ITALIAN MARITIME SPATIAL PLAN

ADRIATIC MARITIME AREA

STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

ENVIRONMENTAL REPORT

(Article 13 of Legislative Decree 152/2006 and amendments, Annex VI to Part II)

AUTORITÀ PROCEDENTE	MINISTERO DELLE INFRASTRUTTURE E DELLA MOBILITÀ SOSTENIBILE *DIPARTIMENTO PER LA MOBILITÀ SOSTENIBILE DIREZIONE GENERALE PER LA VIGILANZA SULLE AUTORITÀ DI SISTEMA PORTUALE, IL TRASPORTO MARITTIMO E PER VIE D'ACQUA INTERNE*
SOGGETTO RESPONSABILE	TERESA DI MATTEO
TECNICI	SOGESID S.P.A.
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1. The strategic and regulatory context of the MSP

1.1 Directive 2014/89/EU and its Transposition into National Law

Directive 2014/89/EU has been transposed in Italy through Legislative Decree No. 201/2016 that:

- Establishes that the Ministry of Infrastructure and Transport (now the Ministry of Infrastructure and Sustainable Mobility) is the Competent Authority (art. 8), to which specific activities are assigned (art. 8, 9, 10, 11);
- Establishes the Inter-Ministerial Coordination Table (TIC) at the Presidency of the Council of Ministers Department for European Policies (DPE), which includes all the central Administrations involved in marine maritime issues (art. 6);
- Establishes the Technical Committee at the Ministry of Infrastructures and Transport (now the Ministry of Infrastructures and Sustainable Mobility), as the Competent Authority, which includes five central Administrations and the Maritime Regions (art. 7);
- Provides that the management plans of the maritime space are drawn up by the Technical Committee mentioned in article 7 and, before approval, are transmitted to the Interministerial Coordination Table mentioned in article 6, which certifies the correspondence with the planning process defined in the guidelines mentioned in article 6, paragraph 2. The maritime space management plans are approved by decree of the Minister of Infrastructures and Transport (now Ministry of Infrastructures and Sustainable Mobility), subject to the opinion of the Permanent. Conference for the relations between the State, the Regions and the autonomous Provinces of Trento and Bolzano;
- Provides that the existing plans and programs that take into consideration the marine waters and the economic and social activities carried out therein, as well as those concerning land activities relevant to the consideration of land-sea interactions, developed and implemented under the European and national provisions in force at the date of entry into force of the decree, are included and harmonized with the provisions of the management plans of the maritime space. Ministerial Decree of 13/11/2017, No. 529, as amended by Ministerial Decree of 11 March 2019, No. 89 and Ministerial Decree of 27 June 2019, No. 263, regulates the organization and functioning of the Technical Committee.

In line with the provisions of art. 6, paragraph 2, of Decree no. 201/2016, with the Decree of the President of the Council of Ministers of 1 December 2017, the "*guidelines containing the guidelines and criteria for the preparation of maritime space management plans*" were approved. The Guidelines have identified three maritime reference areas, for the drafting of three inter-coordinated Plans, referable to the three sub-regions of the Marine Strategy (art. 4 of Directive 2008/56/EU):

- The western Mediterranean Sea;
- The Adriatic Sea;
- The Ionian Sea and the central Mediterranean Sea.

This solution makes it possible to pool the work already carried out under the Marine Strategy with regard to the identification of indicators and the acquisition of environmental data.

The Plans will have a duration of 10 years, with the possibility of a mid-term review, or if deemed necessary following the monitoring of the implementation of the Plan or events that require revision.

2. Principles, objectives and, objectives and contents of the MSP

2.1 Characteristics of the Plan and its Legal Effectiveness

The Plan provides strategic level indications and guidelines for each Maritime Area and their sub-areas, to be used as a reference for other planning actions (sector or local level) and for the granting of concessions or authorizations. Depending on the characteristics of the sub-areas and planning needs, the Plan provides more or less detailed indications, both in terms of spatial resolution and in terms of defining measures and recommendations. The reference time horizon of the Plan is 2032, the year in which, at the latest, an initial update of the Plan will be due, taking into account, where possible and necessary, a longer time horizon (year 2050). The superordinate character of the Plan and its prevalence with respect to other planning and programming acts, does not imply that the latter will cease to exist, but that they must be "*incorporated*" in the new Plan during its first application and, if necessary, modified to guarantee harmonization with its forecasts; following approval of the Plan, they must be consistent with the objectives, addresses, recommendations and forecasts contained therein. Therefore, the Plan will not be derogated from plans or programs or administrative measures, thus being able to guarantee clarity and legal certainty of the use of the maritime space for economic operators, through the coordination of different administrative acts concerning activities taking place at sea or which may have an impact on the maritime space. The Plan has, therefore, the nature of a "first-level instrument", i.e. superordinate to the further and prevalent acts of planning of the management of the "*marine territory", whose content must necessarily flow into it*" (Council of State, section IV, 2 March 2020, no. 1486), and falls into the type of "*super-plans*" (together with the Basin Plan, as per art. 65 of legislative decree no. 152/2006, and the Landscape Plan, as per art. 145 of legislative decree no. 42/2004).

Specifically, the relationship between the Maritime Spatial Management Plan and plans and programs concerning land-based activities, the scope of application of the Maritime Spatial Management Plan is different, but the Maritime Spatial Management Plan must take this into account and may affect it in relation to those aspects which may have an effect on the marine space, i.e. in the presence of land-sea interactions.

In particular, the national legislator clarifies that the scope of application of the Maritime Spatial Management Plan is different from that of the urban plan (to which the port master plan, approved after the entry into force of law no. 84/1994, can be assimilated): in these terms should be interpreted the provisions contained both in d.lgs. n. 201/2016 as well as in the relevant supplementary guidelines, which have the care to clarify that the planning of the maritime space does not apply to urban (and rural: the terminology used textually takes up the content of the Directive, which leaves the "urban and rurar planning" of the Member State unaffected).

2.2 Area of interest of the Plan and its spatial articulation

The drafting of the Italian Maritime Spatial Plans is implemented in three parallel and coordinated processes in the three Maritime Areas identified by the Guidelines (Adriatic, Ionian-Central Mediterranean, and Western Tyrrhenian-Mediterranean).

In each area, the Plan covers all waters and/or seabed beyond the coastline over which Italy has jurisdiction, with the exception of areas with "*urban and rural planning governed by existing legislation"*. The delimitation of the three Maritime Areas covered by the Plan has therefore considered the following criteria:

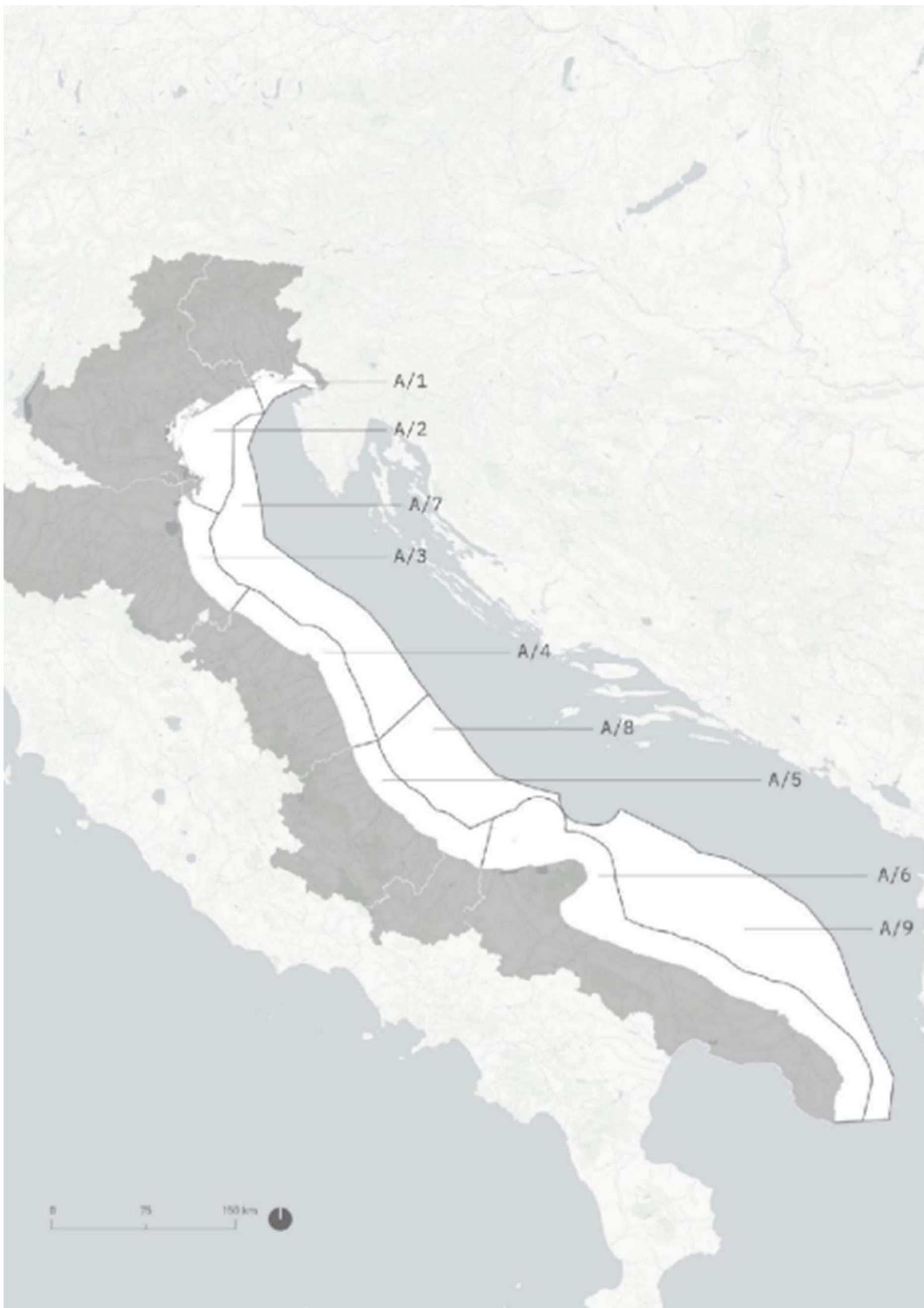
- jurisdictional boundaries where defined, also following specific agreements with neighboring countries, made available by the Istituto Idrografico della Marina - IIM (e.g. 12mn limits, continental shelf limits);
- delimitations between marine sub-regions of the Marine Strategy Directive;
- boundaries of marine areas open to hydrocarbon exploration and production as identified by the MISE;
- virtual equidistance lines.

The delimitations reported in the following do not prejudice in any way the outcome of future negotiations with neighboring Countries for the settlement of existing disputes and the drafting of future agreements on maritime areas and rights of use, also according to the provisions of Law no. 91.

2.2.1 Maritime Area "*Adriatic*"

The "*Adriatic*" Maritime Area has an extension of about 62,930 km2 and is delimited in the East by the limits of the continental shelf already formally agreed with the neighboring countries (Yugoslavia, 1969; Albania, 1992; Greece, 1977 and 2020) and in the South by the delimitation line between the marine sub-regions "*Adriatic Sea*" and "*Ionian Sea - Central Mediterranean*" of the Marine Strategy Directive, as also indicated in the Legislative Decree 201/2016.

Within it, the area is divided into 9 sub-areas, of which 6 within the territorial waters.



Delimitation and internal zoning of the "Adriatic" Area

2.3 The Ecosystem-Based Approach in the Plan

The Convention on Biological Diversity (CBD) (COP 5/ Decision V/6) established in May 2000 the following definition of the ecosystem approach: "*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 manner. Therefore, the application of the ecosystem approach will help to achieve a balance of the three objectives of the Convention: conservation, sustainable use and the fair and equitable sharing of the benefits arising from the use of genetic resources. An ecosystem approach is based on the application of appropriate scientific methodologies focusing on the levels of biological organization, including the structure, processes, functions and essential interactions between organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral part of many ecosystems*."

The need for management approaches based on an ecosystem perspective, which fully incorporate ecosystem considerations, into marine planning has become increasingly urgent (Douvere and Ehler 2008, Ansong et al. 2017). The Ecosystem-Based Approach (EBA) considers humans as an integral part of the natural ecosystem and, if applied, can show the exchange and interactions between the goods and services provided by natural ecosystems and different management objectives (Levin et al., 2009). Although the MSP Directive does not directly provide a definition of EBA, the requirement to implement EBA is set out in Preambles (3), (14), (22) and directly in Article 5 on MSP objectives.

The key principles for the application of the EBA in MSP can be summarized as follows:

- Take the long view;
- Integrate ecological, social, economic, and institutional perspectives and recognize their interdependencies;
- Make the protection and restoration of marine ecosystems a priority;
- Consider anthropogenic pressures and cumulative impacts;
- Consider connections and connectivity between and across ecosystems;
- Take a perspective that considers ecosystem services;
- Promote adaptive management;
- Plan at the appropriate scales;
- Take a precautionary approach;
- Use the best knowledge available;
- Involve stakeholders.

2.4 Strategic objectives

The definition of strategic objectives is one of the fundamental steps in the process of constructing the Maritime Spatial Plans (MSP) of the three Maritime Areas. The objectives identified in this chapter are high level objectives, referring to the national and supranational dimension, and are common to the three maritime areas covered by the Plans. These specific objectives have been developed in coherence with the strategic objectives identified in this chapter and are preparatory to the definition of the Planning Units in each sub-area and the related vocations and measures of the Plan. The identification of the strategic objectives for the three maritime areas was carried out first of all on the basis of the existing strategies, plans and regulations at an international, European and national level, concerning both environmental, landscape and cultural heritage aspects and socio-economic aspects linked to the needs of the various sectors. In this sense, the objectives indicated by the Marine Strategy to achieve GES ("*Good Environmental Status*") are central.

In fact, the Guidelines for the management of the Maritime Space (DPCM 1 December 2017) indicate the ecosystem approach as a fundamental tool for the proper development of Maritime Spatial Planning. The ecosystem approach plays in this sense a bridging role between MSP and the implementation of Marine Strategies. Moreover, the paradigm of sustainable development, declined in the "*Agenda 2030 on Sustainable Development*" of the United Nations (2015) and in the 17 Sustainable Development Goals - SDGs to be achieved by 2030, is considered superordinate and transversal to all the objectives of the Plan, in line with the principles and objectives of the National Strategy for Sustainable Development.

