mercury into the marine environment is recognized as the main determinant of the bio-magnification of its predominant organic form – methyl mercury (MeHg) – in Mediterranean seafood from different trophic levels (UNEP, 2002; FAO/WHO, 2011). Recent papers have focused on biota sampled from Mediterranean industrial hot spots in Southern Italy, such as the gulf of Taranto (Di Leo et al., 2010; Spada et al., 2012) and the Augusta basin (Gabellini et al., 2011). The findings indicate that the presence of MeHg in local seafood of a low trophic level may represent a potential health concern for the population. Monitoring conducted on several commercial target species in the Central Adriatic showed that 25% of all samples of commercially important Norway lobster (Nephrops norvegicus) exceeded the maximum limit fixed by Commission Regulation (EC) No 1881/2006 (Perugini et al., 2009). On the other hand, along the eastern coasts of the Adriatic, several local studies report that concentrations of metals and organochlorine compounds measured in seafood were well below the maximum residue limit indicated by the European Union (Storelli et al., 2007; Stanković et al., 2011; Jureša and Blanuša, 2003). Within the food web, the highest mercury and arsenic concentrations were found in hake (Merluccius merluccius) and the lowest in mackerel (Scomber scombrus); ead and cadmium concentrations were about 10 times higher in shellfish than in analysed fish. The highest lead and cadmium concentrations were found in mussel (Mytilus galloprovincialis) and the lowest in hake. The concentrations of several analysed elements were below acceptable levels for human consumption set by the Croatian Ministry of Health, except for total arsenic and the estimated intake of those trace elements through seafood consumption by the general population did not exceed the provisional tolerable weekly intake recommended by the Joint FAO/WHO Expert Committee on Food Additives (Juresa et al. 2003).

With regard to other contaminants, the distribution of synthetic chlorinated pesticides and industrial chlorinated hydrocarbonsan such as DDTs and PCBs, along the Italian coast of the Adriatic is almost uniform, with the notable exception of the interior of lagoons and areas near the mouths of the Adige and Po rivers (Picer, 2000) and comparison of data reported for DDTs and PCBs levels in different environmental compartments of the Adriatic Sea over the last two decades shows a substantial decline in these compounds (Picer, 2000). The aggregated assessment of hazardous substances in biota shows generally low to moderata concentrations in the AIM (Figure 5-75).

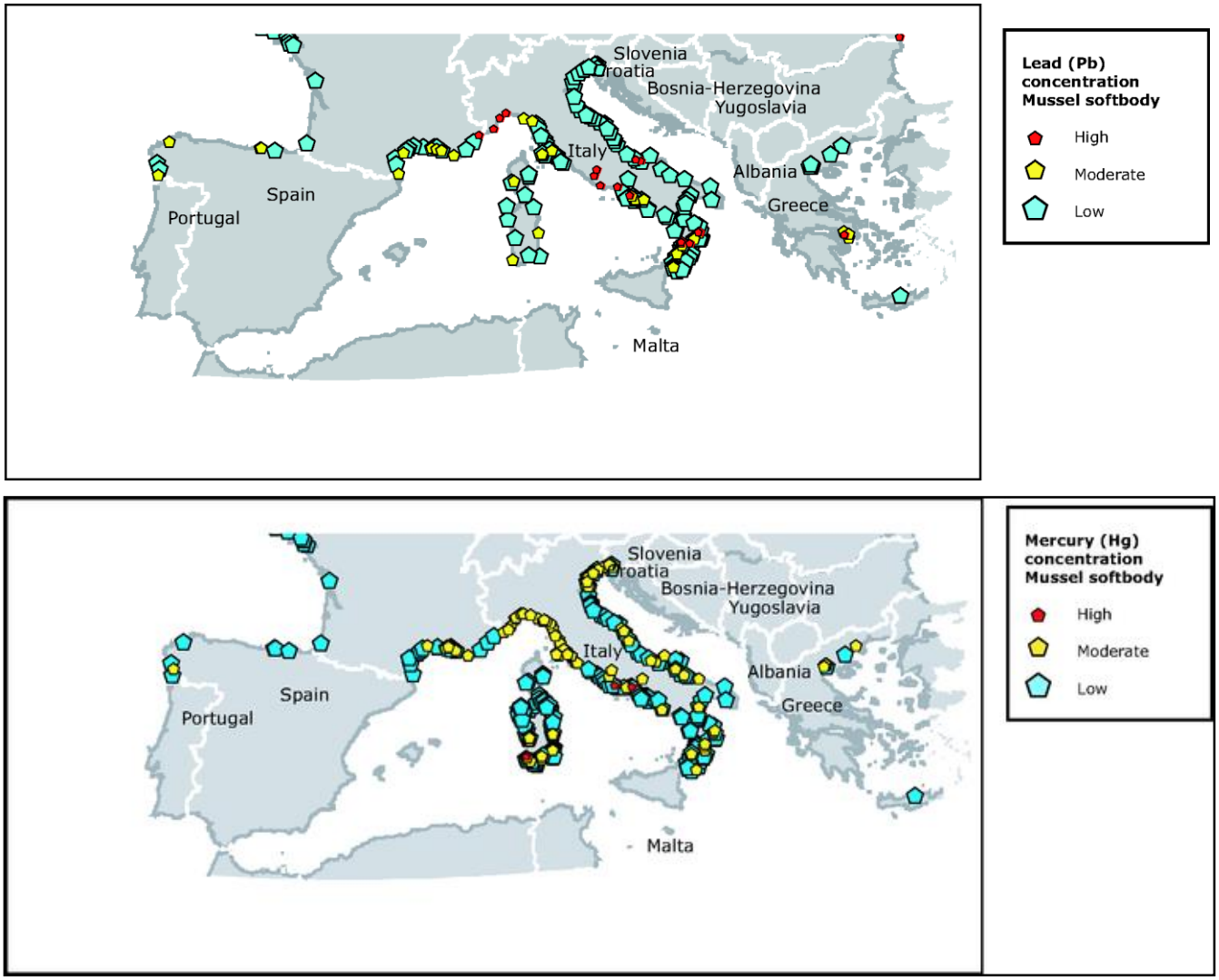

Figure 5-74 Heavy metals in mussels (Mytilus edulis), median concentration 1996-2002 European Environment Agency (EEA), 2006

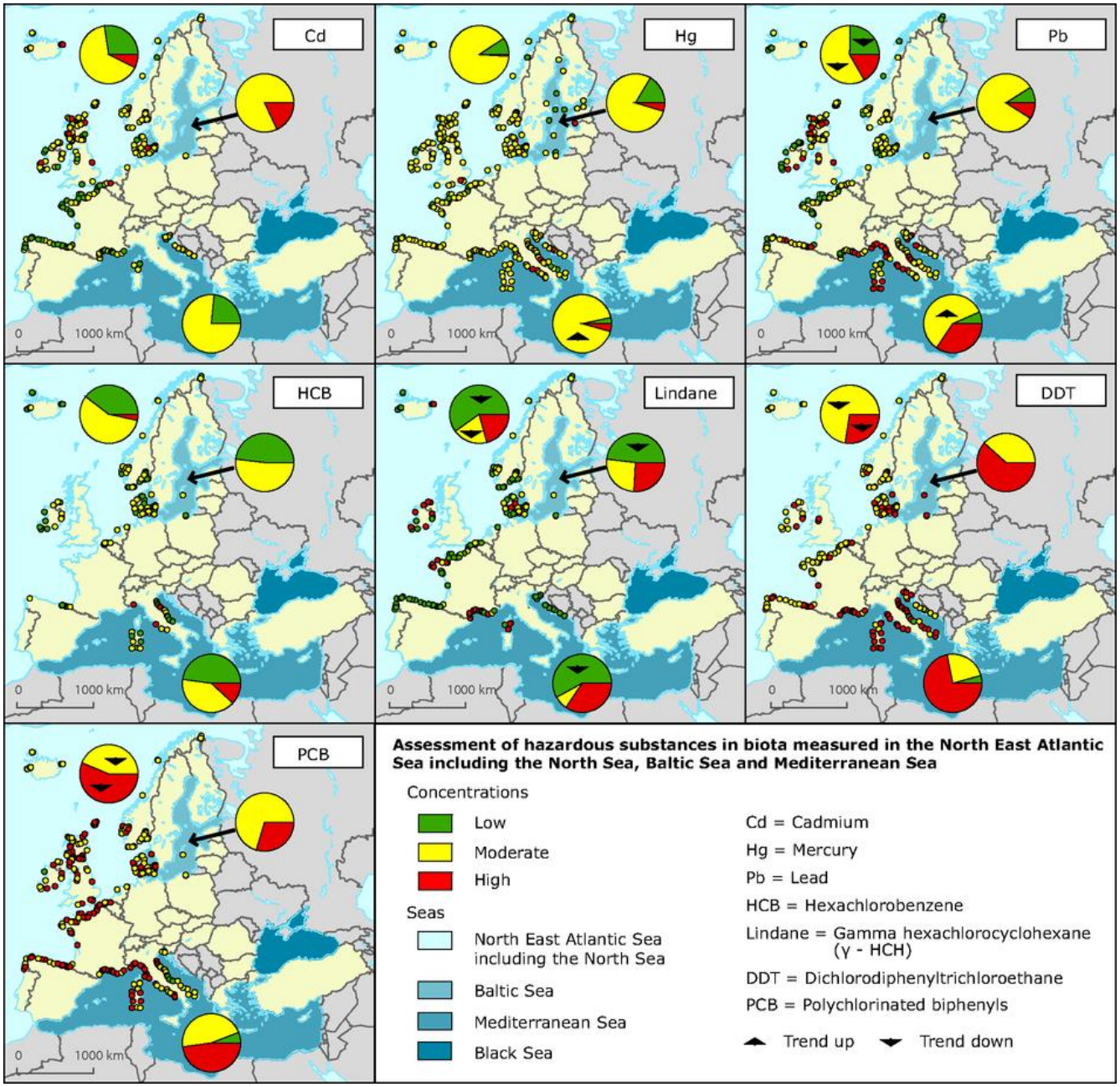

Figure 5-75 Aggregated assessment of hazardous substances in biota measured in the North East Atlantic, Baltic Sea and Mediterranean Sea; 1998-2010. Data source: Waterbase - Transitional, coastal and marine waters provided by European Environment Agency (EEA, 2011)

5.9.3 Specific features of Focus Area 1:

Mercury and Pb presented increased concentration in the near shore surface sediments of the Gulf of Trieste (HgT 0.06-0.88 µg/g dw, Pb 10-37 µg/g dw, Planinc et al., 1993) and they showed a strong north to south gradient due to the influx of Hg and Pb-rich suspended riverine matter from the Soča river which drains the Idrija Hg and Predil Pb mining areas, which have been the largest contributors of Hg into the northern Adriatic Sea since the 16th century although these mines have been closed in the last decade of the 20th century. Mercury levels are also high in mussels and fish ranging from 18 to 51 µg/kg fresh weight in mussels and from 330 to 1410 µg/kg fresh weight in fish (Tušnik et al., 1989). In Kastela Bay (Croatia) Hg

concentrations in mussels Mytilus galloprovincialis ranged from 300 to 410 ng/g dw, while in most other coastal areas in Croatia they were significantly lower (30.4 – 142 ng/g dw). Cadmium concentrations in Mytilus galloprovincialis in the coastal zone of Croatia ranged between 0.09 and 0.48 µg/g, the highest values been recorded at stations in Rijeka area, Brestova, Omiš, Ploče and Rijeka Dubrovačka. Lead concentration in the same organisms were in most cases below 1 µg/g dw (the maximum permissible limit) except samples from Rijeka and Pula (5.5 and 5.1 µg/g dw respectively), which are at the vicinity of relatively big cities with strong traffic (NDA Croatia 2003).