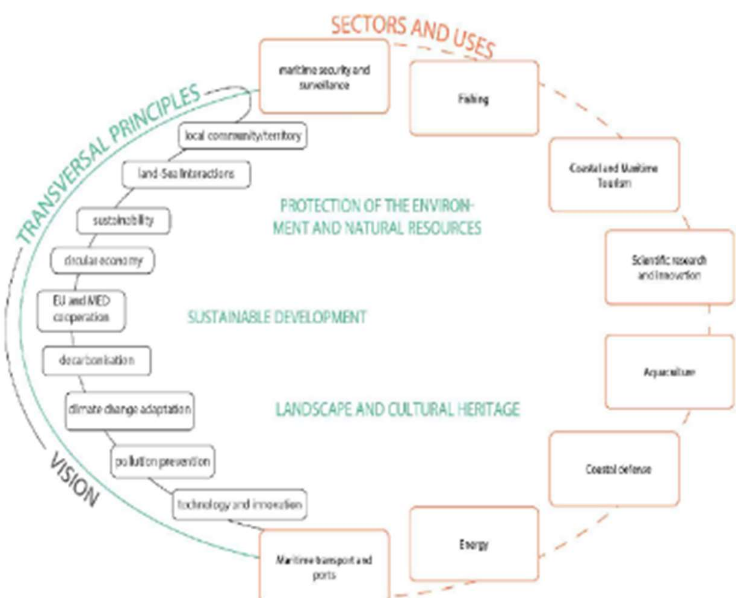
For the systematic collection of planning objectives by macro-theme or macro-sector deriving from the instruments in force at a transnational (EU and non-EU) and national level, Annex 4 of the National Guidelines on Maritime Spatial Planning was used as the main reference. Consequently, the collection is structured in the following 11 themes/sectors:

- Sustainable development
- Environmental protection and natural resources
- Landscape and cultural heritage
- Maritime safety, navigation and surveillance
- Fishing
- Aquaculture
- Maritime transport and ports
- Energy
- Coastal defence, flood protection, seabed morphology restoration
- Coastal and maritime tourism
- Scientific research and innovation

The themes of "*Sustainable Development*", "*Environmental Protection and Natural Resources*" and "Landscape and Cultural Heritage" are transversal and superordinate principles to all the objectives of the Plan.

The themes "*Environmental protection and natural resources*" and "*Landscape and cultural heritage*" are also considered as specific uses of the sea and in this sense used in Phase 4 of planning. The 42 identified strategic objectives are summarized in next Table and constitute a unitary and integrated corpus that contributes to form a Vision for the development of the three maritime areas and, specifically, of the "Adriatic" maritime area.

Sustainable Development and the objectives into which it is declined, represents the paradigm of the development strategy of the maritime areas identified in the Plan. With reference to this paradigm, the objectives of the individual sectors are identified, considering the transversal nature of environmental protection and cultural heritage. The objectives identified are as a whole referable to a series of transversal principles that constitute the elements of reference for the Vision. These principles are identified in purple in the next Figure which also includes the various themes/sectors/uses considered.



	THEMES/SECTORS/USES	Code	OBJECTIVES
Transversal principles	**Sustainable development**	OS_SS|01	Developing a sustainable marine economy, multiplying growth opportunities for marine and maritime sectors
		OS_SS|02	Contribute to the National Strategy for Sustainable Development
		OS_SS|03	Contributing to the European Green Deal
		OS_SS|04	Fully grasp the economic and environmental sustainability opportunities arising from the circular economy
	Environmental protection and natural resources	OS_N|01	Apply a consistent *Ecosystem Based Approach (*EBA) at all stages of drafting Maritime Spatial Plans
		OS_N|02	Supporting the extension of EU marine protection to 30% by 2030
		OS_N|03	Transpose and promote the implementation of the main space measures foreseen in the MSFD Program of Measures
		OS_N|04	Integration of land-sea interaction aspects and integrated management of the coastal strip, with particular reference to environmental aspects
		OS_N|05	Take into account in the medium - long term the process and objectives of marine ecosystem restoration as outlined in the proposed European Law on Environmental Restoration
	Landscape and cultural heritage	OS_PPC|01	Support the landscape value of the coastal strip
		OS_PPC|02	Promoting the recovery and redevelopment of buildings and areas subject to protection
		OS_PPC|03	Promote and support the conservation of underwater archaeological heritage
		OS_PPC|04	Promoting regional and international cooperation in the field
		OS_PPC|05	Promoting and creating awareness on intangible cultural heritage
		OS_PPC|06	Combating unauthorized building in coastal areas
Sectors/Uses	**Maritime safety, navigation and surveillance**	OS_S|01	Preventing pollution from ships and contributing to the implementation of the measures of the Marpol Convention
		OS_S|02	Help promote maritime safety, the implementation of UNCLOS standards and the EU Maritime Safety Strategy
	Fishing	OS_P|01	Sustainable development of the fisheries sector
		OS_P|02	Implementation of European and National Multiannual Management Plans in Geographical Sub-Areas (GSA)
		OS_P|03	Promotion, development and spatial management of small-scale coastal fishing using sustainable techniques
		OS_P|04	Promote the creation of areas for the recovery and protection of fish stocks and protection of *Essential Fish Habitats* (EFH)
		OS_P|05	To encourage cooperation among States in order to achieve concerted measures for the sustainable management of the activities of their national fisheries sectors.
		OS_P|06	Monitoring and combating illegal fishing
	Aquaculture	OS_A|01	Promoting the sustainable growth of the aquaculture sector

		OS_A|02	Promoting quality aquaculture and supporting the process of establishing AZAs (*Allocated* Zones for Aquaculture)
	Maritime transport and ports	OS_TM|01	Promoting sustainable development of maritime transport and reducing its negative impacts
		OS_TM|02	Promoting the use of alternative fuels, reducing discharges into the sea, improving port facilities for the collection of waste and cargo residues and/or encouraging the use of such facilities, improving the management of dredged sediments
		OS_TM|03	Promoting European and regional cooperation on maritime transport and multimodality
		OS_TM|04	Contribute to increasing the competitiveness of Italian ports, the sharing of "best practices" and the implementation of the National Strategic Plan for Ports and Logistics (PSNPL)
		OS_TM|05	Promote the integration and dialogue between existing planning systems in particular regarding the integration of port strategic planning, land planning and sea plans
	Energy	OS_E|01	To contribute to the energy transition towards renewable and low-emission sources through the development of offshore renewable energy production
		OS_E|02	Pursue the environmental, social and economic sustainability of offshore hydrocarbon prospection, exploration and production activities
		OS_E|03	Promote the conversion of platforms and infrastructure associated with depleted fields and synergies between compatible maritime activities
		OS_E|04	Promoting European and regional energy cooperation
		OS_E|05	Promoting the planning of suitable areas for CO capture and geological storage 2
	Coastal defence	OS_DC|01	Promote the development, harmonization and implementation of strategies and measures to protect the coastline and combat erosion foreseen in the Flood Risk Management Plans drawn up at the scale of the Hydrographic District in compliance with the provisions of the Floods Directive (2007/60/EC) and in the Coastal Plans / Integrated Coastal Zone Management Plans prepared by many regions
		OS_DC|02	Ensure the best coherence between the uses and vocations of sea use foreseen in the MSP Plans and coastal uses, with reference to their safeguard in a scenario of necessary adaptation to ongoing climate change
		OS_DC|03	Consider and adequately address the issue of the use and protection of underwater sand for beach nourishment, to be considered as a strategic resource for coastal defense and adaptation plans
	Coastal and maritime tourism	OS_T|01	Promoting sustainable forms of coastal and maritime tourism
		OS_T|02	Promoting coherent planning actions on land and sea, also for tourism purposes
		OS_T|03	To contribute to the diversification of tourist products and services and to counter the seasonality of demand for inland, coastal and maritime tourism
	Scientific research and innovation	OS_RI|01	Target marine research activities on the knowledge needs of the Plan, to strengthen and support the planning process and itssustainable growth objectives
		OS_RI|02	To encourage the development of technologies and innovative solutions to be used to improve the effectiveness of the Plan and to promote their dissemination in the various sectors of the marine economy and in the various marine areas
		OS_RI|03	Support the maintenance and consolidation of the observation network and specific needs for experimentation and research,also in order to evaluate the effects and effectiveness of the Plan and support its updating

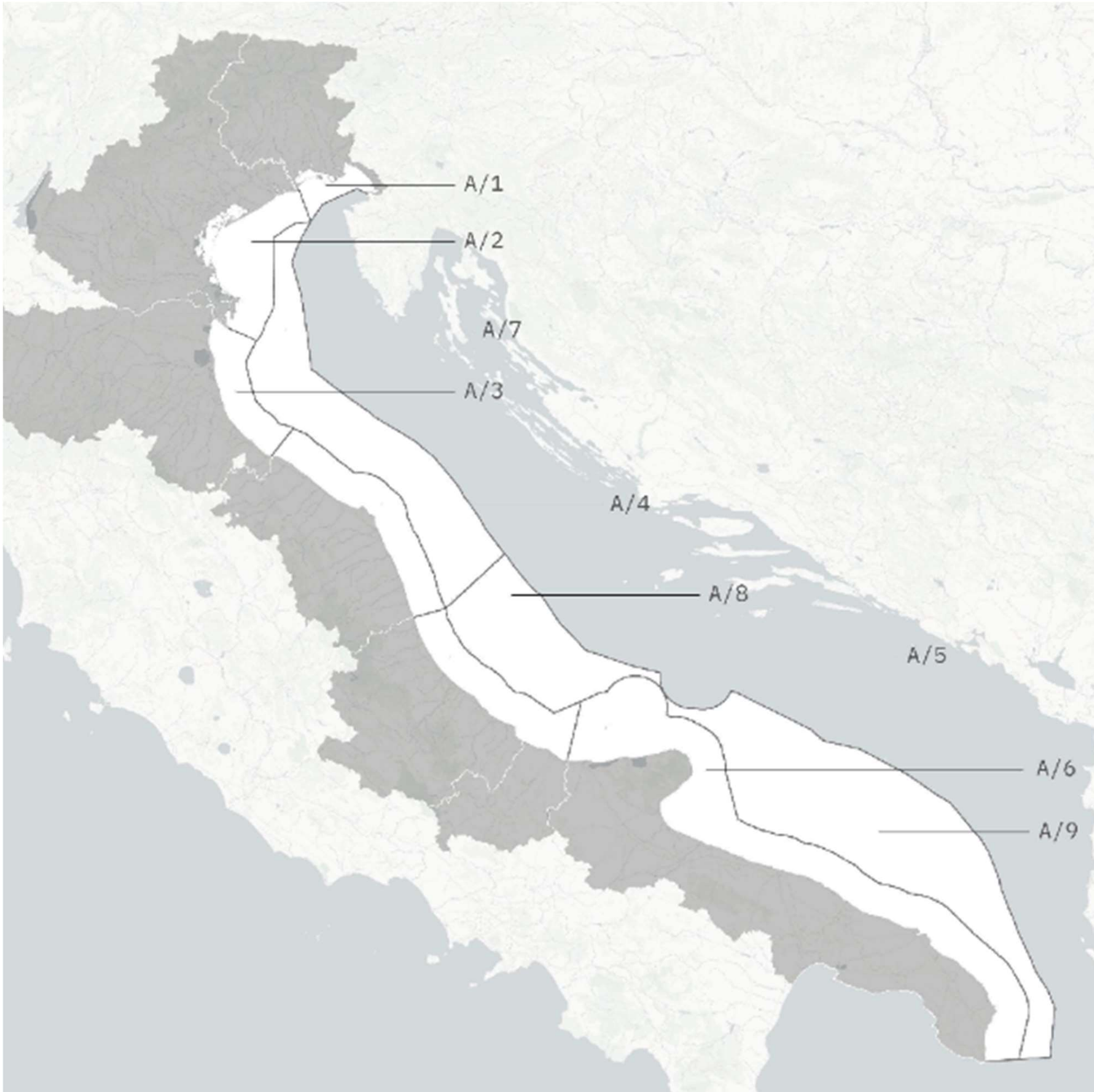
2.5 Definition of sub-areas

The "*Adriatic*" area is influenced by the complex morpho-bathymetric characteristics and hydrological, geographical and environmental as well as social and economic dynamics of the Adriatic Sea. The interregional and international context in which the area insists, moreover, influences in a substantial way the planning needs of strategic level and address for the Maritime Area. Such characteristics have been taken into consideration in the definition of the sub-areas (next Figure), according to the planning needs and the definition, for each sub-area, of an appropriate medium-long term vision and coherent specific planning objectives.

The limits of the sub-areas must be considered as permeable limits, from the point of view of uses, from the environmental/ecosystem point of view and from the point of view of the *governance* system, so as to ensure maximum coherence with respect to the planning of the vast area and neighboring sub-areas, as well as to meet the needs of a unified ecological and functional vision. Taking into account these objectives, the criteria and elements to be considered for the definition of the sub-areas, through their optimal combination and expert judgment, were as follows:

- National and international legal and administrative boundaries: The first distinction in determining the sub-areas was determined by the boundary between territorial waters (from the coastline to the 12 NM line) and continental shelf (from the 12 NM to the median line). The boundaries of the sub-areas along the coastline were defined taking into account the boundaries of the maritime areas and the regions Friuli Venezia Giulia (sub-area A/1), Veneto (A/2), Emilia-Romagna (A/3), Marche (A/4), Abruzzo and Molise (A/5) and Puglia up to Capo di Leuca, the boundary established by the Marine Reporting Unit MSFD (A/6). These boundaries have been extended up to the demarcation of the 12 NM by following boundaries demarcated by existing zones used for sectoral planning and management activities (e.g. between A/2 and A/3 along the separation line between the Natura 2000 Sites being established in the marine waters off the Po Delta) or by following the boundaries of the Maritime Directorates (zones);
- Morphological and oceanographic features: the proposed division into "off-shore" sub-areas (off the 12 NM) mainly took into account the geomorphological, oceanographic and hydrological features of the Adriatic Sea, which vary markedly along the north-south gradient. The northern portion of the Adriatic Sea, which constitutes the largest continental shelf area in the entire Mediterranean Sea, has been enclosed in sub-area A/7, delimited by the boundary of the escarpment that reaches the deep water up to about 270 m of the complex depression of the Fossa di Pomo. The boundary between sub-areas A/7 and A/8 has been drawn in continuity with the boundary between A/4 and A/5 to ensure consistency with planning in territorial waters. Considering instead that below the Gargano Promontory the southern Adriatic Sea shows a deep depression, up to -1225 m, enclosing platform areas of variable surface and a relatively large bathyal area, the boundary between sub-areas A/8 and A/9 has been identified at the point of coincidence between the 12 NM line and the median line, at the agreed boundary between the archipelago of the Tremiti Islands (Italy) and that of Pelagosa (Croatia). This subdivision coincides with the demarcation line between Geographical Subareas (GSAs) 17 and 18, except for a limited northern portion of sub-area A/9 (about 70000 ha).

In addition, in delimiting the subareas, additional specific criteria were taken into account, such as: the distribution of peculiar or prevailing existing uses of the sea, existing areas used for planning and management activities, and the boundaries of marine areas open to hydrocarbon exploration and production identified by the MISE. For general use and to support public consultation, the cartographic layers of the Plan (Areas, Subareas, Planning Units) with the relative attributes and the thematism assigned according to the priority uses of each PU are published on the SID platform - Portal of the Sea[2] and can be consulted together with all the cartographic layers used in the maps of the cognitive framework (Phase1).



2.6 Coexistence and synergy between uses.

Phase 2 of the planning process has highlighted how the Adriatic Sea, similarly to other marine areas of relatively limited extension, is characterized by a high density of uses, particularly in the areas closest to the coast, and therefore by potential and real conflicts between some activities. At the same time, however, different uses can coexist in the same area and develop synergies leading to the effective sharing of the maritime space and its resources (multi-use), with advantages for all the sectors involved. Coastal and marine tourism certainly represents an economic activity of central importance for the Adriatic coastal communities.

The Maritime Space Plan for the Adriatic Area proposes to support through spatial and other measures (e.g. involvement, training, administrative aspects, etc.) the evolution of the sector towards more sustainable activities, including the strengthening or development of synergies with other sectors, such as in particular artisanal fishing (fishing tourism and ichthyic tourism) and aquaculture (aquaculture). The Plan also underlines the need to develop tourist offers (e.g. ecotourism) that are synergic with the objectives of environmental protection and protection of landscape and cultural heritage, also considering the key role that these elements play in supporting the tourist economy of the Adriatic region. In the central area of the Adriatic basin there is a historical coexistence of tourism and offshore mining activities, locally characterized by direct or indirect conflicts.

The process of discharging platforms that are no longer active offers the opportunity for synergic developments between the two sectors. These structures can in fact be potentially reused for various tourism-recreational purposes, such as support for boating, diving activities, recreational fishing or environmental education.

The issue of the potential reuse of decommissioned platforms also concerns other sectors, such as the production of energy from renewable sources at sea, the creation of biological protection areas (as in the case of the SCI-SPA "Relitto Piattaforma del Paguro"), aquaculture and scientific research, thus also looking at the multi-use logic of these infrastructures. The analysis of the planning indications described in the following sections of this chapter of the Plan, highlight possible synergies also between the objectives of fishing and those of environmental protection and natural resources. The Biological Protection Zones (ZTB), established by the Ministry of Agricultural, Food and Forestry Policies with the aim of protecting fishery resources, have positive effects on environmental protection in general. In the same way, well-managed marine protected areas can represent a useful tool for the reconstitution of ichthyic stocks and therefore bring benefits to local fishing.

In the ZTB and marine protected areas can also be promoted forms of sustainable tourism, as for example experimented in the AMP of Miramare and in the SCI-SPA of Paguro.

2.7 Elements of land-sea interaction

The Plan for the Adriatic Sea Maritime Area takes into account characteristics and dynamics, both natural and anthropic, which determine important land-sea interactions relevant to the basin scale, as analysed and described in Phase 1. The Adriatic maritime area is characterized by land-sea interactions of natural origin, strongly linked to the presence of river deltas, lagoons and wetlands, which characterize the dominant landscape of the Italian Adriatic coastal area, especially in its northern strip.

Among the natural factors considered in the analysis of land-sea interactions, the erosive processes of the coast, determined by the combination of natural and anthropic factors. The specific suitability of coastal areas has also taken into account the potential influences on the marine areas facing the coastal areas where human activities on land are located. In particular, relevant interactions at basin scale have been identified, determined by urbanized areas, also for tourism use, industrial areas, port areas (including cruise ports), and areas of primary interest for the tourism system (including marinas and pleasure ports). Furthermore, land-sea connections that characterize numerous maritime activities, such as marine areas for hydrocarbon exploitation (including cables and supporting pipelines), the presence of fishing ports and national military activities have also been taken into consideration. In particular, in order to promote and support the development of tourism in the area, it is necessary to protect the Adriatic beaches with appropriate measures to combat erosion and emissions of pollutants of land-based origin. Furthermore, in consideration of the expected increase in maritime traffic, in line with the Maritime Spatial Plan it will be necessary to verify the robustness and the appropriate integration of land transport systems interconnected with the marine one, as well as the related needs for new infrastructures. The whole Adriatic coastal area is also characterized by the presence of sites of important environmental value and by areas relevant for the protection and enhancement of landscape and cultural heritage (e.g. Natura 2000 network areas, Regional Parks, UNESCO sites, etc.).

In many cases these areas extend between the land and the sea or at least include numerous land-sea interactions that are a constituent part of their natural and/or landscape value. The elements of land-sea interaction highlighted at the scale of the maritime area have been considered for the definition of the Plan elements described below; in particular, with regard to the determination of the suitability and mode of use of the Planning Units closest to the coast or to the hot-spots of land-sea interaction, as well as with regard to the measures of the Plan at national and sub-area level. With regard to the measures, in fact, in the extended document of the Plan of the "Adriatic" maritime area, it is highlighted the possible relevance for the management of land-sea interactions, for example, in relation to the withdrawal of relict sands for coastal defense, the realization of shore connections of offshore plants or the improvement of environmental and energy sustainability of ports (hot-spot of land-sea interactions).

2.8 Relevant elements for transnational cooperation

Italy plays a central role in the transnational cooperation of the Adriatic Sea, also in consideration of its geographical position that extends along the axis of the entire basin. Italy's commitment concerns both strategic and multi-sectoral cooperation initiatives, such as the EU strategy for the Adriatic and Ionian Region (EUSAIR), and sectoral cooperation mechanisms, such as those of the Regional Fisheries Organisations (RFOs, including the General Fisheries Commission for the Mediterranean (GFCM) of the FAO).

The Maritime Spatial Plan represents a fundamental instrument useful to enhance the role of Italy in the framework of the cooperation in the Adriatic basin and therefore to contribute to solve some of the problems of transnational nature. The Plan contributes to the transboundary management of environment and natural resources, through the systematization of the network of environmental protection tools (MPAs, Natura 2000 network, EBSAs - CBD, SPAMI, etc.), and through planning choices consistent with the measures agreed at transnational level for the protection of fishery resources (e.g. FRAs - GFCM) and through choices consistent with the common European objectives defined in terms of quality of the marine environment (MSFD).

The Plan contributes to the recognition of the importance of underwater cultural heritage as an integral part of the cultural heritage of mankind, supporting international cooperation on the subject and implementing the indications and measures established under the UNESCO Convention on the Protection of Underwater Cultural Heritage, adopted in Paris on 2 November 2001, ratified and entered into force in Italy through Law 157/2009, which integrates and expands the protection provisions inherent in the underwater cultural heritage already in the UNESCO Convention on the Law of the Sea. The MSP Plan also promotes a systemic, European and regional vision of maritime transport and the theme of multimodality.

This vision is reflected in the Plan's objectives, which foresee the sustainable growth of Adriatic port systems also on the basis of the strengthening and extension of existing cooperation networks between ports, the further development of Motorways of the Sea as a complementary solution to road transport, the integration of maritime transport with the land transport network in the trans-European perspective of TNT-T multimodal networks, the harmonisation of the Plan's choices with existing international planning tools (first and foremost those defined by the IMO such as shipping corridors). The sustainable management of energy resources and the transition towards renewable ones are a further relevant element for the transnational cooperation, both to promote consistent choices between the two sides of the Adriatic Sea and to strengthen the energy distribution networks, consistently with the EUSAIR Pillar 2.

2.9 Measures (at National and Regional level)

The management plan of the Maritime Area "Adriatic" is elaborated by integrating the existing discipline contained in sectoral regulations and in plans and programs in force (as provided by the guidelines of the D.P.C.M. 1 December 2017, par. 14), which remain fully in force. To complement and supplement the sectoral measures in force, the plan identifies a series of measures to achieve the vocations indicated in the plan itself, to improve the coexistence between uses (resolving any conflicts and developing reciprocal synergies), to contribute to the maintenance and achievement of good environmental status and to ensure the compatibility of uses with the requirements of landscape and cultural heritage protection. Therefore, unless the contents of the maritime spatial management plan make it necessary to modify them (art. 5, co. 3, legislative decree no. 201/2016), the forecasts contained in other plans and programs (integrated and sectoral) are intended to be confirmed and are not reported as measures within this document. The measures of the maritime spatial management plans, therefore, are not reproductive of the existing regulatory framework, but, complement it and where necessary amend its existing planning and programmatic forecasts.

The Maritime Spatial Management Plan considers national level measures and relevant measures at the scale of the individual sub-area. The national level measures apply to the entire Italian marine space and are therefore valid for all three maritime areas. For some sub-areas within the territorial waters of coastal regions, more detailed and specific measures have been defined for these sub-areas. In the case of the offshore sub-areas, no specific measures have been identified, since the national level measures are valid in these sub-areas.

As provided by the guidelines containing the guidelines and criteria for the preparation of MSP plans (D.P.C.M. 1 December 2017, par. 20), the national level measures contribute to the achievement of strategic objectives, while those of regional level contribute to the achievement of the specific objectives declined for the different sub-areas. The measures of the management plan of the "Adriatic" Maritime Area, elaborated at the national and sub-area scale, will be subjected to the implementation, when the available economic-financial resources will result sufficient, without any budgetary consequences. In next Table the national level measures are shown, while please refer to Section 2 of the SEA for consultation on sub-area specific measures.

National level measures. **Measure Category**: S - Spatial measures; are related to the definition of spatial aspects and areas in which activities can take place; T - Temporal measures; are related to the definition of limits or conditions that regulate or define the performance of activities over time; TE - Technical and technological measures; are related to the use or adoption of specific technologies or techniques; M - Monitoring, control and surveillance measures; these relate to the acquisition of data concerning the performance of maritime activities, compliance with rules or regulations, effects on the marine environment, effects in terms of interaction with other uses; G - Governance measures (G); these relate to procedural and organizational mechanisms, including multilevel; E - Economic and financial measures (E); identify actions related to financial resources to support maritime activities (also in the framework of existing programming, such as regional POR-FESR and/or EMFF); A - Other measures (A); such as training, education, communication activities.

Typology of the measure: I - addresses, mainly addressed to public administrations or planning instruments; P - prescriptions that the plan provides to regulate the uses of the maritime space (e.g. in terms of modalities, also spatial and temporal - in which the uses can be exercised); I - incentives; A - actions, i.e. concrete initiatives (e.g. consultations, studies, analyses) carried out by or on behalf of competent administrations, possibly in partnership with private subjects.

Code	Strategic objective	Reference use for measurement	Measure	Category(S, T, TE, M, G, EC,A)	Type (I/P/i/A)	Mainactors
NAZ_MIS|01	Transverse measurements		Develop and implement a long-term strategy for the participation and involvement of stakeholders in the process of implementation, monitoring and evaluation of the Maritime Plans, with a view to their updating. Particular attention will be paid to the most socially embedded sectors, local administrations and the general public.	A	A	MIMS
NAZ_MIS|02	Transverse measurements		Consolidate, develop and update the National Portal of the Sea, in terms of content, functions and interface with different types of users.	TE, M	A	MIMS
NAZ_MIS|03	Transverse measurements		Develop methodologies and tools for the quantitative assessment of the socio-economic effects of plan choices, to support the adaptive management phases of the MSP.	M	A	MIMS
NAZ_MIS|04	OS_SS|01 - Developing a sustainable maritimeeconomy, multiplyinggrowth opportunitiesfor the marine and maritime sectors	**nt** Sustainable development	To carry out a study on the socio-economic characterization and evolutionary trends of the different sectors of the Italian sea economy. The study will consider the three maritime areas of reference of the Management Plans, in order to allow the identification of actions that support the sustainable development of the Italian sea economy, to be conveyed in particular through the Maritime Area Management Plans. The study is configured as preparatory to the definition of a National Strategy for the sustainable development of the sea economy.	**A)** A	A	MISE
NAZ_MIS|05	Contributing to the National Strategy forSustainable Development	Sustainable development	Elaborate a Maritime Strategy (National Strategy for the Sustainable Development of the Sea Economy) at a national level, to be implemented in synergy with the implementation of the Maritime Spatial Management Plans, in order to provide astructured impulse to the sustainable development of the Italian sea economy, inthe short, medium and long term. The Maritime Strategy is also developed on thebasis of the results of the study on the socio-economic characterization and evolutionary trends of the sea economy.	A	A	MISE
NAZ_MIS|06	OS_SS|03 - Contributing to the European Green Deal		Taking into account the forecasts and implementation of the NIPEC, as well as the indications of the Report of the "Climate Change, Infrastructure and Sustainable Mobility Commission" (MIMS, 2022), develop a study on the			

		Sustainable development	impact of climate change on National Maritime Plans and related adaptation measures to be considered in a mid-term assessment of MSP Plans. The study will consider a multi-scale approach, assessing in the analysis and solutions also the dimensions of maritime area, sub-area, local area.	A	A	MITE
NAZ_MIS|07		Sustainable development	Prepare a study on the contribution of MSP Plans to the achievement of national climate change reduction and carbon neutrality targets.	A	A	MITE
NAZ_MIS|08		**nt** Sustainable development	To set up a Working Group of coastal Regions aimed at identifying common needs and strategies to fully exploit the opportunities that the objectives of the European Green Deal offer for the development of maritime territories and areas. The Working Group will also see the possibility to work in subgroups, one for each maritime area, to focus on the necessary specificities.	**A)** A	A	MISE,MITE, Regions
NAZ_MIS|09	OS_SS|04 - Fully grasp the economic and environmental sustainability opportunities arising from the circular economy	Sustainable development	Strengthen the role of the maritime economy within the National Strategy for the Circular Economy, for example: enhancing the link and synergies between the Maritime Spatial Plans and the Strategy for the Circular Economy; specifying more detailed actions with reference to the "Blue Economy" Area of intervention, contemplating the efficient use of the maritime space among the tools envisaged to support the transition towards a circular economy, envisaging proposals for specific actions for the sectors of the maritime economy.	A	I	MITE
NAZ_MIS|10		Sustainable development	To support the structuring, strengthening, development and valorisation of shipbuilding and ship repair, maintenance, overhaul and restructuring, dismantling and component collection activities, structuring a circular naval economy supply chain, wherever possible in synergy with the actions aimed at reconverting the use of coastal industrial areas in crisis/decommissioning and environmental reclamation.	A	I	MIMS, Port Authority
NAZ_MIS|11		Sustainable development	To support the structuring of a recovery, re-use and recycling chain of the by-products of the aquaculture and professional fishery activities (also in line with the relevant Measures of the MSFD PoM Descriptor 10), to be realized also at a wide area level including more sub-areas and wherever possible in synergy with the actions aimed at the reconversion of the use of the industrial coastal areas in crisis/decommission and at the environmental reclamation.	A	I	MISE, MIPAAF, Regions
NAZ_MIS|12		Sust **nt** able ain development	Support the structuring of a national supply chain for the recovery, disassembly, reuse/recycling of end-of-life pleasure, sport and fishing boats, wherever possible in synergy with actions aimed at the conversion of use of coastal industrial areas in crisis/decommissioning and environmental reclamation.	**A)** A	I	MISE
NAZ_MIS|13	OS_N|01 - Applying acoherent Ecosystem based approach (EBA) in the overall approach and guidance of MaritimeSpatial Plans	Environmental protection and naturalresources	In order to enable full integration between the implementation processes between MSFD Measure Programs and MSP Plans, establish an "MSFD-MSP" working grouplinked to the activities of the Technical Committee for MSP, aimed at: 1.1 Ensure the integration in the MSP Plans of the spatially explicit information related to species and habitats as well as their environmental status			