With regards to the Slovenian coasts, there is little information available on pollutants in marine organisms used for human consumption. Concentrations of major pollutants generally do not exceed the legislative limits; therefore, the situation is assessed as good, but the reliability of the assessment is low. The aim is to maintain a good state.

Concentrations of metals and some other trace elements were determined in the following organisms used for human consumption: Mediterranean mussel (Mytilus galloprovincialis), mantis shrimp (Squilla mantis), European anchovy (Engraulis eucrasicolus), European pilchard (Sardina pilchardus), mackerel (Scomber sp.), flathead mullet (Mugil cephalus) and sea bass (Dicentrarhus labrax). All marine organisms were caught/harvested within the monitoring programme carried out by the Fisheries Research Institute of Slovenia.

5.9.4 Specific features of Focus Area 2:

The presence of the heavy metal contaminants, as Cd, Pb and Hg, was recently investigated in bivalve molluscs such as mussels (Mytilus galloprovincialis), clams (Venus gallina) and oysters (Ostrea edulis) through a survey was carried out on 334 samples addressed to the Istituto Zooprofilattico Sperimentale – Puglia e Basilicata, Foggia (ITALY) between 2009-2011, and collected by official authorities along the coasts of Apulia Region. The conformity of heavy metal content in bivalve molluscs was verified, in according to EC Reg. 1881/2006. The compliance was found for the total amount of samples. The obtained data on heavy metals concentration in bivalve molluscs were compared with data found in monitoring studies on the incidence of heavy metals in 1981 in North-Western Mediterranean Sea, in 2003 in Tyrrhenian Sea and in 2010 in Pacific Ocean (Chile), reported in literature. The information obtained from this work offer an essential database, not only for the authorities involved in food control, but also for the official institutions responsible of a constant control of the marine ecosystem pollution.
Different results were obtained from a monitoring program, started during 2008 by the Apulian Regional Agency for Environmental Prevention and Protection (ARPA Puglia) in collaboration with the CNR-Institute for Coastal Marine Environment of Taranto, and carried out for the monitoring of the coastal water quality, using mussels as bioindicators, and the identification of contamination spatial trends, including both south-western Adriatic and Ionian areas. Mussels were sampled in 11 stations located along the marine coastal and transitional waters of the Apulian region. The analyzed contaminants were heavy metals, chlorinated pesticides, chlorinated solvents, organophosphate pesticides, polychlorinated biphenyls, polybrominated diphenyl ethers (PBDEs), alkylphenols, polycyclic aromatic hydrocarbons and organotin compounds. Results were also compared with national and international regulations. The maximum concentration of mercury (0.29 mg kg(-1) d.w.) was found in the Mar Piccolo. Concerning chlorinated pesticides, only 4,4' DDE was found with the maximum concentration in the Mar Piccolo (second inlet) and near the mouth of Ofanto River (26.9 and 18.7 mu g kg(-1) d.w. respectively). The sum of PCB congeners ranged from 2.2 (mouth of Candelaro River) to 383.8 mu g kg(-1) d.w. near the mouth of Galeso River. These studies together with other monitoring programs indicate that contamination by organochlorine compounds is higher in mussels sampled in the Ionian Sea than in those from the Adriatic Sea, with PCB levels up to seven times higher in mussels from Ionian than from the Adriatic Sea. Although PCB levels were above the maximum values indicated by both European Community (EC) and National regulation in several sample sites, the PCB concentrations were particularly high in some stations, suggesting that these locations require a much specific attention. Conversely, results

on the mussel contamination by PBDEs highlight their ubiquitous environmental distribution, and underline the need to establish the maximum level for these compounds in foodstuff, according to European Regulations.
In addition, total mercury (THg) and methylmercury (Me-Hg) concentrations were determined in mussels (Mytilus galloprovincialis) from 10 stations located in the Mar Piccolo of Taranto (Ionian Sea, Taranto Gulf) an important semi-enclosed basin in Italy, devoted to mussel culture activities. The obtained results show that THg and Me-Hg concentrations ranged from 0.236 to 0.559 μg g−1 d.w. and from 0.066 to 0.155 μg g−1 d.w., respectively. Consequently, the Me-Hg/THg ratios ranged from 17% to 49%. The dietary intake of THg and Me-Hg were studied among children and adults from Taranto (Southern Italy). The estimated weekly intake for THg and Me-Hg was below the Provisional Tolerable Weekly Intake (PTWI) established by European Food Safety Autority (EFSA) for all sampled mussels, though their consumption provides a THg intake in children near the PTWI. Results show that health risks due to the dietary THg intake for children especially for fisherman's son of Taranto population cannot be excluded. Overall, the area of Taranto represents an hot spot for this variable and should be carefully monitored.
The concentrations of 137Cs in the waters of Ionian-Adriatic sea range from 2.2 to 12.7 Bq/m3 whereas the mean value is 4.23 Bq/m3. The available values for 137Cs in sediments for the assessment area are from Patras Gulf and range from 1.9 to 11.5 Bq/kg with the mean value being 4.5Bq/kg. For the mussel Mytilus galloprovincialis the mean value is 0.18 Bq/kg. The Committed Effective Dose (CED) delivered to humans through the annual fish consumption is calculated to be 0.08 μSv (mean value) which represents only a very small fraction of the total annual allowable dose of 1 mSv due to all possible sources and pathways.

5.10 D10 Marine litter

D. Scarcella, P.K. Karachle, S. Mezek

Marine litter has been an issue of concern in the Mediterranean since the 1970s. Within the framework of the Convention for the Protection of the Mediterranean Sea against Pollution (the Barcelona Convention), Mediterranean countries adopted the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources and in Annex I of this Protocol, litter is defined as one of the categories of substances: "Litter as any persistent manufactured or processed solid material which is discarded, disposed of, or abandoned in the marine and coastal environment." (UNEP, 2009).

In particular, with the definition "marine litter" we refer to litter washed ashore and/or deposited on coastlines, litter in the water column (including floating at the surface), deposited on the seafloor, micro-particles, in particular micro-plastics and litter ingested by marine animals (Decision 2010/477/EU on criteria and methodological standards on good environmental status of marine waters).

Though obviously there is an important correlation between different maritime uses and the production of marine litter, the relevance of the theme for MSP has to be addressed in a right way in order to be considered in the scheduled planning scheme. Limiting marine litter production coming from maritime activities can be done through appropriate sectoral policies and regulations (waste management control for coastal cities or cruise ships, good practice for waste collection from trawling fishing, etc.) , nevertheless ad hoc analysis on marine litter can be scheduled in ADRIPLAN whenever (regional) planning scenarios to be developed will require it.

In the present document some framework information on marine litter are included in order to be considered as environmental priority issues while considering the environmental footprint of maritime and coastal activities. With the exception of some punctual local programs, mostly organized by environmentalist associations, marine litter pollution is commonly a neglected issue and there is a lack of specific and homogeneous monitoring programs along the Mediterranean coasts. Available data show that floating litter of anthropic origin in the Mediterranean coasts is mainly composed by plastics and those areas of accumulation are

mainly found close to river outlets. Regarding to litter deposited on the seabed, data coming from the Mediterranean Trawl study (MEDITS) for the monitoring of fish stocks indicate that areas with high concentrations of litter are influenced by hydrodynamic conditions, canyons, winds and rivers. It appears that data on marine litter distribution in the Mediterrenean are not yet available, at least for Italian side, since almost all the proposed targets require a period of refinement and are not immediately operating (ISPRA 2013). Those related to marine litter along the coast and on the seabed will be start between 2014 and 2018, depending mainly on the availability of funds specifically dedicated by the development of activities and collection procedures. It is also necessary to define bodies, Institutions and Individuals (eg consortia collection and recycling) involved in the process of collection, transfer, disposal and recovery of the material collected. The operation of the proposed targets for the microplastic on the surface of the sea and marine litter in biota cannot be guaranteed before 2018 (ISPRA, 2013).

So, while the collection of quantitative data on marine litter is in progress, there is still a need for further development of several indicators, notably those relating to biological impacts and to micro-particles, as well as for the enhanced assessment of their potential toxicity.

In this scenario, the issue on the types and amounts of marine litter in the Mediterranean is acquiring more and more importance and it is addressed principally by sub-regional and local authorities in most countries. Also, a relatively systematic and reliable source for amounts and types of litter come from existing NGO initiatives at local level. The quantitative information coming from this kind of initiatives cannot necessarily be exhaustive since they can be dependent also in the participation of NGO volunteers. Reflecting on the need to fill data gaps as well as the aims of involving citizens in environmental issues such as marine litter, the European Environment Agency (EEA) has developed the Marine LitterWatch (MLW). This approach combines citizen engagement and modern technology to help tackle the problem of marine litter and will help to quantify "trends in the amounts of litter washed ashore and/or deposited on coastlines, generally referred as "beach litter", including analysis of its composition, spatial distribution and, where possible, source" that is proposed as a main indicator for marine litter pollution (JRC, 2011).

Indeed, litter on the coastline is one of the most obvious signs of marine litter pollution. Major land-based sources include tourism, recreation, illegal dumping, waste disposal sites, input from rivers, sewage and storm water outflows. Major sea-based sources are commercial shipping, fisheries activities, pleasure crafts and off-shore installations (JRC, 2011).

5.10.1 Main threats

Surveys of litter stranded on the coastline are a primary tool for monitoring the load of litter in the marine environment and have been used world-wide to quantify and describe marine litter pollution. They can be used to measure the effectiveness of management or mitigation measures, identify the sources and activities leading to litter pollution and determine threats to marine biota and ecosystems (Cheshire et al., 2009).

Some data on composition and source of beach litter can be found in the results of International Coastal Cleanup (ICC) campaigns carried out in the Mediterranean in 2002-2006 and elaborated by Hellenic Marine Environment Protection Association (HELMEPA), reported in Table 5-4.

Item	Counts	Percent
Cigarettes/cigarette filters	222,563	27
Cigar tips	86,146	10
Plastic bottles (2 L or less)	81,238	9.8
Plastic bags	70,912	8.5
Aluminum beverage cans	63,282	7.6
Caps/lids	60,920	7.3
Beverages bottles (glass)	48,085	5.8
Cups/plates/forks/knives/spoons	32,037	3.8
Tobacco packaging/wrappers	23,648	2.8
Food wrappers/containers	21,029	2.5
Straws/stirrers	17,184	2.1
Pull tabs	15,488l	1.9

Table 5-4 'Top 12' marine litter items in Mediterranean ICC campaigns (2002-2006). From UNEP, 2009.

The collected litter has been associated to the sources represented in Figure 5-76.

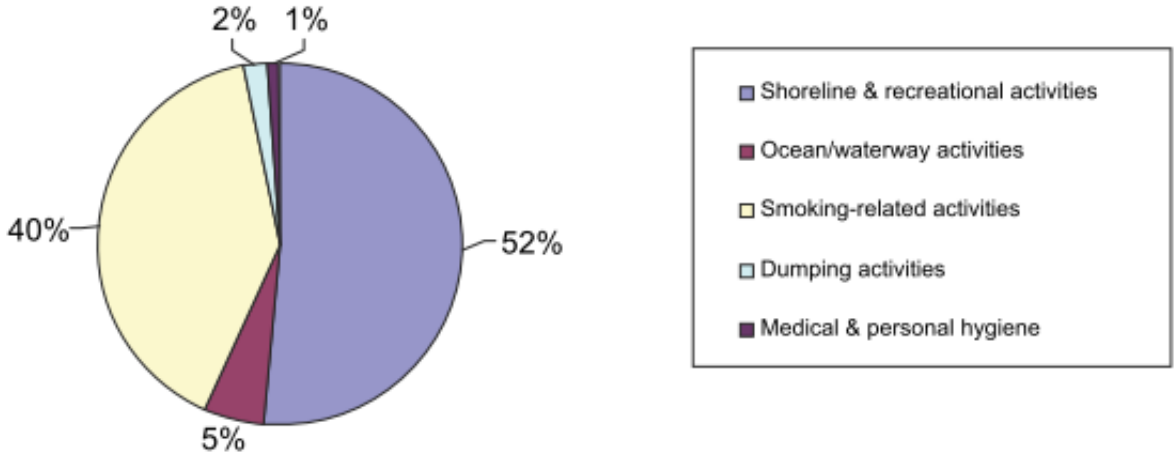

Figure 5-76 Sources of marine litter from Mediterrenean ICC campaigns. (2002-2006). From UNEP, 2009

The issue of litter coming from shoreline and recreational activities has to be carefully managed if scenarios including coastal and maritime tourism development will be scheduled further on in the project.

Finally, since cruise tourism is one the most promising maritime activities in the Adriatic Ionian Macroregion, it is important to address also to waste management control for cruise ships.

A 3,000 passengers cruise ship generates the following amounts of waste on a typical one-week voyage:

- 3,800 m^3 of 'grey water';
- 800 m^3 of sewage;
- 100 m^3 of oily bilge water;
- Almost 0.5 m^3 of hazardous or toxic waste;
- 50 tons of garbage and solid waste;
- Diesel exhaust emissions equivalent to several thousand automobiles;

• Large quantities of ballast water, which can introduce invasive species (a typical release of ballast water amounts to 1000 tons). (Source: Surf Rider foundation, NL).

This issue will be carefully managed if scenarios including cruise tourism development will be scheduled further on in the project.

5.10.2 Specific features of Focus Area 1:

There is a significant lack of data on marine litter in the whole Macro Area. Some studies have been carried out in the Gulf of Trieste and along the Slovenian coast, basically only in order to raise public awareness of this problem. So far, a comprehensive assessment of the state of pollution of the marine environment by solid waste of human origin has not been possible, because too little data are available for a reliable assessment of the situation. The operational objectives of reducing waste in the marine environment are, in the first phase, focused on waste resulting from fisheries, mariculture and tourism, since these activities certainly generate marine waste. A large proportion of waste accumulating in the marine environments is brought by rivers.

Initial measurements were performed for waste in the water column, while the waste on the seabed has not been dealt with yet. Some information was obtained on the impact of waste on the marine ecosystem, as the presence of marine waste in the digestive tract of sea turtles (*Caretta caretta*) was confirmed. It is particularly important to observe the trend in the occurrence of microplastics in the marine environment, which must remain at the same level or demonstrate a downward trend compared to the baseline year of 2011 when the first measurements were carried out in Slovenia.

5.10.3 Specific features of Focus Area 2

There is no accurate information on the impact of litter on marine organisms and habitat in Focus Area 2. However, the great amount of plastics and other marine debris found in the gut contents of turtles and cetaceans indicates this issue is of great concern and must be addressed in the area. Based on studies on marine litter in the southern Adriatic-Ionian Sea, the majority of which focus on items found on beaches and the continental shelf seabed and to a lesser extend on floating items, it constitutes a serious problem. The Hellenic Marine Environment Protection Association (HELMEPA) reports that the volume of marine litter collected in the Greek Ionian-Adriatic coastline seems to be in constant levels and not increasing as in other parts of the county, with a mean of 136 kg/km. The composition of marine litter in the area is presented in figure 5-76.

5.11 D11 Energy, including underwater noise

R. Mosetti, M. Lipizer, P.K. Karachle, S. Mezek

Energy input can occur at many scales of both space and time. Anthropogenic sounds may be of short duration (e.g. impulsive) or be long lasting (e.g. continuous); impulsive sounds may however be repeated at intervals (duty cycle) and such repetition may become "smeared" with distance and echoing and become indistinguishable from continuous noise. Higher frequency sounds transmit less well in the marine environment (fine spatial scale) whereas lower frequency sounds can travel far (broad spatial scale). There is however great variability in transmission of sound in the marine environment. Organisms that are exposed to sounds can be adversely affected over a short time-scale (acute effect) or a long time-scale (permanent or chronic effects). Adverse effects can be subtle (e.g. temporary harm to hearing, behavioural effects) or obvious (e.g. worst case, death). These considerations have been described above in relation to sound, but can equally apply to other types of energy. With sufficient resources

and research, it might be possible to develop indicators for these many facets of harm from energy input; however the initial indicators described below focus on sounds that affect relatively broad areas rather sounds that affect local parts of the marine environment. High amplitude, low and mid-frequency impulsive anthropogenic sounds are those that have caused the most public concern, particularly in relation to perceived effects on marine mammals and fish. These sounds include those from pile driving, seismic surveys and some sonar systems. Laboratory studies have found both physiological and behavioural effects in a variety of marine organisms, while field studies have shown behavioural disturbance and in some cases death (physiological effects are difficult to study in the field). There will be a variety of degradation gradients caused by such noise, the scale of these depending on the marine organism under consideration and the loudness, frequency and persistence of the sound. In principle, sound input is likely to have greater adverse effects at higher sound amplitudes (loudness) and with a greater number of inputs (persistence). Lower frequency sounds will affect a wider area, but this is complicated by the ability of organisms to detect a limited range of sound frequencies; sounds outside their range of detection will be less likely to have an adverse effect. Depth sounding sonar systems on small vessels typically use frequencies between 50 and 200 kHz. Sonar usage, particularly on leisure boats, is increasing and is unregulated. These vessels tend to operate in coastal areas throughout the EU; these waters are often important for some marine mammals. These animals use frequencies up to about 180 kHz for communication and thus there is an overlap in frequency usage. There has been little research on the effects of these sonar systems and the scientific evidence for adverse effects is limited. However, the sounds are similar to those used in acoustic alarms (pingers) that are designed to scare away small cetaceans from gill and tangle nets used in the fishery, and can therefore be expected to cause adverse effects. The following table (Table 5-5) shows the typical frequency bands produced by mammals (Table 5-5) and fish, compared also with sound produced by commercial shipping (Figure 5-77).

Species	Frequency range (kHz)	Distance (km) of recording
Sperm whale	0.1 - 30	37
Bowhead whale	0.025-3.5	17
Humpback whale	0.02-8.2	15 / 160 (2 studies)
Fin whale	0.01-0.75	> 20
Blue whale	0.012-0.39	600 / 1,600 (2 studies)

Species	Frequency range (kHz)	Active space (km)
Bottlenose dolphin whistle	4 - > 20	20-25 max, 16 average
Killer whale call	1 - 20	26
Sperm whale click	0.1 - 30	60

Table 5-5 Maximum distances from which marine mammals can be detected and estimated active spaces of some odontocete signals (taken from Janik 2005).

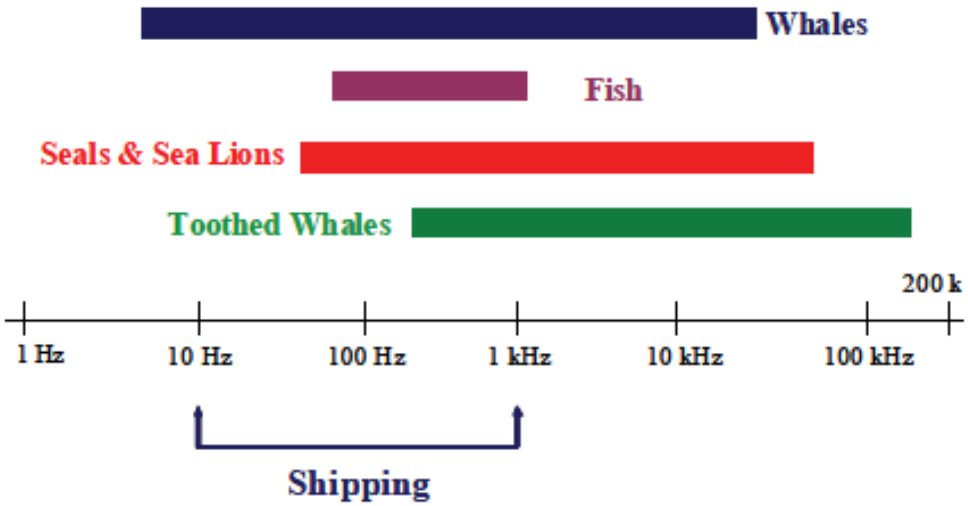

Figure 5-77 Typical frequency bands of sounds produced by marine mammals and fish compared with the nominal low-frequency sounds associated with commercial shipping (taken from OSPAR 2009b).

Possible and established effects of noise include physiological, perceptual and behavioural aspects such as: damage to body tissues, temporal and permanent hearing threshold shifts, impacts on non-auditory systems, avoidance or abandonment of preferred habitat, behavioural change, masking effects, including overlap between passive perception (orientation) and communication. Noise and also other forms of energy may include also temperature and electromagnetic fields (whose effects are insufficiently known). Two or three of these physical phenomena may happen simultaneously in some cases. For examples:

- Pile driving: noise and heat
- Undersea cables: heat and electromagnetic field
- Sonar: noise, heat and electromagnetic field

There are gaps in knowledge on the effects of submarine cables. In-situ measurements of the electromagnetic fields (including induced fields) emitted by operating cables of different types are not well known, including the consequences of operational and environmental variables, including burial depth. Several studies have shown that an increase of temperature of just 1°C can affect ecosystem balance. It would be particularly useful to understand the effects of relatively permanent sources of heat input, such as some power cables, on local flora and fauna. Observations should cover both the water column and the seabed.

This descriptor is related to the biodiversity descriptor (D1) as well as to the food web descriptor (D4). The energy descriptor is primarily a 'pressure' descriptor that could have effects on the biodiversity descriptor (especially distributional aspects – species abundance) and food web descriptor (especially functions of life communities, balance in species assemblages), of which both describe generally the 'status' of biological components.