			and expected trends, and their integrated assessment, contributing to fill the current knowledge gaps and reinforcing the activities foreseen within the MSFD Directives (with particular reference to the measures MADIT -M032-NEW3; MICIT -M032-NEW3; MWEIT -M035-NEW3 and Measure 3 of the PoM MSFD 20/12/2021 Update) and Natura 2000. 1.2 Adopt analytical tools for analysis and continuous monitoring of potential cumulative impacts of anthropogenic activities on environmental components (in synergy with MSFD and Natura 2000 Directives) as well as of conflicts/synergies between anthropogenic uses.	M, G	A, I	MITE,ISPRA
NAZ_MIS|14	SO_N|02 - Support the extension of EU marine protection to30%, of which 10% ina stringent manner, by 2030	**nt** Environmental protection and naturalresources	In order to enable full integration between the implementation processes between MSFD Measure Programs and MSP Plans, establish an "MSFD-MSP" working grouplinked to the activities of the Technical Committee for MSP, aimed at: 2.1 Identify priority areas for environmental conservation and/or marine resources for the purpose of expanding the network of Marine Protected Areas (MPAs) and/or Natura 2000 Network sites, in line with the forecasts and tools provided bythe MSFD Directives (with particular reference to Measure 1 of Descriptor 1 of theMSFD 20/12/2021 PoM Update), Natura 2000 and the 2030 Biodiversity Strategy. 2.2 Promote studies and assessments of connectivity, ecological status, ecosystem functions and ecosystem services derived from them.	**A)** S, M, EC	A, I	MITE, ISPRA, Regions
NAZ_MIS|15	OS_N|03 - Transposeand promote the implementation of the main space measures foreseen inthe MSFD Program ofMeasures	Environmental protection and naturalresources	In order to enable full integration between the implementation processes between MSFD Measure Programs and MSP Plans, establish an "MSFD-MSP" working grouplinked to the activities of the Technical Committee for MSP, aimed at: 3. establish procedures aimed at the spatial definition, prioritization and application of the measures foreseen by PoM MSFD with an appropriate multi-scalar approach that also takes into account specific objectives (sub-areas) and suitability (U.P.).	S, TE, M	A, I	MITE,ISPRA
NAZ_MIS|16	OS_N|04 - Integrating aspects ofland-sea interaction and integrated management of the coastal strip, with particular reference to environmental aspects	**nt** Environmental protection and naturalresources	To support study and research activities aimed at improving the spatial knowledge of land-sea interactions, with particular reference to the areas identified as interaction hot spots and/or suitable for "environmental protection and natural resources" and landscape protection. These activities should support the integrated management of the protection instruments in force and/or planned.	**A)** TE, M, G	I, A	MITE, ISPRA, Regions
NAZ_MIS|17	OS_N|05 - Take intoaccount in the medium - long termthe process and objectives of marine ecosystem restoration as outlined in the proposed European Law on Environmental Restoration	Environmental protection and natural resources	Prepare the National Environmental Restoration Plan, identifying the priority areas to be restored and the restoration measures and methods to be adopted, in synergic and subsidiary relation with the implementation and monitoring process of the Maritime Space Plans.	S, T	I, A	MITE, Regions
NAZ_MIS|18		Environmental protection and	Improve the knowledge on the distribution of habitats and species indicated in theproposal for an EU Regulation on Environmental Restoration (COM(2022)304 final), capitalizing also on the results of European research			Research Institutions

		naturalresources	projects and of the National Centre for Biodiversity (PNRR-MUR) being set up, and ensuring their effective and direct transfer to the National Plan for Environmental Restoration and, from there,to the Maritime Spatial Plans.	M	A	, Universities, ISPRA
NAZ_MIS|19	OS_PPC|01 - Supporting the landscape value ofthe coastal strip	Landscape and culturalheritage	Initiate analysis to identify and prescribe in appropriate guidelines, principles, criteria and standards to minimize the visual impact on the coastal landscape of seawater facilities and structures (for energy, aquaculture, etc.).	S, TE	A	MIC, MITE
NAZ_MIS|20		Landsnctape and cultural heritage	Provide facilities or incentives for current holders of aquaculture concessions, in the case of activities to improve the characteristics (spatial distribution and color of thenfloats) of the facilities already under concession.	**A)** TE	i	Regions
NAZ_MIS|21		Landscape and culturalheritage	Integrate the Guidelines for the identification of AZAs with a methodology that allows to take into account also the visual perception of aquaculture facilities from the ground. Promote specific studies at a sub-area scale aimed at valorising and capitalising on the experiences already made in the field of compatibility betweenaquaculture facilities and landscape protection requirements, as well as at identifying further practices.	S, TE	I	ISPRA, Regions
NAZ_MIS|22	OS_PPC|02 - Promoting the recovery and redevelopment of buildings and areas subject to protection	Landscape and culturalheritage	Through the analysis of the landscape plans, carry out a reconnaissance of the systems of immovable assets characterising the coastal landscape (e.g. lighthouses, towers), also insisting on non-bound areas, in order to identify and plan enhancement interventions on a sub-area scale.	A	A	MIC, Regions
NAZ_MIS|23	OS_PPC|03 - Promoting and supporting the conservation of theunderwater archaeological heritage	Landscape and culturalheritage	By systematizing the available knowledge and what has already been regulated, define a unitary picture (at the scale of the maritime area), accompanied by mapping, of the areas with the presence of submerged archaeological assets subject to protection or to be protected, of the anthropic activities in such areas prohibited or to be prohibited (including trawling), of the interventions carried out for this purpose or of those to be implemented (including through mechanical and technological means) and of the necessary monitoring activities.	S, M	A	MIC, Regions
NAZ_MIS|24	OS_PPC|05 - Promoting and creating awareness on intangible culturalheritage	**nt** Landscape and culturalheritage	Provide incentives and facilitations for the management, valorisation, conservationand/or restoration of tangible assets representing the intangible heritage linked to the uses of the sea (e.g. trabucchi, historical fishing tools, etc.). Providing incentivesand facilitations for the valorisation of activities that constitute the intangible heritage linked to the uses of the sea, such as techniques and traditions of historical artisanal fishing, traditional shellfish farming activities or ephemeral events that are part of the intangible heritage of the sea (e.g. festivals and religious processions at sea).	**A)** A	i	MIC, Regions
NAZ_MIS|25		Landscape and culturalheritage	Provide for the historical boats, special forms of evaluation of their cultural value, in order to catalogue them, to carry out the necessary restoration works and to preserve them in suitable structures (e.g. Sea Museum).	A	I	MIC
NAZ_MIS|26	OS_PPC|06 - Combating unauthorised building in coastalareas	Landscape and culturalheritage	Systematize the information available in the national database on unauthorized building and from other sources, in order to develop a study on the extent of the phenomenon of unauthorized building in the coastal strip (300 meters deep) at	M	A	Mi, Regions

			the scale of the maritime area, to be used in the planning of interventions to combat it.			
NAZ_MIS|27	OS_S|02 Help promote maritime safety, the implementation of UNCLOS standards and the EU MaritimeSafety Strategy	Maritime safety, navigation and surveillance	With particular reference to the area of the Strait of Sicily, strengthen the dialogue and international coordination for the management of emergency situations involving the safeguard of human life at sea.	A	I	Coastguard / NationalMaritime Rescue Coordination Centre
NAZ_MIS|28	SO_P|01 - Encouraging the sustainable development of thefisheries sector	**nt** Fishing	To guarantee the adequate spatial coverage of the fleet modernization actions (also regarding the energy efficiency of the vessels) for all fishing segments, in particularfor the small artisanal fishery, and to incentivize adequate conditions for the fishing sector in the ports, in order to ensure safe and decent working conditions for the operators and to improve the competitiveness of the sector. In this context, foresee also the appropriate actions aimed at the training of the fishery operators on the sustainability aspects of the professional fishery as per Measure 8 (Descriptors 1 and 3) of the PoM MSFD 20/12/2021 Update.	**A)** TE	I	MIPAAF,ISPRA, Regions
NAZ_MIS|29		Fishing	To encourage the application of solutions aimed at increasing energy efficiency (in particular as regards the energy efficiency of vessels) and the use of renewable energies in the fisheries sector with a view to the supply chain, including the processing and marketing of the product, considering the land-sea interactions offishing activities.	TE	I	MIPAAF,ISPRA
NAZ_MIS|30	OS_P|02 - Support the implementation of the forecasts of the European and National MultiannualManagement Plans in the Geographical Sub-Areas (GSA)	Fishing	Support the appropriate spatial distribution of investments to align fishing capacity with fishing opportunities as indicated by the European and National multi-annual plans for the Management of Sub-Geographical Areas (GSA), in order to contribute to the reduction of fishing pressure, also through studies aimed at assessing the balance between the capacity of fleet segments and the availability of resources, promoting their conservation and sustainable exploitation.	S,EC	A	MIPAAF
NAZ_MIS|31	OS_P|03 - Promotion, development and spatial management of small-scale coastalfishing using sustainable techniques	**nt** Fishing	Stimulate projects, studies and research aimed at promoting an adequate spatial presence of small-scale fisheries, their sustainability and direct actions to strengthen the related skills and develop human capital.	**A)** TE,G	I	MIPAAF, Regions
NAZ_MIS|32		Fishing	Promote agreements between fishermen practising small-scale fishing and the bodies/bodies responsible for the management of coastal and marine areas subjectto protection (MPAs, coastal and marine sites of the Natura 2000 Network, national or regional parks that include coastal and marine areas, etc.) in order to enhance the role of these areas in sustainable development and in the recognition of the quality, also environmental, of the products and services offered by small-scale artisanal fishing. This objective is aligned with the goal of supporting the extension of the protection of EU seas to 30% by 2030, generating positive effects for small-scale artisanal fishing, in synergy with the aims of nature protection.	S, T, G	A	MIPAAF, Regions,MPA managers
NAZ_MIS|33		Fishing	Develop local small-scale fisheries plans that also contain spatial forecasts and measures.	S, A	A	Regions

NAZ_MIS|34	OS_P|04 - Encouragethe creation of areas for the recovery and protection of fish stocks and protectionof Essential Fish Habitats (EFH)	Fishing	Launching an integrated evaluation of the knowledge on the Essential Fish Habitats (EFH) of the main alieutic species, aimed at the determination of the areas to be subjected to protection constraints as a priority, thus supporting the institution of spatial measures of resources management (e.g. ZTB) and related actions of joint spatial planning of fishing activities. This survey activity and related periodic monitoring will have to be carried out as a priority within the 0-6 nautical miles from the coast, as well as capitalizing on the activities foreseen in Measure 3 (Descriptors 1, 3, 6) to support the implementation of the environmental target 6.3 of the PoM MSFD 20/12/2021 Update.	TE, EC, M,G	A, I	MIPAAF
NAZ_MIS|35	SO_P|05 - Encouragecooperation betweenStates in order to achieve concerted measures for the sustainable management of activities of their national fisheries sectors	Fishing	In the context of national, EU and international cooperation initiatives (e.g. FAO-GFCM, CBD), identify, propose and/or strengthen multi-level governance systems (from transnational, to national, inter-regional and compartmental scales) that identify and promote concerted measures for monitoring, sustainable management of shared fishery resources, management of interactions between different fisheries systems, and protection of protected species at a broad range.	**A)** G	I	MIPAAF
NAZ_MIS|36		Fishing	Strengthen international dialogue and coordination for the management of fishing activities in international waters, in order to prevent disputes and ensure the safeoperation of Italian fishing fleets	A	I	MIPAAF,MAECI
NAZ_MIS|37	OS_P|06 - Monitoring and combating illegalfishing	Fishing	Support and strengthen the fight against illegal fishing through co-management schemes as well as through technological adaptation of control networks in all maritime areas.	M, G	A, I	MIPAAF, Captaincies
NAZ_MIS|38		Fishing	Carry out studies and pilot projects for the registration and geo-referencing of fishing activities, in collaboration with the Harbour Offices, which evaluate the extension of the use of VMS and/or AIS systems also for non-compulsory segments (small boats) and possibly the development and adoption of low-cost systems, also using economic incentives (e.g. in the context of FEAMPA).	TE, M, G	A, I, i	MIPAAF, Regions
NAZ_MIS|39	SO_A|01 - Promotingthe sustainable growth of the aquaculture sector	Aquaculture	To encourage the adoption of solutions aimed at increasing energy efficiency and the use of renewable energy in the aquaculture sector from a supply chain perspective that includes the processing and marketing aspects of the product, considering the land-sea interactions of the activities themselves.	TE	I	MIPAAF, Regions
NAZ_MIS|40		Aquaculture	Promote coexistence between aquaculture growth and environmental conservation, through targeted studies and pilot projects for the integration of aquaculture activities and Natura 2000 sites.	**A)** TE	I	MIPAAF,ISPRA, Regions
NAZ_MIS|41	OS_A|02 - Promotequality aquacultureand support the process of establishing AZAs (Allocated Zones forAquaculture)	Aquacultureе	Develop, adopt and implement AZA Plans at the regional scale, in line with the MSP Plans and with the support of the AZA Technical Guide (ISPRA /HIPAA).	S, G	A	Regions
NAZ_MIS|42		Aquacultureе	Establish a permanent working table aimed at supporting the integration and progressive harmonization between regional AZA plans and MSP in the different maritime areas, strengthening the already existing tools (e.g. ITAQUA).	G	A	MIPAAF,ISPRA, Regions
NAZ_MIS|43		Aquacultureе	Address through targeted studies an adequate spatial distribution of investments for the technological development and diversification of	A	A	MIPAAF, Regions

			productions, and monitoring and support systems for the same.			
NAZ_MIS|44	SO_TM|01 - Promoting the sustainable development of maritime transportand reducing its negative impacts	Maritime transportand ports	Produce a study aimed at identifying the areas of highest concentration ("hot spot"areas) of pressures generated in the marine environment by maritime traffic: air emissions, water pollution, waste dispersion, underwater noise emissions, collisions with marine megafauna. The study will also include the definition of specific measures that will ensure, starting from what is indicated in the MSP Plans and with reference to the LSI analysis, the reduction of these pressures and the mitigation of negative impacts on the environment.	TE, M	A	MIMS, ISPRA, PortAuthority
NAZ_MIS|45		Maritime transportand ports	Produce an analysis aimed at identifying new areas of spatial management of maritime traffic (PSSAs, ATBAs, TTSs) and strengthening existing ones, with the aim of improving the regulation of shipping lanes and reinforcing conservation actions for marine ecosystems and biodiversity.	TE, M	A	MIMS, MITE, PortSystem Authority
NAZ_MIS|46		Maritime transport and ports	Encourage the identification and adoption within the MSP of specific spatial, behavioral, and technological measures to reduce the impacts of underwater noise on biota, including in line with MSFD Descriptor 11 objectives and measures.	**A)** S, TE	A	MIMS,MITE
NAZ_MIS|47	OS_TM|02 - Promotethe use of alternativefuels, reduce discharges into the sea, improve port facilities for the collection of waste and cargo residues and/or encourage the use of such facilities, improve themanagement of dredged sediments	Maritime transportand ports	Prepare the mapping at the scale of the maritime area of the sites suitable for the delivery of dredged materials, also through the connection with the databases available at regional level; strengthen the harmonization and coordination of management practices of dredged sediments in the maritime area and at national level.	S, TE, G	A, I	MITE, MIMS, Regions, Port System Authorities
NAZ_MIS|48		Maritime transportand ports	Actively contribute to European and Mediterranean-wide harmonization initiatives of solid waste collection methods on ships and their delivery to ports, in order to optimize procedures (from the planning phase to the service assignment phase), maximize recyclable fractions and contribute to the development of circular economy supply chains. Particular attention must be paid to plastic waste, to activities to combat the abandonment of this waste at sea and on beaches, to the related collection and recovery activities and to environmental education and information activities.	TE, EC, M	I	Port System Authorities , Regions
NAZ_MIS|49	OS_TM|03 - Promoting Europeanand regional cooperation on maritime transport and multimodality	Maritime transportand ports	Adapting multimodal transport networks, integrating the local scale with international and European traffic networks.	G, TE, M	A	MIMS, PortSystem Authority
NAZ_MIS|50	OS_TM|04 - Contributing to increase the competitiveness ofItalian ports, the sharing of best practices and the implementation ofthe National Strategic Plan for Ports and Logistics (PSNPL)	**nt** Maritime transportand ports	Adapt the performance and functionality of Italian ports to the standards required to obtain the different existing certifications such as European Clean Ports, Environmental Management System (EMS), PERS (Port Environmental Review System) and Environmental Port Index.	**A)** G	A, I	Port System Authority