5.11.1 Main threats

Shipping is the main contributor to the rise in background noise in European waters. Underwater noise is generated by most of the maritime activities present in thw AIM, and it is particularly associated to all kinds of navigation and to activities linked to oil and gas exploration. Due to high density of commercial and also cruise traffic, underwater noise is particularly intense in the proximity of the large ports of the North Adriatic. In the Slovenian sea, underwater noise is generated mainly by cargo ships and other vessels. In addition to continuous low frequency sound emitted by vessels, impulsive noise in the Slovenian waters, which is probably generated only by sonars and construction activities in the littoral zone (e.g.

installation of pile foundations), may also present a problem. Sonar systems of small vessels, which measure depth, represent a communication barrier for many marine mammals that use the same frequency to communicate with each other at long distances. Due to the small number of measurements performed so far, it is not possible to assess the trends or the spatial distribution of underwater noise. The impact on marine mammals (dolphins), fish and other organisms has not been studied. However, the results of underwater noise measurements show that the levels measured in the Slovenian sea are quite high and that they directly affect the behavioural characteristics of marine organisms.

For the Adriatic Ionian Macroregion, but also at regional level, a map of sources and/or effect of noise does not exist, however the main sources are ports, traffic routes, military sonar, offshore constructions, hydrocarbon and gas exploration, fishing and touristic resorts.

For the Mediterranen basin, energy introduction including noise represents a high threat to GES targets (Knights et al., 2011).

6. SWOT Analysis

L. Alfarè, D. Scarcella

Following the main results of the IA, a SWOT analysis on the key priorities concerning the marine/maritime uses has been developed. The aim is to sinthetize the large amount of information contained in the report having in mind the needs for the planning phase in terms of conflicts/synergies and priority maps to be produced. The issues analyzed are grouped according to the themes set up for stakeholder discussion initially used in the first stakeholder workshop held in Rijeka on 28 February 2014. The results coming from the workshops are also taken into account.

The analysis is reported for the AI Macroregion.

Transport: Routes and port infrastructures

Strenghts

Commecial transport

- Maritime transport (Short-sea shipping, deep-sea shipping, and passenger ferry services) is by far the largest maritime economic activity in the Adriatic and Ionian in terms of GVA and employment: 12 ports (Venice, Dubrovnik, Corfu, Bari, Split, Ancona, Ravenna, Trieste, Sibenik, Brindisi, Igoumenitsa and Rijeka) show growth for passenger movements and for ship calls in the last decade.
- Four Northern Adriatic ports (Koper, Rijeka, Venezia, Trieste) established the logistical platform of the North Adriatic Port Association (NAPA).
- High level of development of short sea shipping connections between Balkan to the Italian ports
- Five of the 10 Pan-European corridors (X, XI, IV, V, VIII) ends in AIM
- AIM proximity to the large market extending from the Balkan Peninsula to Central Europe.
- Increased awareness of citizens on the promotion and use intermodal transport
- Containers: Handled container volume increased during last years in AIM. The main port in container handling is Koper. Remarkable volumes are observed in the Italian ports of Trieste, Venice, Ravenna, Ancona and Taranto and in the Croatian port of Rijeka. Koper, Rijeka, Trieste and Taranto ports are integrated directly in the East-West line.
- Dry and liquid bulk: AIM is mostly specialized in dry bulk transport, whose largest volumes are observed in the port of Taranto (iron and steel products, grain and chemicals) followed by Ravenna, Bari, Venice, Koper and Ploce. For liquid bulk cargo the main port in AIM is Trieste that serves as the starting point for the crude oil Transalpine Pipeline.
- Ro-Ro: The main port for Ro-Ro traffic is Trieste (line between Trieste and Turkey). Also, remarkable figures are observed for the Greek ports of Igoumenitsa and Patras and the Italian ports of Ancona and Bari.

Cruise and passenger transport

- Only in Adriatic in 2012 there were almost 5 million passenger movements in the cruise ports and more than 16 million relative to ferry traffic
- AIM has a high share of cruise traffic, as it attracts about the 14.5% of tourists cruising at Mediterranean
- AIM is amongst the most active European regions in international passenger traffic as the 8% of all ship passengers are travelling from Adriatic-Ionian ports

- Cruise passenger flows are steadily increasing in the last decade and many ports can accommodate ships with high carrying capacity. Apart from the transit passenger flows, port of Venice accommodates remarkable homeport traffic. Significant volumes of cruise traffic are also observed at the ports of Dubrovnik, Corfu and Bari, since the annual passengers in these ports exceed 600k.

Weaknesses

Commercial transport

- Lack of synergies among EU Member States about legislation and cooperation
- Absence of large Trans-national logistic operators that could play leading role for uniting interested stakeholders
- Data on maritime transport in non-EU countries are spatially and temporally discontinuous
- Lack of commercial intermodality development: (1) Over-aged vessel fleet shipping in the area or inadequate port infrastructure to support fast modal shift, (2) Problematic port-hinterland connections, mainly with railway routes, (3) responsibility of more than one public authority in every country for logistic operations could arise inefficiently because of lack of coordination
- Lack of passenger intermodality development, including lack of one-ticket issuing information system developed, neither in involved countries nor integrated within Adriatic region.
- Competitiveness of AIM ports respect to north European ports because of relative long distance from the main Suez-Gibraltar sea-route and in terms of infrastructures and hinterland connections' quality.
- Container ports: container handling sector shows the lowest performance of cargo traffic. A relative lack of connections is observed at the ports of Bar, Brindisi, Durres, Ploce and Split which are only served by regional feeder services.

Cruise and passenger transport

- Seasonality: some passenger route not in operation during the winter period.
- 36% of the region's ports own a dedicated passenger terminal. Also the 36% can accommodate cruise ships with draught over 11 m. and less than 30% can accommodate ships with length over 350 m. (the last generation of cruise ships are exceeding 11m draught and 300 m. length).

Opportunities

Commercial transport

- Short Sea Shipping has been identified as the most promising activity in all AIM countries (with exception of Albania)
- Creation of PPP schemes, promoting smoother cooperation between private and public sector
- New potential trading routes due to Asian economy development, raise of cargo flow in the Mediterranean from/to Europe and improvement of Middle-East infrastructures
- Enable maritime traffic information exchange between national VTMIS20 systems.
- Enhancing administrative cooperation to simplify and harmonise burocracy for shipping
- Creation of maritime clusters and research networks as well as the formulation of a research strategy to spur innovation
- Increase efficiency and reduce the environmental impact of transport systems through alternative, sustainable and environmentally friendly combined transport solutions.

- Improve the culture of compliance in flag and port state control, liability and insurance of shipping, ship sanitation and control, accident investigation, cooperation for facing oil spills (through EMSA – European Maritime Safety Agency)
- The EU White Paper "Roadmap to a Single European Transport Area" underlined the huge potential that EU ports have for sustaining the economic recovery and contributing to the long term competitiveness of European industries; identify ten goals around three priorities for reaching a competitive and resource efficient transport, which corresponds also to the benchmarks for achieving the 60% GHG emission reduction target, by the year 2030, 30% of cargo transport travelling over 300 km, must be taken away from the road network and 50% by the year 2050 incentivizing in this way alternative transport means (including maritime).
- Developing environment-friendly fuels in marine transport as well as implementation of renewable energy sources in ports.
- Develop Ro-Ro transport "mode shift" from touristic transport to freight transport when tourist flow decrease.
- Optimization of Commercial transport Intermodality through railways and roads development and further coordination with the territorial planning and improving the multimodal transport connections, including logistics sector and workforce training.
- Better integration of public transport services, together with information and ticketing (multimodal passenger tickets)

<u>Cruise and passenger transport</u>

- Increase of cruise and passenger traffic: despite the relative lack of adequate infrastructure, cruise passenger flows are steadily increasing in the last decade and many ports can accommodate ships with high carrying capacity. Additionally, port authorities strengthen their networks among shipping lines and thus, tend to attract significant traffic.
- Passenger ferry services have been identified as the most promising activity in Croatia, Italy, Albania and Montenegro.
- Reducing isolation of islands and remote areas by improving their access to transport.
- Cooperation strategies of shipping lines operating in the region through joint services in order to overcome seasonality

Threats

- Congestion in main ports and routes
- Weakening of Regional economies depending on road transport
- Increase of Fuel price
- Non coordinated response to incidents involving major spills among AIM countries.
- Environmental impacts due to: (1) traffic congestion and enlargement of local ports in order to adequately accommodate the new mega cruise ships increase the risk for maritime incidents with great impact on sea-pollution and (2) expected increase in ship call and cargo turnover in the port
- Infrastructure obsolescence due to continuous advancement of the sector

Energy

Strenghts

- AIM is an European energy crossroad, given the geomorphology of the region and its central position in Europe.
- Most important pipelines are located offshore in central Italy and connect offshore gas production platforms with coastal power plants; in Croatian waters the main pipeline is the one connecting gas platforms offshore Istria peninsula with mainland
- The first offshore LNG terminal in the world has been built in the Northern Adriatic in the proximity of Porto Levante (province of Rovigo, Veneto Region)

Weaknesses

- As far as oil and gas deposits research, southern Adriatic has been little investigated compared with the northern Adriatic. There is a different approach in allowing research permit in Italy (whose issuing is actually stopped for environmental reasons) and Croatia (where the government auctioned seabed lots for private subjects)
- Presently there are no development plans for renewable energy (wind, tides and waves) within the AIM and there is no active offshore wind farm

Opportunities

- The framework 2020-2030 presented by the European Commission in January 2014 seeks to drive continued progress towards a low-carbon economy, aiming at ensuring affordable energy for all consumers, increasing the security of the EU's energy supplies reducing the dependence on energy imports
- The EU regulation No 347/2013 on guidelines for trans-European energy infrastructure provides criteria to identify cross-border projects eligible for EU funding under the "Connecting Europe Facility" financing instrument
- Significant investments are urgently needed to update and expand Europe's energy networks to achieve the Union's energy and climate policy objectives in terms of competitiveness, sustainability and security of supply

<u>Gas</u>

- Joint-Ventures for the exploitation of transboundary gas field, like "Annamaria" deposit exploited jointly by Italia-Croatia in the joint venture INA – ENI
- International energy interconnections, like ITGI (Interconnection Turkey – Greece – Italy), scheduling an offshore section (207 km), called the Poseidon Pipeline, in AIM, or TAP (Trans Adriatic Pipeline) on the transportation of natural gas from Azerbaijan via Greece and Albania to Italy
- Improve the sustainability related to the installation of offshore Liquefied Natural Gas (LNG) terminals

<u>Oil</u>

- Several energy pipelines are planned to bypass the Adriatic-Ionian Sea, thus serving the East-West energy chain (Pan-European Oil Pipeline –PEOP- starting from Constanta and ending to Trieste in Italy and AMBO pipeline starting from the Bulgarian Black Sea port of Burgas and ending to the Albanian port of Vlorë).
- Establishment of common rules for oil and gas research permits in AIM continental platform, taking into account sustainability and environmental aspects

<u>Offshore wind farms</u>

- Four investment companies have expressed their interest in developing offshore wind farms in Dapontia Islands and one in the area between the Amvrakikos Gulf and Lefkada Island and in the area of Molfetta and Brindisi. All applications are still in request.

Threats

- Reaching political agreement for the completion of transboundary pipeline projects
- Enviromental impacts of oil and gas exploitation (e.g. landslides, impacts on marine flora and fauna), LNG terminals (e.g. impact on fisheries), offshore Windfarms (e.g. landscape).