NAZ_MIS|51	OS_TM|05 - Promotethe integration and dialogue between the planning systemsin force in particular regarding the integration of port strategic planning, land planning and sea plans	Maritime transportand ports	Ensure the integration in the MSP Plans of the updates and adjustments of the Port Master Plans, as far as they are concerned and in particular as regards the needs interms of new water spaces in the areas in front of the ports with the aim of ensuring the development of port activities.	G	A	MIMS, PortSystem Authority
NAZ_MIS|52	OS_E01 - Contributing to the energy transition towards renewable and low-emission sources through the development of offshore renewableenergy production	**nt** Energy	Develop national Guidelines for the identification of suitable sites for offshore renewables (wind, solar, wave and current) and the assessment of single and cumulative environmental and landscape impacts, considering the elements of potential impact, during the construction, operation and decommissioning phases, and also considering the elements for the transport of the energy produced onshore. These Guidelines will allow to: i) refine the spatial planning (e.g. in termsof robustness and spatial resolution); ii) address the design of the plants; iii) facilitate the permitting phases (e.g. EIA and VINCA).	**A)** S	A,I	MITE, MIC
NAZ_MIS|53		Energy	To develop a Decision Support System (DST), dynamically linked to the National Portal of the Sea and also fed by the data deriving from the pre-operational and post-operational monitoring and investigation activities (pre-operational phases, including EIA, operation and decommissioning) for offshore renewable energy production plants. This DST aims to support - from an energy, environmental, technological and socio-economic point of view - the phases of feasibility analysis, preliminary design, assessment of environmental impacts, identification of solutions and mitigation measures and assessment of the social acceptability of offshore infrastructure for the production of energy from renewable sources, for the benefit of operators, administrations, local communities.	S, M	A	MITE
NAZ_MIS|54		Energy	Establish an observatory on the monitoring of the impacts of offshore wind farms on the environment and other uses of marine space and the coast, considering thedefinition, implementation and evaluation phases of the monitoring plans required for the installation and operation of wind farms. The assessments of this observatory will need to be taken into account in the implementation of the monitoring plans of the MSP plans, and therefore in the eventual revision of these plans.	M	A	MITE, MIC, Regions
NAZ_MIS|55		**nt**	Initiate and support research and innovation activities, also through pilot projects, on various issues related to offshore renewable energy production, such as in particular: (i) energy production from sources other than wind (wave, tides and currents, solar, combination of different sources), (ii) plants and technologies in areas with clear added value (for synergy with other sectors and issues, for the self-sufficiency of marginalized areas, for the management of energy demand peaks in particular areas, etc.) such as ports, remote areas and minor islands, (iii) combination of offshore renewable energy production with other uses	**A)**		

		Energy	(multi-use) such as aquaculture, tourism, recreation, fishing, protection, (iv) innovative technologies, such as the use of renewable energy sources in the environment, in the tourism sector, in the tourism industry, in fishing, in the protection of the environment, etc.) such as ports, remote areas and small islands, (iii) combination of offshore renewable energy production with other (multi-use) uses such as aquaculture, tourism, boating, fishing, environmental protection, (iv) innovative technologies, also aimed at minimizing impacts on the environment and landscape; (v) experimental assessment of the environmental effects on specific habitats or target species of the solutions adopted.	TE, S	A	MUR, MITE
NAZ_MIS|56		Energy	Create a working group to improve authorization procedures, speeding up processes while respecting the principles of transparency and efficiency.	G	A	MITE, MIC, Regions
NAZ_MIS|57		Energy	Offshore renewable energy installations should adopt solutions to reduce conflicts and promote wherever possible and safe coexistence with other uses of the sea (e.g. permeability for shipping, fishing with gears, sand extraction for coastal defense works, offshore aquaculture facilities, managed tourism, scientific research).	S, T, TE	P	MITE
NAZ_MIS|58		**nt** Energy	Within Marine Protected Areas and marine areas included in National or RegionalParks, the installation of offshore wind power plants is forbidden, with the exception of micro-wind power plants possibly used for self-consumption, also for the supply of energy to activities allowed in the protected area.	**A)** TE	P	MITE
NAZ_MIS|59	OS_E02 - Pursue the environmental, socialand economic sustainability of offshore hydrocarbonprospection, exploration and production activities	Energy	Create an MSP-PiTESAI working group, linked to the activities of the Technical Committee for the MSP, to align the two plans reciprocally and progressively in the implementation and possible revision phases of the plans themselves, supporting the energy transition objectives of the PiTESAI as far as the MSP is concerned, also through the sharing of data and portals.	S, M	A, I	MITE,MIMS
NAZ_MIS|60	OS_E03 - Promote the reconversion of platforms and infrastructures associated with depleted fields and synergies between compatible maritime activities	Energy	Promote, within the scope of the MSP and in compliance with current regulations and the "National Guidelines for the decommissioning of offshore hydrocarbon production platforms and related infrastructures", experiments and projects for the reconversion of decommissioned platforms and related infrastructures (e.g. sealines).	TE	A	MITE
	OS_DC|01 - Promotethe development, harmonization and implementation of strategies and measures to protect the coastline and to combat erosion, as foreseen in the FloodRisk Management Plans prepared at thelevel of the	**nt**	Relaunch the mandate of the National Coastal Erosion Table (TNEC - Memorandumof Understanding MATTM-Regions signed 6.4.2016) in order to: (i) address in a coordinated manner Integrated Coastal Zone Management (ICZM) at the national scale; (ii) systematize existing strategies and plans (ICZM strategies and plans, coastal plans, flood risk management plans pursuant to Legislative Decree 49/2010, etc.(iii) to promote measures and actions for research and experimentation of climate change adaptation interventions (also in	**A)** S, TE, G	A, I	MITE, Regions

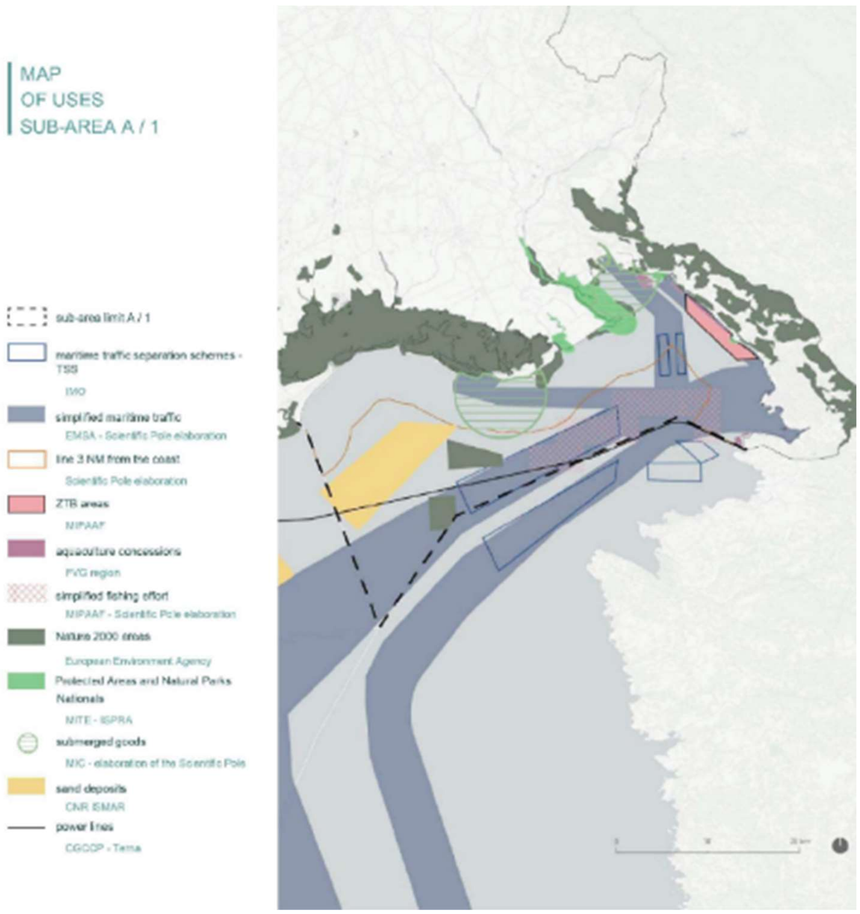
NAZ_MIS|61	Hydrographic Districtin compliance with the provisions of the Floods Directive (2007/60/EC) and in the Coastal Plans / Integrated Coastal Zone Management Plans prepared by many regions	Coastal defence	synergy with mitigation objectives) that are conceptually, environmentally and technologically advanced (e.g.nature-based solutions) implemented at the right spatial scales and on the basis ofappropriate scenarios; (iv) to census and monitor these interventions at the national and regional scales; (v) to foster interregional cooperation on these issues. Within its mandate, the TNEC should regularly coordinate with the Technical Committee for MSP.			
NAZ_MIS|62	OS_DC|02 - To guarantee the best coherence between the uses and vocations of sea use foreseen in the MSP Plans and the coastaluses, with reference to their safeguard in a scenario of necessary adaptationto the ongoing climate change	**nt** Coastal defence	Analyze the coherence between the existing coastal strategies and plans/GIZC, theprojects that intervene on the coastal morphology (for conservation, restoration or modification) and the forecasts of the MSP plan; propose possible corrective actions, also taking into account the most recent climate scenarios, possibly elaborated at regional and/or local scale.	**A)** S, G	A, I	MITE, Regions
NAZ_MIS|63	OS_DC|03 - Adequately consider and address the issueof the use and protection of underwater sand for beach nourishment, to be considered as a strategic resource forcoastal defense and adaptation plans	Coastal defence	To complete the mapping, qualitative assessment and quantification of the volumes of underwater sand deposits available in the seabed, through dedicated funds, in order to plan the use of this (non-renewable) resource on the basis of current and future (erosion and flooding) risk mitigation needs (arising from climate change adaptation needs) in particular considering the increasing demand for sediment forthe implementation of 'nature-based solutions'. Promote the systematic organization and sharing of information acquired at different management scales (regional and national).	S, M	A	MITE, Regions
NAZ_MIS|64		**nt** Coastal defence	Reduce conflicts and impacts related to the use of marine sands for defense worksby: i) prioritizing the use of deposits outside protected areas or with nature priority established by the MSP; ii) reducing conflicts with other uses (e.g. fishing and aquaculture) through the choice of the most suitable deposits and appropriate extraction methods and timing; iii) adopting impact mitigation measures to be assessed in a site-specific way.	**A)** S, T, TE	A, P	MITE, Regions
NAZ_MIS|65		Coastal defence	Create a working group to improve regulations and authorization procedures related to concessions and coastal nourishment interventions with underwater sand in order to clarify and speed up the authorization procedures in compliance with the principles of transparency and efficiency.	G	A	MITE, MIC, Regions
NAZ_MIS|66	SO_T|01 - Promotingsustainable forms of coastal and maritime tourism OS_T|02 - Promotingcoherent planning actions on land and sea, also for tourism purposes	Coastal and maritime tourism	Facilitate the development of coastal and maritime eco-tourism initiatives also in amulti-use perspective and therefore promote opportunities for co-planning between the tourism sector and other sectors of the sea economy (such as. fishingand aquaculture). In this sense, promote the spatial application of the awareness and information measures provided by Measure 2 (Descriptors 1 and 6) of the PoM MSFD 20/12/2021 Update.	S, G	A, I	Ministry of Tourism, ISPRA
	OS_T|02 - Promotingcoherent		Designing and developing monitoring activities for pleasure boating, also on the			

NAZ_MIS|67	planning actions on land and sea, also for tourism purposes	Coastal and maritime tourism	basis of the systemisation of any existing initiatives, through collaboration between Regions and operators/local bodies, in order to acquire adequate knowledge of traffic flows and define management measures for the sustainable development of the sector.	A	A	Regions
NAZ_MIS|68		**nt** Coastal and maritime tourism	At the sub-area scale, assess the establishment of areas for the regulation of recreational traffic and the creation of structures to ensure eco-friendly moorings, in order to preserve the most vulnerable benthic ecosystems and minimize conflicts with other activities. As far as this measure is concerned, the subjects responsible for the implementation and management of the various areas and structures will have to be identified.	A	A	Regions, municipal authorities
NAZ_MIS|69	SO_T|03 - Contributing to the diversification of tourism products andservices and to countering the seasonality of demand for inland, coastal and maritimetourism	Coastal and maritime tourism	Identifying assets or coastal areas subject to strong tourism pressure, also by monitoring the number of accesses, in order to define, where necessary, specific actions for the development of sustainable tourism and the regulation of tourist flows at all or certain times of the year, such as: limiting the number of daily accesses, requiring the purchase of a special ticket whose proceeds are destined to finance interventions for the protection and enhancement of the environmental and cultural heritage, the creation of equipment and initiatives for sustainable tourism (e.g. buoy fields, sea and land visit routes, initiatives for sustainable tourism education, etc.). equipment and initiatives for sustainable tourism (e.g. buoy fields, sea and land visit routes, environmental education initiatives, etc.).	T, G, S	A, I	MIC, Ministry of Tourism, Regions
NAZ_MIS|70		Coastal and maritime tourism	To initiate a study, at the scale of the maritime area, aimed at identifying and promoting sustainable technologies and practices in the sector of navigation for tourism purposes (passenger transport and boating), orienting it spatially and temporally on areas that are particularly vulnerable and congested due to high tourist pressure.	T, TE, S	A, I	MIMS, Regions
NAZ_MIS|71	OS_RI|01 - Target marine research activities on the knowledge needs of the Plan, to strengthen and support the planningprocess and its sustainable growth objectives	**nt** Scientific research and innovation	Design and establish a science-to-policy interface structure aimed at supporting the concrete and timely transfer and application of scientific research results in the MSP process, targeting marine research on the priority needs of the MSP process and disseminating this research to society	A	A	MUR,MIMS

2.10 Summary of planning for each Sub-area

2.10.1 Sub-area A/1 - Territorial waters of Friuli Venezia Giulia

The main uses of the sea and coast present in the sub-area are represented in the Figure. The figure in question shows a synthetic and simplified representation of the maritime activities existing in the area, aimed at providing an overall framework and understanding the planning choices made in the area. In the maritime area in question, the main uses of the sea are: coastal and maritime tourism, maritime transport and related port activities, fishing, aquaculture, protection of the environment and natural resources, protection of the landscape and cultural heritage. The sources of the spatial data used are given in next Figure and represent information available at the national level through the contribution of the Ministries involved in the MSP process.