Coastal defense and protection and Climate change adaptation in coastal areas including sand deposits for beach protection and nourishment

Strengths

- Significant number of experience in protection works aimed at contrast coastal erosion in the Italian and Slovenian coastline
- Presence of offshore sand deposit in the continental platform, exploited only for very small quantity till now

Weaknesses

- Subsidence (especially in Emilia Romagna Region) due to the extraction of gas and water for irrigation.
- Change of coastal landscape due to the building of coastal defense structures
- Coastal erosion induced downdrift by some hard structures for coastal defence
- Possible eutrophication induced by coastal, riverine and atmospheric inputs agricultural, forestry run-off, municipal wastewater discharge and aquaculture, or influenced by dredging, sand extraction and coastal engineering which mobilize large amount of nutrients present in sediment pore waters.
- Lack of quantitative information on spatial and temporal variations of biodiversity in the north Ionian sea.
- Quantification of sand available in Mediterranean shelves deposit is not well known yet

Opportunities

- Formulating or strengthening integrated coastal zones management plans through coastal strategies coordinated with MSP
- Coordinated transboundary programs of geologic mapping to quantify the sand resource in AIM
- Beach and dunes maintainance (planned beach renourishment) programs for the promotion of beach tourism
- Promoting biodiversity protection, preserving the unique coastal ecosystem along with their habitat and species
- Mitigate the over-exploitation of the coastal resources
- Introduction of common adaptation measures to climate change, notably sea level rise and the increased storm frequency or magnitude
- Reducing marine litter and improve coastal waste management
- Preserving cultural and natural heritage

Threats

- Impacts of climate change, e.g. rising sea levels, changing ecosystems in lagoons, increased frequency and intensity of floods, introduction of alien and invasive species from warmer regions, and a decrease in some marine and coastal populations of fish and invertebrates
- Extinction of monk seal and dolphins due to human activities
- Loss of areas with economic value for coastal erosion, associated to the loss of natural defenses (natural sand dune) with coastal flooding
- Destruction of natural shoreline defenses, such as sand dunes and coastal ridges, for coastal urban development relating to commercial or touristic activities. These alterations degrade the beach stability, reduce the bulk of moving sediment and increase the erosive problems over urban settlements and roads
- Pressure due to population density (urbanization of coastal areas)
- Combination of local erosion trends and subsidence driven by natural and/or anthropogenic causes) can determine severe consequences for coastal floodings

- Saline water intrusion into the ground and surface waters in the coastal belt, negatively affect the potable water supply and agriculture
- Increase of invasive species due to ballast water
- Increase the Harmful Algal Blooms (HABs) phenomena
- Water quality degradation consequent to eutrophication including effects such Red Tides and excessive foam
- Increase of marine litter
- Desertification of rocky coast every year for destructive fishery of the mussel Lithopaga lithopaga (mainly in Croatia, Montenegro, Albania and Apulia)
- Increase of noise due to maritime traffic and Oil&Gas extraction
- Reduction of Posidonia meadows
- Excessive pumping of groundwater or gas, which may increase subsidence due to the lowering of piezometric surfaces of confined aquifers, as well as to compaction phenomena

Coastal Tourism
Strenghts

- AIM coastline, including the large number of islands, is a popular tourist destination
- Tourism sector is a driving force for AIM, attracting 10% of the total tourists visiting European destinations
- More than 600k people are employed in the tourism sector in which more than 150k of local units are active.
- Along the Adriatic/Ionian coast there are several UNESCO WHS (Croatia: the city of Dubrovnik, Diocletian's Palace of Split, Cathedral of S. Jacob in Sibenik, Stari Grad Plain on the island of Hvar, the Heuphrasian Basilic of Porec, the historic city of Trogir. In Montenegro: Cultural-historical region of Kotor. Italy: Archaelogical area and Patriarchal Basilica in Aquileia, City of Venice, Mosaics of Ravenna, Castel del Monte and Trulli of Alberobello. In Albania: city of Gjorokaster. In Greece: Old town of Corfù, Archaeological site of Olympia.
- AIM includes 3 out of 5 of the most developed Mediterranean countries for maritime tourism (Italy, Croatia and Greece).
- AIM includes different model of tourism development: from low profile to niche tourism and from mass tourism to high profile tourism. AIM has developed a large range of tourist infrastructures and most of the coastal space includes accommodation infrastructure such as hotels and marinas.
- On 20 February 2014, the European Commission adopted a Communication on "A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism", setting up 14 targeted actions involving national, regional and industry level partners.

Weaknesses

- Maritime and coastal tourism is essentially a cross-cutting theme and because the inclusion of tourism as EU competence is relatively recent, there is no specific regulatory framework for it
- Lack of funding for the cultural sites renovation and maintenance.
- Missing of a common brand and Weak networking of tourism development stakeholders.
- High seasonality of coastal and maritime tourism.
- Possible failure of the accommodation capacity to satisfy tourism demand in high season. Exceeded carrying capacity in some historical towns.
- Pollution induced by tourism activities (e.g. discharges of waste waters from tourist establishments or vessels (yachts, speed boats, excursion boats).
- Wide disparity in Member States practice as regards licensing/qualifications for recreational boat operators.
- Lack of cross-border development of concepts and tools for a sustainable management of the UNESCO sites.

Opportunities

- Boost attractiveness by setting the basis for a common branding including a wider sustainability approach (not only environmental but also socio-economic), looking to the EUSAIR Pillar 4, basing on valorization of cultural and historical heritage of AIM coasts, reducing seasonality of demand and limiting its environmental footprint
- Public-private synergy opportunities for collaboration between P.A., touristic operators and SMEs.
- Promote sustainable development of cruise tourism, e.g. introducing a thorough waste management control for cruise ships.
- Explore alternative or innovative and sustainable forms of tourism and establishing links with other forms of regional economic development (e.g. fishing or eco tourism).

- Improving quality management and sustainability, e.g. through the European Tourism Quality label (ETQ) or other joint labels, as well as the promotion of service innovation (e.g. through the use of ICT) and the introduction of other socio-economic indicators to measure total relevance of coastal tourism sector.
- Implementation of a common certification system (e.g. licensing for sailing and motor boats), useful for the marina sector particularly as regards visiting yachts

Threats

- Irreversible change of the morphological characters
- Depletion and physical degradation of historic centers
- Lack of innovation in touristic offer
- Inefficient spatial planning implementation
- Risk of overburdened infrastructural systems in the summer months (water supply, roads, telecommunications), due to the seasonal character of tourism
- Increasing of coastal erosion
- The business model of "sun-and-beach" mass-tourism appears to be increasingly problematic and less sustainable
- Possible pressure on local communities and cultures: commercialization of local culture, cultural homogenization, too rigid adaptation to tourist demands, social tensions
- Environmental and social impact of massive cruise tourist arrivals

Fisheries and Aquaculture
Strengths

Fishery

- Despite the fact that the percentage of fishing activities to the total national GDP is about 1% for the AI countries, the sector generates a high number of jobs
- The good quality of water and the high biodiversity of the Adriatic-Ionian Sea
- Fishing vessels registered in the AIM ports are about 17.000 (20% of the total EU registered vessels).
- Presence of research Institutes specialized in fishery.
- Increasing of recreational and sport fisheries in AIM, where detailed regulations for recreational fisheries already exists

Aquaculture

- Aquaculture production is increasing (from 32% of total fish production in 2006 to 40% in 2011).
- The Adriatic region is the most important area for mussel production.
- Development of offshore aquaculture limiting intensive farming, which is traditionally land based, generally with an higher environmental impact

Weaknesses

Fishery

- Over exploitation of the resources and destruction of the habitats with highly impacting fishery instruments and changes in water quality that may be related to high nutrient loads
- Extreme sensibility and fragility of the reproductive areas
- High production costs
- Catches overcoming the demand
- Unfair competition between the fishing operators due to lack of market transparency and high market distortions.
- High seasonality of fishing products and difficulties to compete with low quality products coming from overseas markets
- Scarce infrastructural development on the Balcan side, comparing to the Italian side.
- General poor coordination among different operators
- Difficulty for small enterprises to access to innovative production methodologies and tools
- Uncertain estimation of the impacts of recreational fishing for a lack of catches control

Aquaculture

- Release of suspended material and nutritive salts
- Discharge of nutrients, dissolved and solid waste if not captured and treated on-farm

Opportunities

Fishery

- The reformed CFP (Common Fishery Policy) aims to bring fish stocks back to sustainable levels, to promote sustainable aquaculture, to provide EU citizens with a stable and healthy food supply for the long term and to promote healthy marine ecosystems. It seeks to bring new prosperity to the fishing sector, end dependence on subsidies and create new opportunities for jobs and growth in coastal areas.
- Creating a cross-border model for sustainable fisheries and implementation of pilot projects for sustainable aquaculture.
- Increase harmonization of fisheries policies across borders and support the adoption of the European Fisheries Policy by EU Member and non member.
- Promoting common marketing and consumer awareness on Adriatic-Ionian seafood products, including seafood traceability and quality certification systems.
- Improving the culture of compliance, saving resources, facilitating the collection, and transfer of data and information and enhancing cooperation for the monitoring and control of fishing activities.
- Assisting to adapt fishery methods and gears to the new obligations deriving from the Common Fishery Policy reform.
- Establish a common data base on fisheries resources at Macroregion level.
- The establishment of fisheries restrictions within limited areas, the so-called "fisheries restricted areas" (FRA), placed under the GFCM authority, will help to regulate or prohibiting fisheries activities within a certain area.

Aquaculture

- The Commission intends to boost aquaculture through the Common Fisheries Policy reform, and has recently published Strategic Guidelines presenting common priorities and general objectives at EU level, furthermore the Commission intends to help national and regional administrations to implement EU environmental legislation without imposing unnecessary burdens on producers.
- Developing tools to properly site aquaculture, including tools to identify activities for potential co-location with other economic activities.
- Growing collaboration between producers, market actors and NGO's on aquaculture Standards.
- Development of specific guidelines and frameworks for aquaculture environmental impact assessments.
- Increasing demand for eco-labelled products – e.g. using LCA, footprint and food-miles criteria.
- Technology upgrades to existing farms could raise output without development of new sites.
- Reduce administrative burdens and constraints for the development of the sector.
- Developing the potential co-location with other economic activities (e.g. offshore windfarms)

Threats

Fishery

- Trawlers tend to fish illegally within the 3 nautical miles limit or within the 50 meters depth limit. Due to the higher capacity of trawlers, this poses a threat to the artisanal fishermen.
- Temperature increase may reduce populations of coastal fish, affect the life history and movement of species, including commercial species and induce changes in the distribution of key fisheries and fishing effort. Alien species could be favored by new climate conditions and/or outcompete species already affected by mass mortalities damages.

- Decrease in fish populations (either commercial or not), due to by-catching, discarding, ghost fishing, etc.
- Competition between recreational and commercial fisheries: (a) competition for resources, especially where unlicensed recreational or "hobby" fishermen compete with commercial pot or net fisheries both for the resource and by supplying low priced fish to markets and (b) competition for space and gear interactions, for example between anglers and fixed nets, set close inshore or around wrecks
- Angling and handline recreational fishing threaten juveniles of most littoral, demersal fishes, because they are practiced on nursery areas such as shallow rocky bottoms, seagrass beds.
- Spear fishing has an impact mainly on endangered species such as groupers and brown meagre
- Rod-and-reel and longline recreational fisheries impact populations of commercial interest

Aquaculture

- Risk of disease /parasites in aquaculture farms.
- Spread of Commercially unfavorable/invasive species.
- Uncertain spat-fall under extensive production conditions.
- Strict Environmental regulation without support for technology upgrade could compromise the activities of many existing farms.

Marine Protected Areas

Strengths

- There is a relevant of protected areas in AIM. Marine Protected Areas (MPAs) have been established in Croatian and Italian waters, while in Montenegro and Albania the currently existing protected areas within the proposed area have the status of Coastal Protected Areas (CPAs). AIM includes also many protected sites including Natura 2000 and other forms of protected areas (e.g. Biological Protection Zones) and other ecologically and naturalistically important marine areas (sea-grasses or rocky outcrops).
- AdriaPAN (Adriatic Protected Areas Network) initiative, including protected areas from Italy, Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Albania, as far as Greece.

Weaknesses

- General Lack of concrete strategies for the socio-economic development of protected areas.
- Lack of data on marine litter for the whole AIM zone
- Presence along the coasts of highly polluting activities such as the petrochemical industries and the oil refineries

Opportunities

- MPAs joint vision, motivation, coordination, overall management, especially in facilitation and conflict resolution, communication with local community, stakeholder involvement in park management, communication of MPAs values, issues and rules of behavior with the general public (especially visitors), monitoring and evaluation, project cycle management
- Enhancing the management skills and communication strategy through EU projects
- Use different tools for vulnerability assessments at different spatial and temporal scales, in different regions and for different management purposes, on the basis of the information and data available
- Improve the effectiveness of the management of existing MPAs and increase communication on a social level
- Reduce/eliminate the most destructive fishing practices or pollution on a regional scale
- Improve the participation of citizens in order to reach consensus and have some chances to create effective planning tools under the complementary aspects of nature conservation and human development
- Develop transboundary studies through the region (habitat mapping, tagging genetics) and establish common assessment methods and monitoring plans

Threats

- Accumulation of stressors can considerably decrease the resilience of MPA ecosystems to an additional stress such as climate change that can cause extinction of local populations.
- Loss of biodiversity.
- Introduction of non–native species.
- Bloom proliferation.
- Destruction of habitats (e. g. posidonia meadows).

7. Executive summary

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The "Blue Economy" in the Adriatic and Ionian region generates an annual turnover that exceeds € 21 billion, with an increasing growth trend. An effective spatial planning is an essential condition in order to guarantee a long-lasting development without depleting the sea and therefore ensuring a sustainable use of marine resources for future generations.

Maritime spatial planning will be in the next years implemented according to the new Directive "Establishing a framework for maritime spatial planning", whose provision is that each Member State shall establish and implement maritime spatial planning, taking into account land-sea interactions. These interactions shall establish a substantial connection with the implementation process of the Protocol on Integrated Coastal Zone Management to the Barcelona Convention ratified by the European Council in 2010.

The issue is particularly important today, because the European Commission is launching the Action Plan for the Adriatic and Ionian Region (EUSAIR), that will be endorsed by the European Council this autumn and that will contribute to the definition of the development strategies of the region and to the destination of resources and projects.

<u>The Adriatic-Ionian Region Macroregion</u>

The Adriatic and Ionian Sea links its coastal states, all members of the Council of Europe, into a distinct European region, bringing together EU and non-EU members. In terms of demographic trends, an overall population growth has been observed, with most areas growing albeit by significantly different degrees. From an economic viewpoint, the countries bordering the Adriatic-Ionian Sea are characterized by great differences according to the level of their economic development. Regions' average GDP p.c. is around 18,000€. The highest GDP p.c. is observed at the coastal regions of Italy, as the average GDP p.c. at 22 Italian coast regions exceeded the 24.000€ in 2011. The analysis of uses and environmental conditions at the AIM scale, carried out in the Initial Assessment phase allowed to point out some key needs and priorities for maritime spatial planning in the area. In terms of activities, maritime transport of goods and people is a crucial sector for the economies of the region and the ports of Adriatic-Ionian Sea are among the most active ports of Europe. At the cargo traffic, the region is mostly specialized in dry bulk transport while in terms of passenger traffic it attracts the 14.5% of tourists cruising in the Mediterranean.

The Adriatic-Ionian Sea is still featured by an excellent quality of water and the high biodiversity. The region is also highly active in fishing and aquaculture (reported for Italy, Croatia and Greece) sectors. Fishing activities at AIM scale rank second in terms of total gross value added generated by maritime activities and rank third as regards employment (EUNETMAR, 2014). Fish products exceed 10% of the total exported agricultural products with the exception of Montenegro and Slovenia. However, commercial and recreational fishing activity interactions often create conflicts in terms of competition for resources and space. There is a relevant number of established Marine Protected Areas (MPAs) in the region (Croatia, Italy and Greece) while in Montenegro and Albania they have the status of Coastal Protected Areas (CPAs). The main issues detected concern their conflicts with other uses (e.g. tourism) and their legal context.

The extended coastline of the Adriatic-Ionian countries and the large number of islands has rendered the region a popular tourist destination. Tourism is presently one of the largest

maritime activities in the region and one of the most promising at AIM scale (EUNETMAR, 2014). It is related to maritime activities (cruise, marinas, etc.) and partially to coastal uses strictly connected with the marine areas (e.g. beaches, natural sites, coastal cities, etc.). Region's capacity of tourism establishments accounts for 11% of the total European capacity and region's occupancy accounts for 10% of total European occupancy in bed/nights terms. EUNETMAR (2014) analysis showed that presently coastal and maritime tourism issues are better addressed at regional level or through bilateral cooperation rather than multilaterally.

In fact, the transnational dimension of this MSP priority is related to the development of a more strategic and integrated touristic offer of the Adriatic-Ionian territories (i.e. tourism spatial planning), able to both locally capture the economic benefits and at the same time mitigate the possible negative effects of localized and massive tourist arrivals. Territorial development plans in the coastal areas shall improve the development of regional clusters and common branding.

Proper management of intensive tourism activities is fundamental in order to mitigate possible negative effects on the coastal, marine, and hinterland environment (marine litter, nutrients, organic and microbiological pollution, coastal landscape) on which it strongly depends.

Additionally, the geomorphology of the region and its central position in Europe is strengthening the perspective of rendering the Adriatic-Ionian Sea to a European energy crossroad. The port of Trieste is acting as the supplier of the crude oil Transalpine Pipeline. Moreover, several energy pipelines are planned to bypass the Adriatic-Ionian Sea, thus serving the East-West energy chain, such as Pan-European Oil Pipeline (PEOP) starting from Constanta and ending in Trieste, Italy, and the AMBO pipeline starting from the Bulgarian Black Sea port of Burgas and ending in the Albanian port of Vlorë and Trans Adriatic Pipeline (TAP) for the transportation of natural gas from Azerbaijan via Greece and Albania to Italy and further to Western Europe.

Oil & gas exploitation activities and plans for future exploitation along the whole eastern and western border of the basin, from Istria to the Apulian coast need to be well integrated in a MSP process and well evaluated from an environmental / ecosystem point of view. Main potential pressures on the environment are related to discharges during exploration and exploitation, to oil spills and to subsidence effects on the coast.

The recent tender from the Croatian Government for licenses for the exploitation and production of hydrocarbon along the whole Croatian continental shelf and a number of requests for exploration and permits on the Italian continental shelf are clear evidences of such need.

Safety is also a key issue and shall be regulated, in connection with other international regulations, according to the recent EU Directive 2013/30/EC on safety of offshore oil and gas operations.

Although currently no offshore wind plants are installed in the region, several advances have been initiated on the part of Italy and Greece in terms of renewable energy sources.

The MSP priorities in terms of uses and environmental issues, briefly presented below.

Key marine and maritime uses:

- ✓ Maritime transport (goods, passengers - cruise)
- ✓ Hydrocarbons search and exploitation
- ✓ Fisheries

- ✓ Coastal and maritime tourism
- ✓ Marine Protected Areas and Site of Conservation Interest

Key environmental issues:

- ✓ High biodiversity, presence of many species requiring conservation and management measures
- ✓ High risk of introduction of non-indigenous species
- ✓ Presence of nursery and spawning areas of fish of high socio-economic and environmental relevance
- ✓ Over-exploitation of several commercially relevant fish stocks
- ✓ The sea floor hosts several habitats of high ecological and economical relevance
- ✓ Several hot spots of contamination from hazardous substances, however high risk of contamination caused by ship accidents due to high traffic intensity
- ✓ Increasing trend in marine litter
- ✓ Probable high level of underwater noise

Focus Area 1:

Transport (goods, passengers - cruise) is a key policy for development in Adriatic-Ionian territories; one cannot conceive an integrated macro-area system in Adriatic-Ionian territories without an efficient transport and communication network at a macro-regional scale.

The four NAPA seaports (Koper, Rijeka, Venice and Trieste) are located at the northern tip of Adriatic Sea, a natural waterway that penetrates deep into the middle of the European continent, thus providing the cheapest naval route from the Far East via Suez to Europe. Container traffic in those ports is expected to increase by 350% within 2030. A significant number of important industrial centers are located along the western Adriatic coast and several mid- European – and in many cases landlocked – countries heavily depend on the Northern Adriatic ports for the import of energy.

In addition, several of the eastern Adriatic ports are deep-water ports – especially in Croatia – which could host super-tankers. These ports could serve as a solution for today's bottlenecks with regard to oil export routes in Eurasia. Consequently, the Adriatic countries believe that maritime transport will increase in the future. Existing routes will be used more intensively, new routes will be introduced and new South - eastern transit ports will gain importance (among others Ploce in Croatia, Bar in Montenegro and Vlorë in Albania).

Short-sea shipping has been identified as one of the most promising in all countries of the area (except in Albania), thus playing an important role under a macro-regional perspective. Improving passenger ferry service has proven to be a most promising activity in Croatia, Italy, Albania and Montenegro (EUNETMAR, 2014).

Coastal and cruise tourism is recognized as a key economic and development factor in the whole Adriatic Sea. Such high potential requires a sustainable management of natural resources in order to avoid or reduce environmental impacts, therefore compromising touristic activities.

This intensive maritime transport implies also ships and port emissions, risks of accidents, the potential introduction of invasive alien species through ballast water discharges and a

substantial increase in underwater noise. All these aspects need to be considered and carefully managed in order to mitigate their impacts on the ecosystems.

Other coastal and marine uses in the area potentially affected, conflicting or having potential synergies with maritime transport, also considering the infrastructures needed, are tourism and recreational uses, fisheries and aquaculture, MPAs.

Fish stocks have suffered from overfishing and / or pollution, especially in the Italian part of the Northern Adriatic Sea. Besides the decreasing productivity, another negative effect on the economic performance of the fisheries investigated was determined by increasing costs. Fishing is characterised by multi-gear fishing activities, ranging from small-scale artisanal fishery and hydraulic dredging to demersal trawling and pelagic mid-water trawling and recreational fishing. In Croatia fishing is primarily artisanal, while in Italy trawling is the most common fishing method.

Small scale fisheries is the most important sector in the Adriatic Sea in terms of number of vessels. In association with its economic value, it has a significant social and cultural value for coastal communities in many areas, also associated to coastal tourism.