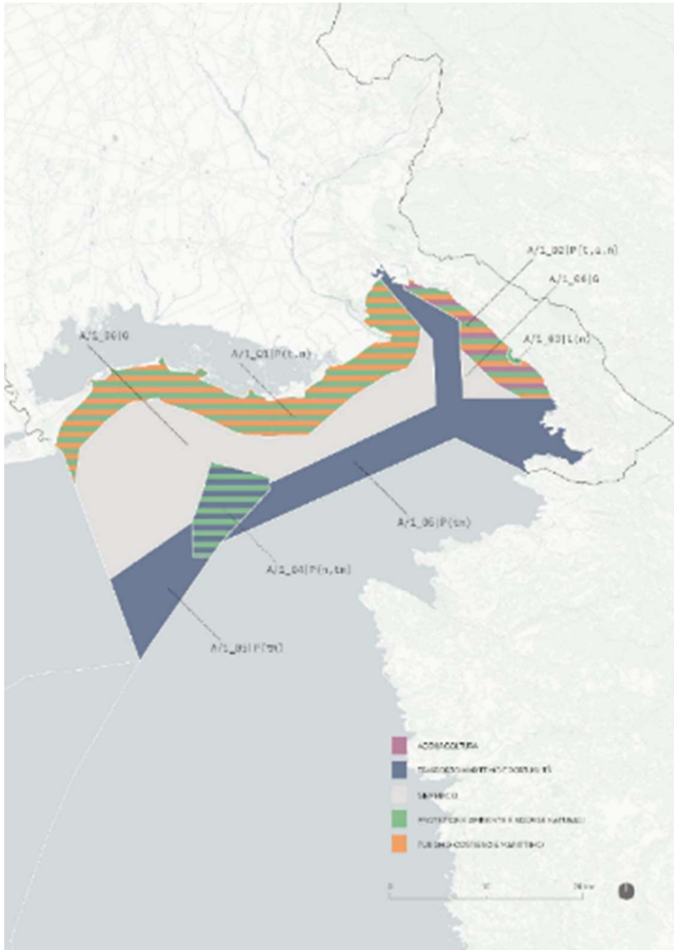


The specific objectives for sub-area A/1 are reported in the following table

Sectors concerned	**Code**	**Specific objectives**
Maritime transport and ports *with particular reference to commercial ports and shipbuilding*	(A/1)OSP_TM|01	Ensure the development of commercial maritime traffic involving the regional commercial port system, in the context of TEN-T networks and international and global traffic scenarios, with a view to sustainable development.
	(A/1)OSP_TM|02	Ensure the periodicity of maintenance work on the seabed functional to the activities of the regional commercial port system.
	(A/1)OSP_TM|03	Enable the development of shipbuilding activities in line with sector production trends.
Maritime transport and ports		
with particular reference to		Provide, through a specific planning, maintenance interventions of the seabed, waterways and marinas for a

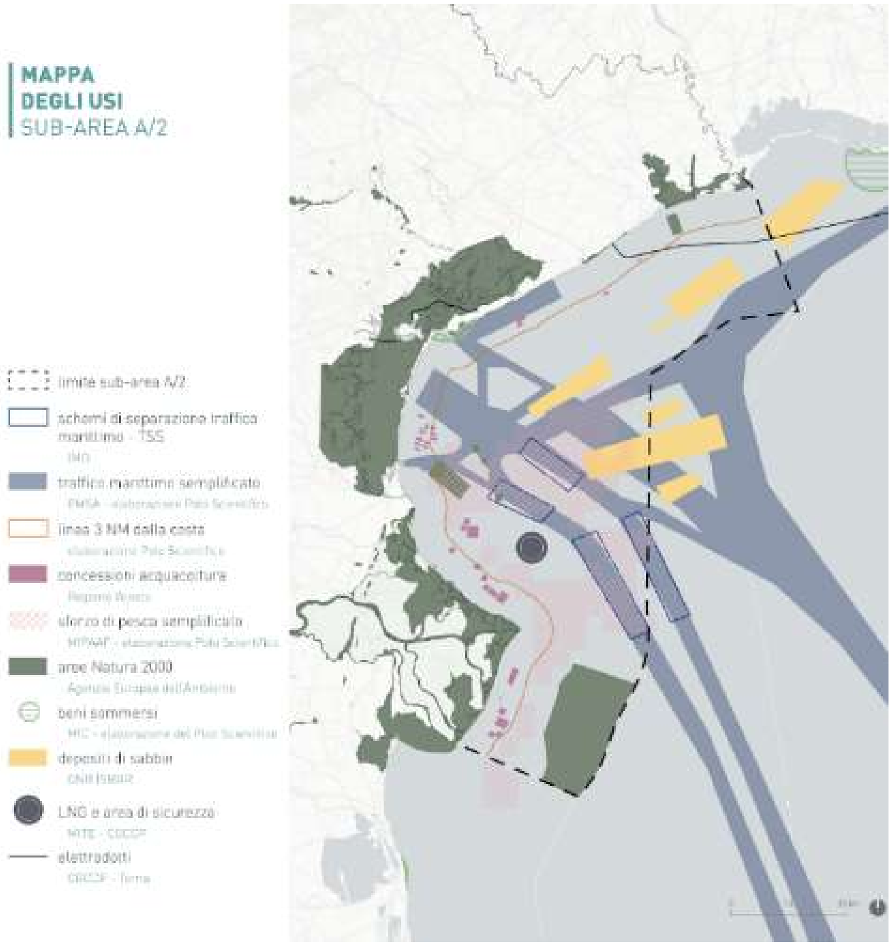
dredging and maintenance of the seabed and related sediment management	(A/1)OSP_TM|04	periodic management of sediments at sea and within the lagoon, also in function of the protection of fishing and aquaculture activities
Dredged sediment sea-diving	(A/1)OSP_ISD|01	Identify sea areas and bounded areas compatible with the management and transfer of sediments deriving from dredging activities and maintenance of the seabed and lagoon and port waterways, in line with what is allowed by the regulations in force and with regard to fishing activities.
Environmental protection and natural resources	(A/1)OSP_N|01	Enhance the system of protected areas within a framework of overall ecological coherence, considering existing conservation measures, including reducing pollution in ports and taking into account interactions with the coast and lagoon environments, in synergy with other present uses
Including protection of Special Areas of Conservation	(A/1)OSP_N|02	Highlight marine environments and habitats of relevant environmental value and monitor their conservation over time.
	(A/1)OSP_N|03	Achieve and maintain the environmental objectives stemming from the Marine Strategy Framework Directive (MSFD) and the Water Framework Directive (WFD) (Dir. 2000/60/EC).
Fishing	(A/1)OSP_P|01	Promoting the sustainable management of small-scale fisheries, through the regulated management of fishing grounds.
	(A/1)OSP_P|02	To favour the sustainable management of fishery, through specific local regulation of the use of gears, different from the artisanal ones, within the national management plans for target species (small pelagics, demersal and bivalve mollusks).
Aquaculture	(A/1)OSP_A|01	To encourage the maintenance of marine and lagoon aquaculture activities.
Coastal and maritime tourism *with particular reference to seaside tourism, nautical tourism and cruise tourism*	(A/1)OSP_T|01	Safeguarding the tourist use of the coasts by improving and/or maintaining the quality of bathing water (Directive 2006/7/EC), protection against flooding and a strategy to combat coastal erosion
	(A/1)OSP_T|02	Developing pleasure boating, with a view to diversifying the tourist offer, while ensuring accessibility to waterways and environmental sustainability
	(A/1)OSP_T|03	To favour the activities functional to the development of the cruise sector
Landscape and cultural heritage	(A/1)OSP_PPC|0 1	Encourage the protection and enhancement of coastal scenic beauty, while respecting the uses already permitted, also identifying maritime stretches of water as additional contexts for the protection of the landscape of coastal areas, enhancing the *skyline*, visual cones, intervisibility of places.
	(A/1)OSP_PPC|0 2	Promote interventions that support the restoration and conservative recovery of coastal real estate assets of high historical-architectural and archaeological value in coherence with the objectives and guidelines of the Regional Landscape Plan (coastal fortifications, lighthouses and markers).
	(A/1)OSP_PPC|0 3	To support conservation interventions and the promotion of assets and places that constitute the historical testimony of the environmental culture of the sea and navigation.

The Planning Units identified for Sub-area A/1:



2.10.2 Sub-area A/2 - Territorial waters Veneto

The main uses of the sea and coast present in the sub-area are depicted in the Figure. The figure in question shows a synthetic and simplified representation of the maritime activities existing in the area, aimed at providing an overall framework and understanding the planning choices made in the area. In the maritime area in question the main uses of the sea are: coastal and maritime tourism, maritime transport and related port activities, management of the Porto Viro offshore regasification plant, fishing, aquaculture, protection of the environment and natural resources, protection of the landscape and cultural heritage, aquaculture.

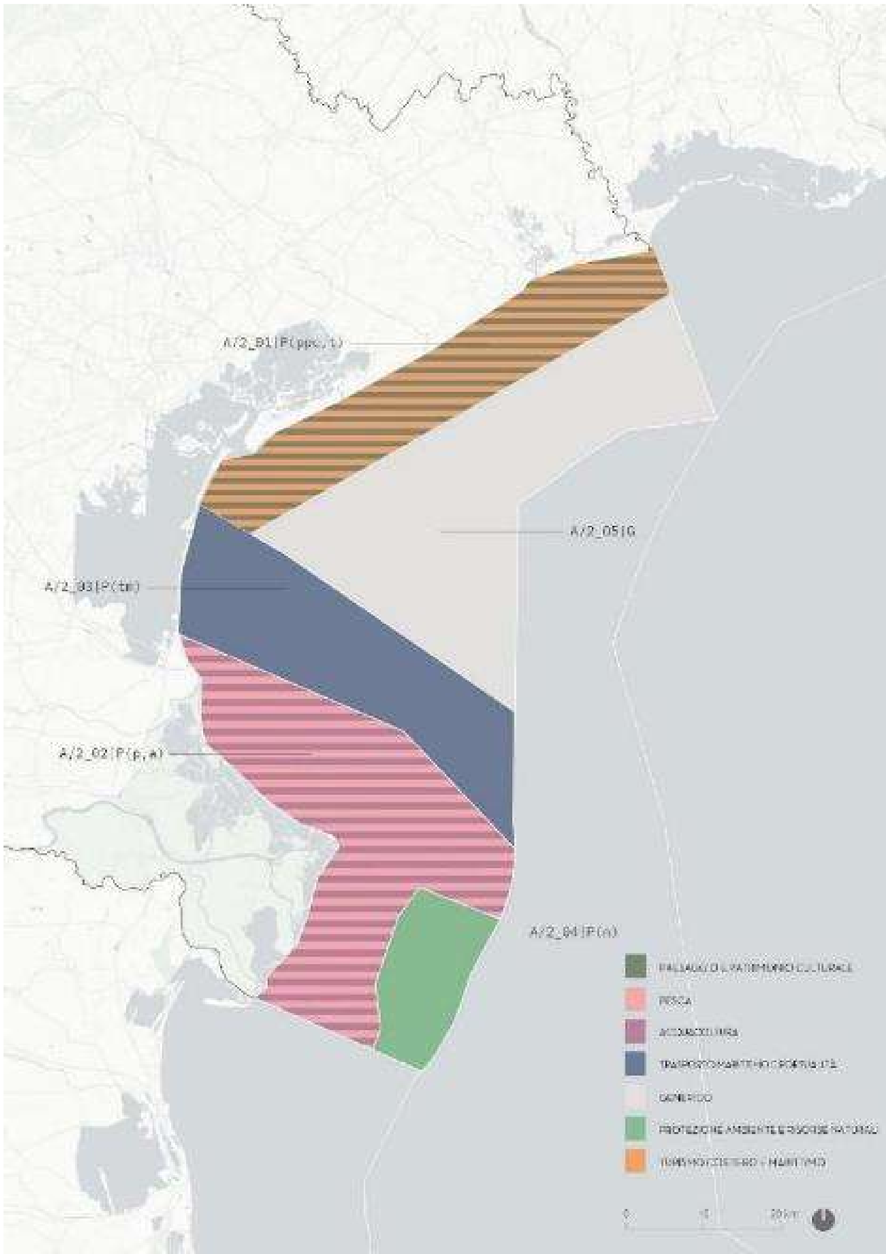


The specific objectives for sub-area A/2 are reported in the following table

Reference sector	Code	Specific objective
Maritime transport and ports *with particular reference to port infrastructure and the development of commercial and passenger traffic*	(A/2)OSP_TM|01	Guarantee the infrastructural conditions of nautical accessibility for the strengthening of commercial maritime traffic involving the Veneto Port System in support of the regional economy.
	(A/2)OSP_TM|02	To support the competitiveness of Veneto ports in relation to their specificity of "regulated ports".
	(A/2)OSP_TM|03	Relaunch the Veneto cruise economy through the resumption of traffic with O/D Venice by solving the terminal problem.
Maritime transport and ports *with particular reference to dredging activities*	(A/2)OSP_TM|04	Activate a program of dredging of waterways and lagoons, protecting habitats and through careful consultation with fishermen
Dredged sediment sea-diving	(A/2)OSP_ISD|01	Identify, in agreement with the fishermen's categories, areas in the sea for the transfer of sediments deriving from the dredging and maintenance activities of the seabed and of the lagoon and port waterways
Environmental protection and natural resources	(A/2)OSP_N|01	Promote uses of the sea that are compatible with conservation areas.
	(A/2)OSP_N|02	Protect marine habitats and species of Community interest by monitoring their presence and conservation status.
	(A/2)OSP_N|03	Achieve and maintain the environmental objectives stemming