All countries are aware of the need to promote the principles of sustainability and responsibility in fisheries concerning AIM. The Common Fisheries Policy (CFP) principles should be better implemented and disseminated all over the macro-area, in order to obtain a better harmonization in rules and practices. An important potential application of MSP in the area is related to the fish migration loop between Italy, Croatia and Slovenia. Certain fish species (e.g. Sole and Tub gurnard) migrate in a loop, following the currents in the Northern Adriatic Sea. As a result of overfishing in the area, fish stocks are under pressure. Protection of species by one country will not be effective given the migration paths of these fish.

Aquaculture is a key policy not only for European economy blue growth, but also for the maritime strategy for Adriatic and Ionian Seas. Although aquaculture presently does not appear among the largest marine and maritime activities of the blue economy, it has been identified among the growing activities in all countries of the area (EUNETMAR, 2014). The growth potential of the activity is mainly influenced by the fact that it could impact on the fishing effort in the area, reducing the impact of natural stocks, diversifying the origin of supply of fish products in terms of production methods and introducing new species in the value chain.

MSP on fisheries and aquaculture shall promote a sustainable management of fish stocks, according to CFP and MSFD provisions, the protection of seafloor habitats affected by trawling and at the same time stimulate all the relevant synergies with the touristic sector. Potential negative effects from aquaculture (e.g. aesthetic, organic and pharmaceutical pollution, invasive species, marine litter) shall be mitigated through proper planning and regulations, including carrying capacity of areas, management and monitoring.

Other coastal and marine uses in the area potentially affected, conflicting or having potential synergies with fisheries and aquaculture are tourism and recreational uses, maritime transport and MPAs.

Coordination among Energy Plans of Italy, Slovenia and Croatia could favour strategic choices that reflect in important boundary conditions for the MSP effort. The Italian Energy Strategy intends to develop by 2020 the production of hydrocarbons up to 14% of the national requirement, compared to the present value of 7%. The above strategy is very relevant both in terms of employment savings on energy costs.

One LNG terminal is presently located in the area, in front of the Po river delta. A second LNG is authorized in the Rijeka area, while other plants are foreseen in the area and their optimal siting is being discussed. Such discussion shall take into account potential impacts on the ecosystem, on fisheries, on coastal tourism and on maritime transport.

Transnational coordination is needed on these issues and is presently underway, mainly through the Trilateral Commission for the protection of the Adriatic.

A peculiar aspect of coastal tourism in FA1 is related to the need to adopt protection and defense measures for coastal beaches, natural sites, lagoons and cities, also considering short and medium term climate change scenarios. Such coastal protection measures shall be envisioned in an integrated and strategic perspective and not in limited time and spatial scale. Marine uses mainly affected are fisheries and stocks of relict sands for beach nourishment.

This is a clear example of land-sea interaction where MSP and ICZM measures need to be strictly coordinated, as far as planning, technical, funding and governance aspects are concerned (Figure 7-1).

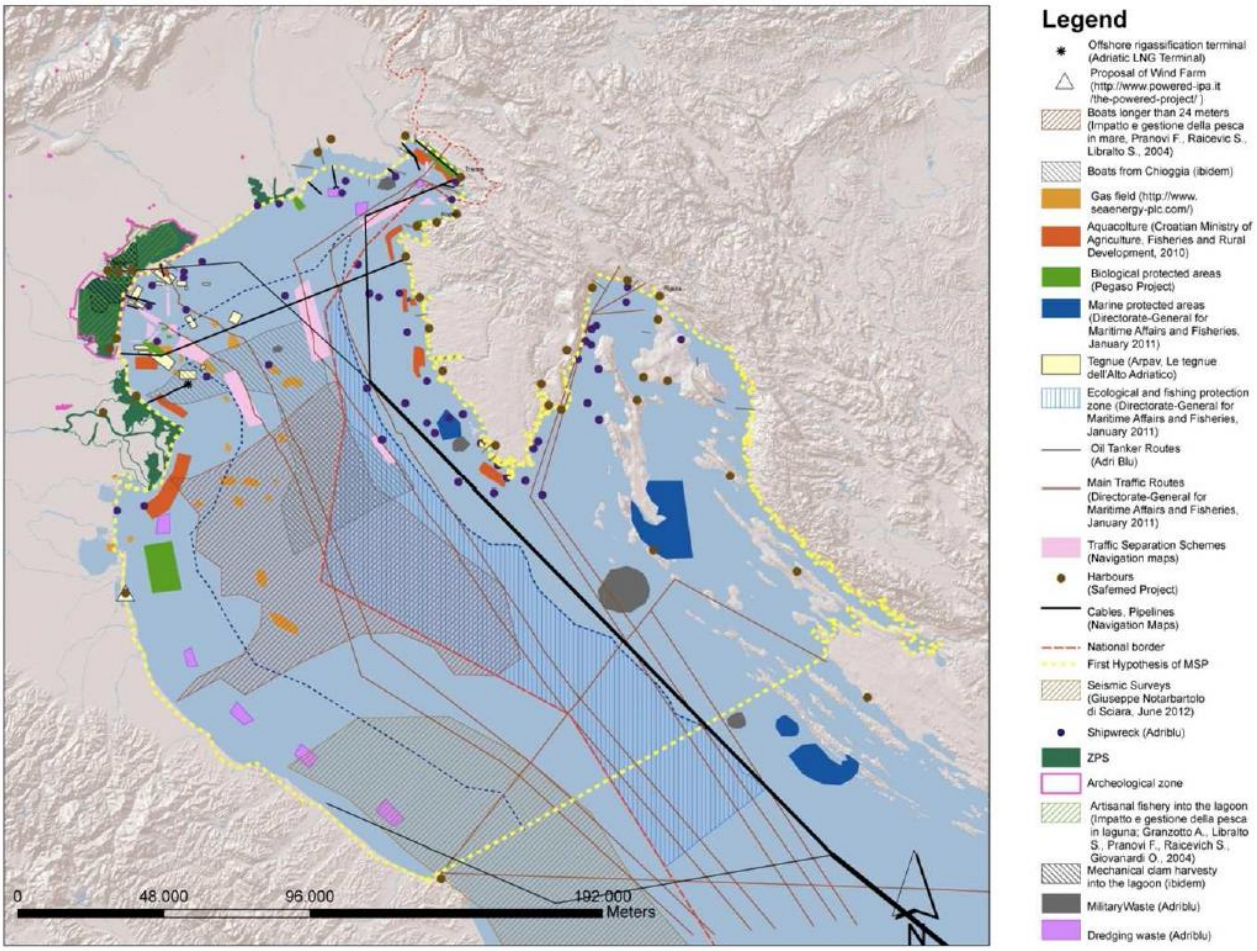

Figure 7-1: Example of conflicts among maritime uses in FA 1 (Source: IUAV Elaboration «MSP student workshop, 2012»).

Summarizing, the key marine and maritime uses are:

- ✓ Maritime transport (goods, passengers - cruise)

- ✓ Fisheries
- ✓ Aquaculture
- ✓ Hydrocarbons search and exploitation
- ✓ LNGs
- ✓ Coastal and maritime tourism
- ✓ Coastal defence / beach nourishment

The main environmental issues concern:

- ✓ Presence of sensitive benthic habitats crucial for biodiversity conservation, of lagoons and critical environments protected by several international conventions
- ✓ Very high risk of introduction of non-indigenous species
- ✓ High exploitation of fish and shellfish stocks
- ✓ High vulnerability of food web integrity due to cumulative impacts of several concentrated pressures (wide range of trophic conditions, hypoxia risk, overfishing, jellyfish increase, physical loss and damage)
- ✓ Several localised areas at risk of eutrophication
- ✓ Sea floor integrity threatened by several conflicting activities
- ✓ Large degree of coastline artificialisation and high vulnerability to erosion and subsidence
- ✓ Confined areas at risk of contamination from hazardous substances

Focus Area 2

FA2 is composed by the Italian NUTS-III regions of Bari, Brindisi and Lecce, the Greek regions of Thesprotia and Corfu, six coastal districts of Albania and six smaller prefectures of Montenegro.

The structure of local economies is heavily depended on sea activities. Amongst the highest contributors to local employment is the activity of maritime transport. More precisely, it is estimated that over 2k local units which are directly or indirectly involved in maritime transport are established in FA2 providing jobs to over 15.5k people. The most active regions are the regions of Puglia and Ionian Islands and the less active are the coastal areas of Montenegro. Greece has the largest merchant fleet in the EU and one of the largest merchant fleets in the world. The country is surrounded by a rather large number of important shipping lanes and has 20 ports with more than one million tonnes of cargo per year, out of which the port of Piraeus is the most important one (DG-MARE, 2011). Apulian area hosts large/medium shipping harbours (Taranto, Bari, Brindisi, Monopoli, Barletta, Manfredonia and Gallipoli) and several fishing ports, touristic marinas and small docks. Greece is also an attractive destination for cruise passengers. Given Greece's unique geographical features and in particular its extensive insular territory, the country's territorial and social cohesion depends directly on the existence of frequent and reliable coastal shipping services (serving 94 islands, 144 ports and around 36 million passengers per year) (DG-MARE, 2011). The situation in most ports in the Ionian Sea has improved in terms of port infrastructure with the implementation of numerous projects through the last decade. Also, ferry connections have been strengthened significantly both in terms of intraregional connections between the islands, and with ports between the islands and the mainland and with Italy.

Cruise industry is a major sector of maritime transport in the area. According to the statistics of the cruise traffic in Corfu and Argostoli there is a steadily increasing traffic both in ships and passengers even during the current economic crisis (2009 to present), which shows that the international nature of the cruise industry makes it less vulnerable to the negative effects of the economic crisis. The Ionian islands are well connected with Italy, Albania and the mainland of Greece and specifically with the major Italian ports of Venice, Ancona, Bari and Brindisi and Sarande (Albania). The potential impacts of these activities have been already described for FA1.

Moreover, FA2 is highly active in fishing and aquaculture sectors. Fishing vessels registered in FA2 ports account about 2.6% of the total European fleet. The sea has historically characterized the economy of this area, where communities lived the sea as a place of exchange, communication and work. Along with agriculture and maritime trade, fishing has been, for centuries, one of the main activities of coastal populations, which obtained from the sea fundamental products for their economies. Aquaculture is a considerable economic activity in FA2. Particularly in the Region of Western Greece, fish farm are a dynamic production sector in the region with the products of intensive aquaculture constituting an important exportation product of the country. From the other side, Apulia plays a prominent role in the Italian aquaculture, with a strong consolidation of the Apulian productive base, which consists of 15 active fish farms, 5 in the province of Foggia, 5 in Taranto, 2 in Bari, 2 in the province of Lecce 2 and 1 in Brindisi. There are also 3 hatcheries specialized in the sea bass and sea bream breeding. The contribution of the aquaculture in the Montenegrin national economy is insignificant, but there is potential for development. Modernisation of the sector and diversification in production, as well as training and education could provide this potential. Albania has a population of 3.4 million inhabitants and indicate the one of the highest

population growth rates in Europe. In countries such as Albania, the aquaculture, if correctly developed, can assist in the alleviation of poverty.

Finally, the geomorphology of the region and its central position in Europe is strengthening the perspective of rendering the FA2 to a European energy crossroad. This is testified from the fact that the planned *AMBO* oil pipeline is ending to the Albanian port of Vlorë while the *Trans Adriatic Pipeline* (TAP) project which concerns the transportation of natural gas, starts from Azerbaijan and via Greece and Albania is heading to Italy and further to Western Europe. Greece is currently being connected to Italy via the IGI project (Interconnection Greece – Italy) for the import of natural gas in Italy through Greece and has one offshore oil and gas extraction plant. The geological structure of the narrow and wider area of the Ionian Islands contains strong evidence for the existence of hydrocarbon deposits. Planned studies in the sea area are expected to record the precise areas where these are located. According to current estimates for the Ionian Sea, it is expected that there is an 80% of possibility for such deposits in the Ionian Sea area. So far, previous drilling (not in depth) carried out in specific areas of the Ionian Islands (such as Zakynthos) have not indicated the existence of oil and gas hydrocarbons with prospect of economic potential. Clearly, more in depth investigations in combination with the results of new seismic surveys in appropriately selected areas will give a better picture on the economic exploitation of hydrocarbons that are located in the Ionian Sea. The possible identification and exploitation of hydrocarbons (oil and gas) will completely change the production structure of the Ionian Islands Region. These actions could contribute to the strengthening of the secondary sector. Taking this into consideration and with the fact that under the existing law 4001/2011 a regional tax of 5% is applied to mining companies, the national policy should be evaluated in relation to the issue of marine pollution which can be a burden for the already affected tourism industry, the marine ecosystems and the marine environment in general.

Currently, Italy has no active offshore wind farms. However, according to 4C Offshore – an independent marine energy consultancy company – a considerable number of offshore wind farms is expected. For what is concerned with energy from current and waves, in the Mediterranean basin, the annual available wave power level off the coasts of the European countries varies between 4 and 11 kW/m, the highest values occurring for the area of the South - western Aegean Sea. Presently there are no plans for of this kind of energy within the AI Macroregion. The same is for energy extraction from marine currents.

The region is also highly active in tourism activities and especially in coastal tourism. The extended coastline of FA2 regions has rendered the region to a popular tourist destination. Regions' establishments in 2011 exceeded 7.9k, a number that equals about 1% of the total tourist establishments in Europe. The positive dynamics of the tourism sector is evidenced by the fact that the number of tourist establishments presented a growth of about 5% during the years 2010-2011. Greece is ranked 15th worldwide as a tourist destination. In FA2, tourism sector brings remarkable economic results and significant prospects for regional development as the direct jobs created by tourism activities exceeds 26.5k and the indirect jobs 77k, contributing more than 18% to the annual Gross National Product (DG-MARE 2011). The Special Framework for Spatial Planning and Sustainable Development for Tourism has set two centres for maritime tourism in FA2. These are: Corfu and Lefkada with a radius of influence reaching the coast of Western Greece, including the Amvrakikos Gulf, northwestern Peloponnese and the Ionian islands. Patra with a radius of influence reaching the coast of Korinthiakos and Patraikos Gulf, of Western Greece and the Ionian islands. In the last decade, Apulian tourism has recorded a steady increase in national and international tourist flows. Official data from 2012 show over 3.2 million arrivals and 13.3 million of total tourist

presences. The comparison with 2011 shows a minimum reduction of arrivals, estimated in 0.1% and a reduction in tourism presence of 1.6%. The economic crisis has resulted in a greater impact on the Italian market, the largest market for tourism in Apulia, which records a compression in both the number of arrivals and in the average duration of staying, but this has been compensated with a significant increase in foreign tourist flows (7 % more arrivals and +5%).

In FA2 (especially along the Apulian coasts), a general coastal retreat affects almost all the beaches. In particular, the coastal strip of the Gulf of Manfredonia shows an evident retreat due to human activity. To control coastal erosion, several defence interventions have been realised. Results of these interventions are often debatable, and most changes occurring in the beach profiles are mainly due to wrong human interventions.

Several coastal and marine uses in the area potentially affect the critically endangered species and key populations of marine mammals and reptiles under threat, and therefore require specific MSP actions (Figure 7-2, as an example).

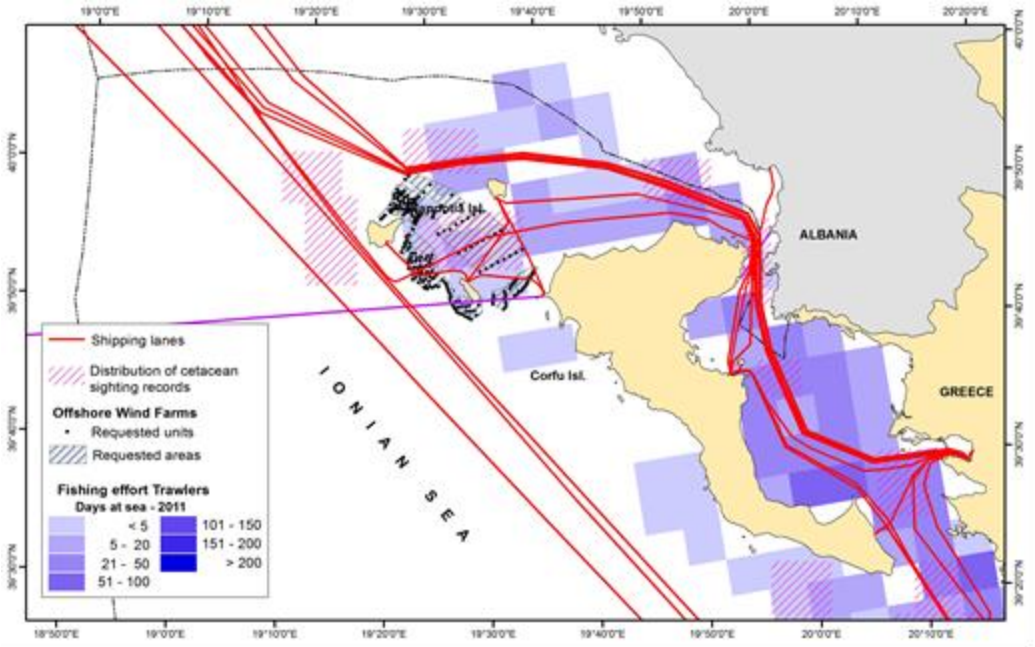

Figure 7-2: Interaction of cetaceans with small scale fisheries, shipping routes and the potential establishment of wind farms.

Summarizing, the key marine and maritime uses are:

- ✓ Maritime transport (passengers - cruise)
- ✓ Fisheries
- ✓ Coastal tourism
- ✓ Cables and pipelines
- ✓ Wind farms
- ✓ Aquaculture
- ✓ Marine Protected Areas and Site of Conservation Interest

The main environmental issues concern:

- ✓ Vital area for biodiversity, hosts critically endangered species and key populations of marine mammals and reptiles under threat, presents some key priority habitats
- ✓ Risk of introduction of non-indigenous species close to the main ports
- ✓ Presence of anchovy nursery habitats
- ✓ Confined areas at risk of eutrophication
- ✓ Confined areas at risk of contamination from hazardous substances
- ✓ Marine litter (foul areas)

The aim of the environmental characterisation is to provide ecologically relevant maps for marine spatial planning against which environmental pressures and human activities can be measured. This will promote an ecosystem-based approach to the management and planning of human activities in the marine environment.

In order achieve the goal of a long-term sustainable development an integrated marine spatial plan should include a comparison of ecologically relevant information with existing environmental pressures and the impact of the human activities in order to assess the sum of impacts on the marine ecosystem, preferably quantitatively.

The EU Member States are required to prepare such assessments through implementation of e.g. the EU Marine Strategy Framework Directive (art. 8.b, annex III) " – an analysis of the predominant pressures and impacts, including human activity, on the characteristics and environmental status of those waters..." (European Commission 2007e)

The synthesis of the potential pressures on environmental compartments of the maritime uses relevant for the AIM is contained in the following matrix (Table 7-1).

NEGATIVE POSITIVE NOT ESTABLISHED		Biological disturbance (D1, D2, D3, D4)			Nutrient and organic matter enrichment (D5)	Physical loss (D6, D7)	Physical damage (D6)	Interference with hydrological processes (D7)	Contamination by hazardous substances (D8, D9)	Systematic and/or intentional release of substances (D8, D9)	Other physical disturbance (D10, D11)	
Indicative list of human activities		Extraction of species including non-target catches	Non-indigenous species and translocations	Microbial pathogens	Fertilisers and other nitrogen and phosphorus rich substances Organic matter	Smothering Sealing	Siltation Abrasion Extraction	Thermal regime Salinity regime	Synthetic compounds Non-synthetic substances Radio-nuclides	e.g. produced water, carbon storage	Underwater noise/energy	Marine litter
Commercial, passenger and cruise transport	Shipping		-						-	-	-	-
	Port operations		-			-	-	-	-		-	-
Recreation: beach tourism, sailing, boating, diving, personal watercrafts, wildlife watching	Tourism and recreation incl. yachting		-		-		-				-	-
Fisheries (commercial and recreational) and acquaculture	Fisheries incl. recreational fishing (fish and shellfish)	-					-				-	-
	Aquaculture (fin-fish and shellfish)		-	-	-		-				-	-
Renewable Energies (wind, waves, tides, currents)	Marine-based renewable energy generation (wind, wave and tidal power)					?	?	?			?	?
Oil & Gas	Marine hydrocarbon (oil and gas) extraction					?	?		?		?	?
	Marine hydrocarbon (oil and gas) research					?	?				-	
MPA	Marine protected areas											
Sand and non living resources extraction	Marine mining (sand and gravel, rock)	?				?	-		?		-	
	Dredging	-					-		-		-	
Dredging disposal areas	Solid waste disposal incl. dredge material					-			?			-
	Storage of gasses									?		
Cultural and historic conservation areas	Cultural and historic conservation areas											
Cables, pipelines, transmission lines	Submarine cable and pipeline operations						-		?		-	?
Military zones	Defence - recurrent defence operations								?		-	
	Defence - dumping of unwanted munitions								-		-	-
Man-made structures (incl. construction phase)	Land/sea physical interaction: land claim, coastal defence											
	Placement and operation of offshore structures (other than for energy production)					-	-				-	
Land-based activities/industries	Coastal, riverine and atmospheric inputs from land - industrial discharges and emissions				-							
	Coastal, riverine and atmospheric inputs from land - agricultural and forestry run-off and emissions				-				-			-
	Coastal, riverine and atmospheric inputs from land - municipal waste water discharge				-				-			-
Research and survey	Marine research, survey and educational activities	-									-	

Table 7-1: MSFD (Annex 4, 2011) table linking maritime uses relevant for the AIM and potential pressures on environmental compartments. The table derives from information collected in ADRIPLAN Initial Assessment on results from previous analysis and on expert judgement.

Aspects addressed in the report and in the executive summary are not exhaustive of MSP needs but refer to what our Initial Assessment showed as most important at the Focus Area

scale, with a specific attention to the transnational and cross-border dimension. The evaluation of MSP priorities takes into account, qualitatively at this stage, their environmental, social and economic relevance.

Since ADRIPLAN project's main purpose is the incorporation of the best knowledge available for the Adriatic – Ionian Macroregion, integrating ecological, social, and economic data, the IA represents the basic reference for the development of MSP in the region. The MSP process requires the support and the involvement of all relevant stakeholders who will provide their experiences, perspectives and will help building detailed proposals and recommendations through the entire process of the implementation of cross-border MSP.

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