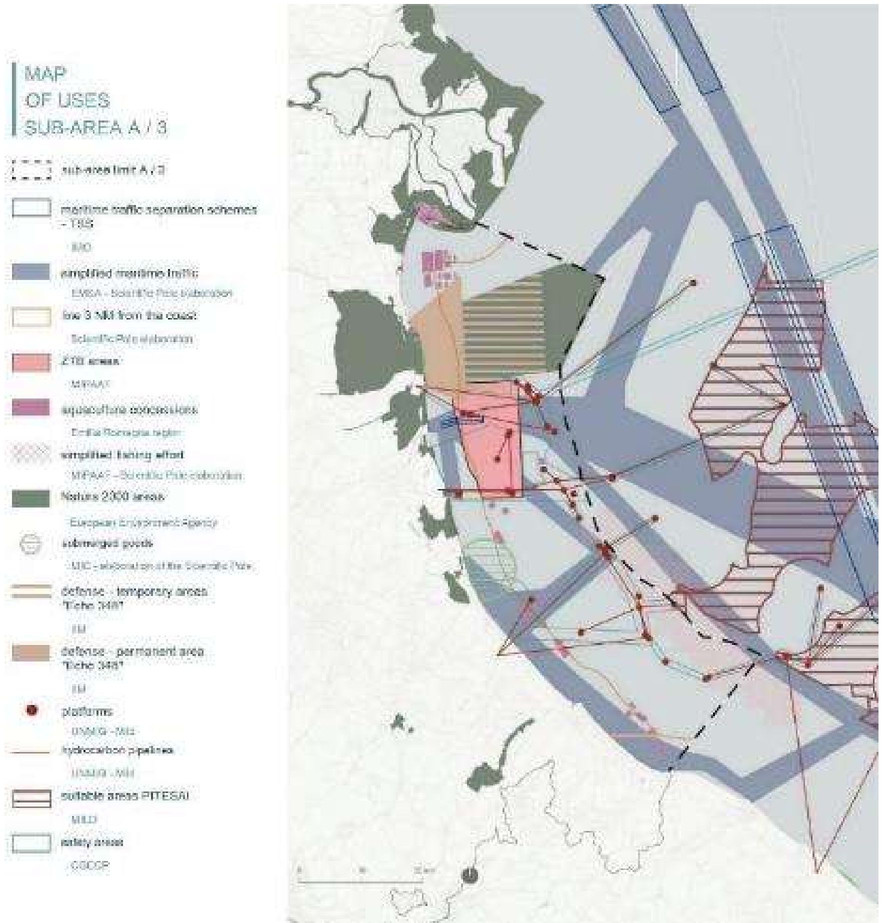
		from the Marine Strategy Framework Directive (MSFD) and the Water Framework Directive (WFD) (Dir. 2000/60/EC).
	(A/2)OSP_P|01	Promote sustainable fisheries management within the framework of national management plans for target species (in particular small pelagics, demersal and bivalve molluscs).
Fishing	(A/2)OSP_P|02	Promote the sustainable management of small-scale coastal artisanal fisheries through regulated management of fishing grounds.
	(A/2)OSP_P|03	Promoting the adaptation of structures and processes that enable the development of economic activities in the fisheries and aquaculture sector, including complementary activities such as fishing tourism and ichthyic tourism
Aquaculture	(A/2)OSP_A|01	Promoting the development of aquaculture activities in the territorial sea areas
Coastal and maritime tourism	(A/2)OSP_T|01	Promote a quality tourism that sees in the achievement of high quality standards (such as the maintenance of the state of quality of bathing water) the elements for its promotion
with particular reference to sustainable tourism and the identity of places	(A/2)OSP_T|02	Developing slow and experiential tourism on the coastal strip in synergy with inland and endolittoral navigation and yachting, supporting the redevelopment of small ports, integrating the land and sea planning system, protecting the landscape characteristics of the coastal system and the architectural features of seaside towns
Coastal defense	(A/2)OSP_DC|01	Programming integrated actions for coastal defense that combine sea defense works and planned beach nourishment with naturalistic interventions for the recovery of dune systems.
	(A/2)OSP_DC|02	Reduce fluid and gas extraction in coastal areas generating accelerated subsidence and increased flood risk areas
Landscape and cultural heritage	(A/2)OSP_PPC|0 1	Promote land-sea interactions in the new landscape planning of the coastal strip. Identify actions for the knowledge and enhancement of the underwater archaeological heritage

The Planning Units identified for Sub-area A/2:



2.10.3 Sub-area A/3 - Territorial waters of Emilia-Romagna

The main uses of the sea and coast present in the sub-area are depicted in the Figure. The figure in question shows a synthetic and simplified representation of the maritime activities existing in the area, aimed at providing an overall framework and understanding the planning choices made in the area. In the maritime area in question, the main uses of the sea are: coastal and maritime tourism, maritime transport and connected port activities, fishing, aquaculture, protection of the environment and natural resources, protection of the landscape and cultural heritage, hydrocarbon research and cultivation, and activities connected to military defense. The sources of the spatial data used are reported in Figure and represent information available at national level through the contribution of the Ministries involved in the MSP process.

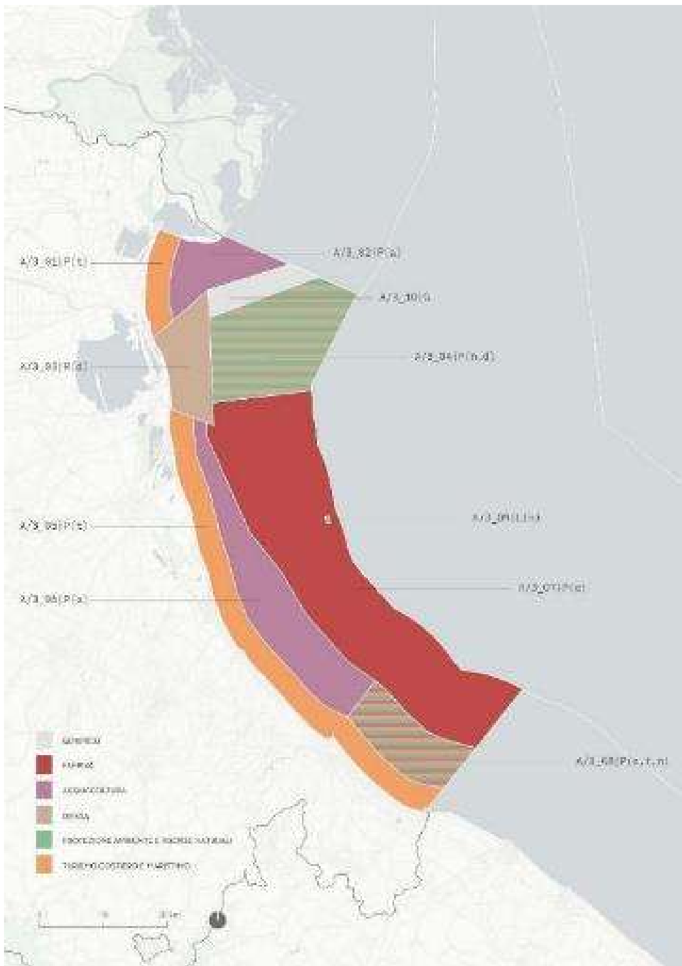

MAP
OF USES
SUB-AREA A / 3
maritime traffic separation schemes - TSS
simplified maritime traffic
ZTB areas
aquaculture concessions
simplified fishing effort
Nature 2000 areas
European Environment Agency
submerged goods
defense - temporary areas
defense - permanent area
platforms
hydrocarbon pipelines
suitable areas PITESAI
safety areas

The specific objectives for sub-area A/3 are reported in the following table

Reference sector	Code	Specific objective
Coastal and maritime tourism *also relevant for coastal defense*	(A/3)OSP_T|01	Safeguard the tourist use of the coasts (seaside tourism) by protecting them from flooding, combating erosion, maintaining and restoring the beach system
Coastal defense	(A/3)OSP_DC|01	Allowing the exploitation of underwater sand deposits, indispensable for beach nourishment; reducing conflicts with other uses; ensuring the prudent management of this non-renewable resource and minimizing and impact on the environment
Energy	(A/3)OSP_E|01	Manage the exploitation over time of the methane fields already authorized in a way that is safe for man and the environment, in line with the guidelines and forecasts of PiTESAI. reducing conflicts and increasing synergies with other sectors of the marine economy (tourism, aquaculture, environmental protection)
	(A/3)OSP_E|02	Promote the generation of energy from renewable sources at sea, also promoting, where possible, the conversion of decommissioned platforms for multi-purpose projects that include the storage of energy produced from renewable sources (hydrogen), the creation of areas of 'biological protection' and/or sites of interest for tourism and underwater fishing and aquaculture
Fishing	(A/3)OSP_P|01	Promoting the sustainable and regulated expansion of small-scale fishing with particular attention to the development of income-generating activities such as fishing tourism and ichthyic tourism
	(A/3)OSP_P|02	To review the regulation of trawling, taking into account the effects on the seabed, the areas with EFH, the sustainability of the exploitation of stocks, with particular attention to the development of income-generating activities such as fishing tourism and fishing tourism
Aquaculture	(A/3)OSP_A|01	To support the sustainable development of the aquaculture activities in synergy with the other uses present in the area, with particular attention to the development of income-generating activities such as Acqui-tourism and through the identification of Aquaculture Areas (AZA), as per European indications.
Environmental protection and natural resources	(A/3)OSP_N|01	Consolidate the existing system of protected areas and conservation measures, within a framework of overall ecological coherence and in synergy with other present uses.
	(A/3)OSP_N|02	Maintain/achieve WFD, MSFD and H&BD environmental objectives.
Maritime transport and ports	(A/3)OSP_TM|01	To support the development of maritime (and/or tourist/fishing) commercial traffic involving the regional commercial port system, in the context of TEN-T networks and international and global traffic scenarios, with a view to sustainable development
	(A/3)OSP_TM|02	Manage the periodicity of maintenance of the seabed functional to the activities of the commercial and tourist port system by promoting the sustainable management of sediments (from port dredging, excavations, hydraulic systems, etc.), with the aim of coastal nourishment for emerged and submerged beaches.
	(A/3)OSP_TM|03	Developing recreational boating, with a view to diversifying the tourist offer, promoting environmental sustainability

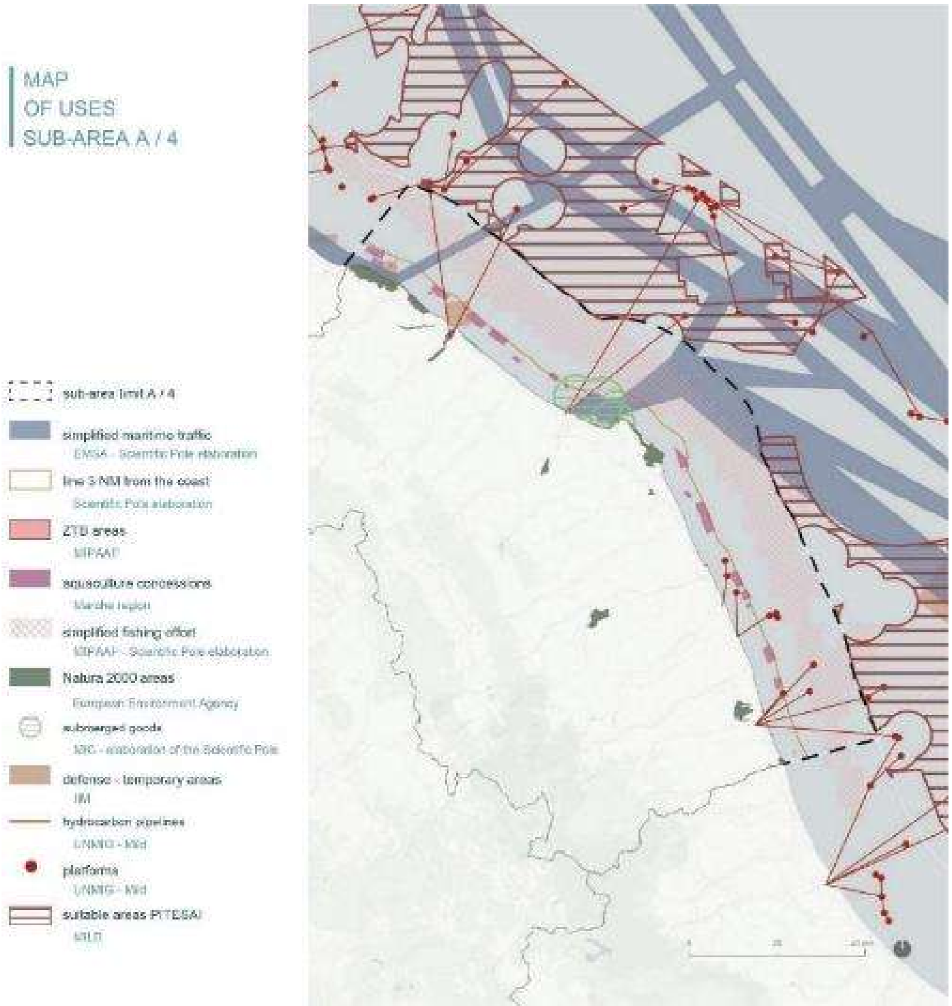
		and at the same time ensuring accessibility to waterways
Defense	(A/3)OSP_D|01	Allowing the maintenance of the military functions of certain areas, reducing conflicts with other present uses
Landscape and cultural heritage	(A/3)OSP_PPC|01	Promoting the coordination of Maritime Spatial Planning with the Landscape Planning of the regional territory and with the needs of conservation, recovery and enhancement of historical, architectural and archaeological heritage

The Planning Units identified for Sub-area A/3:



2.10.4 Sub-area A/4 - Marche territorial waters

The main sea and shoreline uses present in the sub-area are depicted in the Figure. The figure in question shows a synthetic and simplified representation of the maritime activities existing in the area, aimed at providing an overall framework and understanding the planning choices made in the area. In the maritime area in question, the main uses of the sea are: coastal and maritime tourism, maritime transport and connected port activities, fishing, aquaculture, protection of the environment and natural resources, protection of the landscape and cultural heritage, hydrocarbon research and cultivation, and activities connected to military defense. The sources of the spatial data used are reported in Figure and represent information available at national level through the contribution of the Ministries involved in the MSP process.

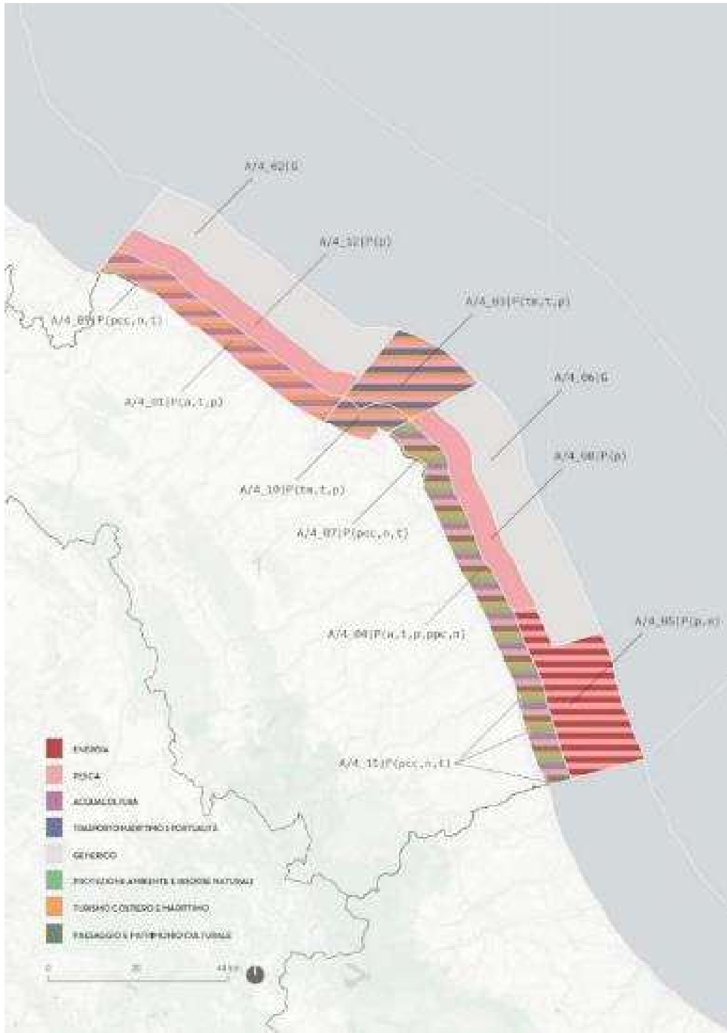


The specific objectives for sub-area A/4 are reported in the following table

Reference sector	Code	Specific objective
Coastal and maritime tourism	(A/4)OSP_T|01	Improving the services available to tourists, whether seaside, yachtsmen or cruise passengers, and integrating the tourist offer with the cultural attractions present on the coasts and, above all, in the inland areas
	(A/4)OSP_T|02	Improving the network of tourist ports through the modernization of existing ports
	(A/4)OSP_T|03	Encourage the modernization of tourist port facilities and related services, in the logic of a new vision of the port and waterfront as a tourist destination and, as such, the hub of the tourism system
	(A/4)OSP_T|04	Developing pleasure boating, with a view to diversifying the tourist offer, while ensuring environmental sustainability
	(A/4)OSP_T|05	Supporting activities functional to the development of the cruise sector, enhancing the value of the ports of call as tourist infrastructures, not just transport infrastructures
Coastal defense	(A/4)OSP_DC|01	Implementing the measures related to the "buffer zone" connected to the regulations (NTA ICZM Plan/Title III), in terms of seasonality of the bathing establishments, minimization of the interference with the hydrodynamic

including flood protection, and restoration of seabed morphology		balance and limitation of soil consumption also in implementation of the Floods Directive (2007/60/CE)
	(A/4)OSP_DC|02	Reduce vulnerability in support of increased resilience of the coastal strip in implementation of the ICZM Plan including through actions to reactivate solid river transport feeding the coastal strip
	(A/4)OSP_DC|03	Pursue the objectives and principles of the Mediterranean Protocol (art. 28 NTA ICZM Plan) through specific actions including the renaturalisation of the coastal strip (art. 24 NTA ICZM Plan) and the harmonisation between public use and the tourist and recreational development of the coastal area
Aquaculture	(A/4)OSP_A|01	Sustainable development of aquaculture, with increased production and use of farming systems that minimise the use of plastics
Fishing	(A/4)OSP_P|01	Maintain current fishing capacity in a sustainable manner.
	(A/4)OSP_P|02	Promote sustainable fisheries also through the development of dedicated port infrastructure.
Environmental protection and natural resources	(A/4)OSP_N|01	Implementation of policies to ensure conservation of habitats and species and restoration of the most threatened habitats.
	(A/4)OSP_N|02	Protect and preserve the quality of the marine environment (Directive 2008/56/EC and Directive 2000/60/EC) and increase the effectiveness of control actions also through sea monitoring.
Landscape and cultural heritage	(A/4)OSP_PPC|01	Promote interventions that promote the restoration and conservation of coastal real estate of high historical and architectural value (coastal fortifications, lighthouses and signals)
	(A/4)OSP_PPC|02	To encourage the conservation and promotion of the assets that constitute the historical testimony of the environmental culture of the sea and navigation.
	(A/4)OSP_PPC|03	Encourage the preservation of coastal scenic beauty.
Maritime transport and ports	(A/4)OSP_TM|01	Ensuring a major freight flow for the "traditional" ferry lines, "crucial" to maintaining the line and remaining sustainable.
	(A/4)OSP_TM|02	Encourage the reconversion of activities in crisis in or near commercial ports into activities related to shipbuilding or the circular economy.
	(A/4)OSP_TM|03	Encourage logistical innovation and the modernisation of port infrastructure in order to boost maritime transport of both goods and people and cruise passengers.
Energy *with particular reference to renewable energies*	(A/4)OSP_E|01	Contribute to decarbonisation by promoting the use of marine renewable energies, provided they are compatible with landscape protection and environmental sustainability.
	(A/4)OSP_E|02	Promote the creation of a global value chain in the region based on marine renewable energies by protecting the marine environment and coastal landscape.

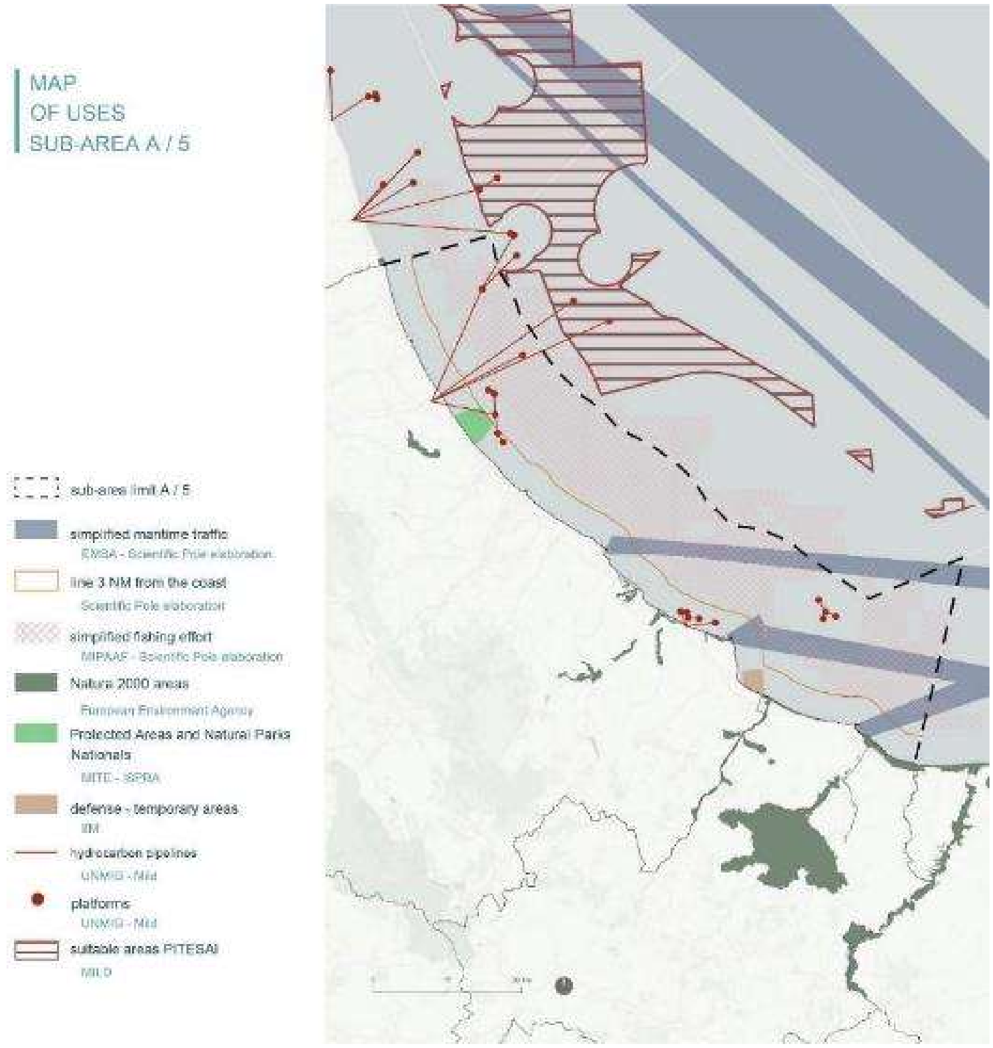
The Planning Units identified for Sub-area A/4:



2.10.5 Sub-area A/5 - Abruzzo and Molise territorial waters

The main uses of the sea and coast present in the sub-area are depicted in the Figure. The figure in question shows a synthetic and simplified representation of the maritime activities existing in the area, aimed at providing an overall framework and understanding the planning choices made in the area. In the maritime area in question, the main uses of the sea are: coastal and maritime tourism, maritime transport and connected port activities, fishing, protection of the environment and natural resources, protection of the landscape and cultural heritage, hydrocarbon exploration and production, and activities connected to military defense.

The sources of the spatial data used are reported in Figure and represent information available at national level through the contribution of the Ministries involved in the MSP process.



The specific objectives for sub-area A/5 are reported in the following table

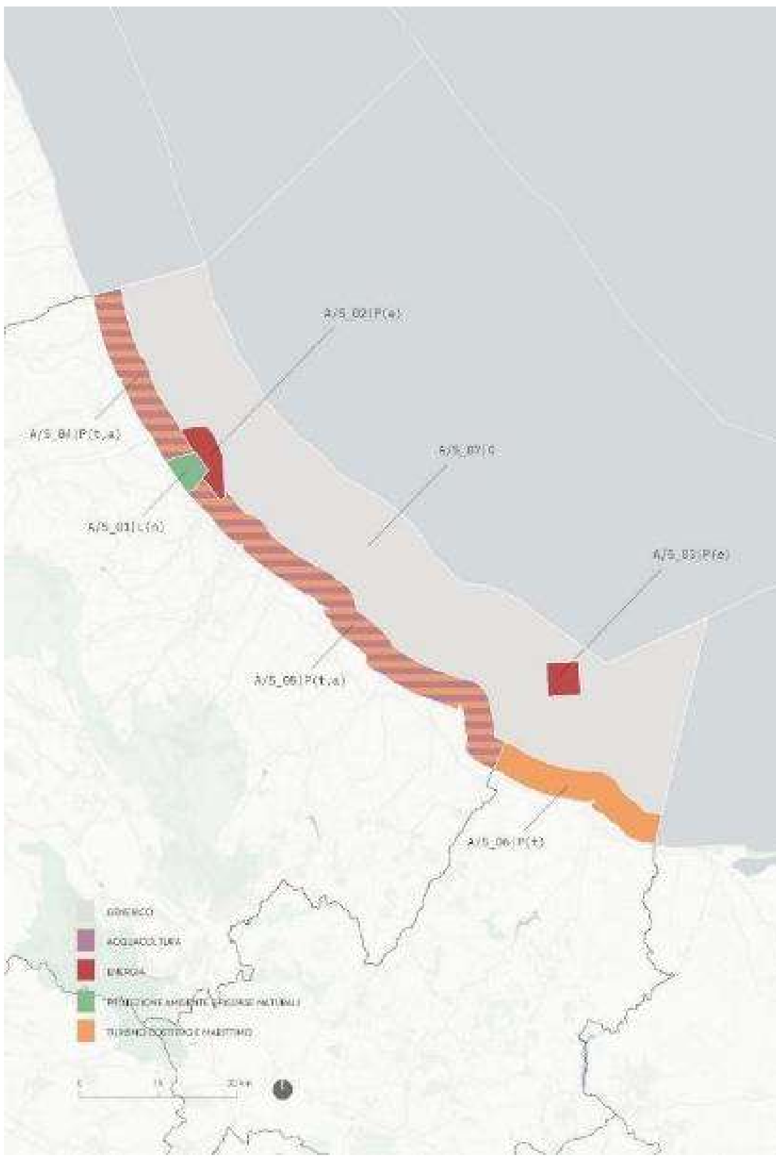
Reference sector	Code	Specific objective
Maritime transport and port activities with particular reference to commercial ports and shipbuilding	(A/5)OSP_TM|01	To ensure the development of commercial maritime traffic involving the regional commercial port system, in the context of TEN-T Networks and international and global traffic scenarios, with a view to sustainable development. To promote cross-border cooperation by establishing an active and long-term partnership through the improvement of multimodal connections and maritime transport.
	(A/5)OSP_TM|02	Enhancing the port areas through a process of urban requalification and integration.
	(A/5)OSP_TM|03	Guaranteeing the periodicity of maintenance interventions on the seabed functional to the activities of the regional commercial and tourist port system. Supporting the implementation of a monitoring and management system of silting

		in the ports that allows a dynamic collection of data necessary to develop a planning and forecasting system for ordinary and extraordinary maintenance of the seabed.
	(A/5)OSP_TM|04	Enable the development of shipbuilding activities in line with sector production trends.
	(A/5)OSP_TM|05	Providing for a planning of maintenance interventions of the seabed, waterways and marinas also in function of the protection of fishing and aquaculture activities.
Maritime transport and ports With particular reference to dredging and seabed maintenance Dredged sediment sea-diving	(A/5)OSP_ISD|01	Identify sea areas and defined coastal areas compatible with the management and delivery of sediments deriving from dredging activities and maintenance of the seabed and port waterways, in line with what is allowed by the regulations in force and having regard to fishing activities. Propose strategies for the re-use of sediments deriving from the dredging of port areas aimed at the nourishment of eroding stretches of coastline.
Environmental protection natural resources	(A/5)OSP_N|01	Enhancing the protected area system within a framework of overall ecological coherence, considering the existing conservation measures and defining a valorization strategy capable of virtuously combining conservation and valorization aims, adopting a unitary view of promoting sustainable development. Safeguard relict dune areas and backdune areas for the maintenance of biodiversity with the proposal of actions aimed at their restoration and conservation. Promote the exchange of experiences and best practices for the management and conservation of coastal and natural heritage through the participatory involvement of stakeholders.
	(A/5)OSP_N|02	Highlight marine environments and habitats of relevant environmental value and monitor their conservation over time, also with reference to the expansion of the Natura 2000 network of sites at sea.
	(A/5)OSP_N|03	Achieve and maintain the environmental objectives stemming from the Marine Strategy Framework Directive (MSFD) and the Water Framework Directive (WFD) (Dir 2000/60/EC)
Coastal defense	(A/5)OSP_DC|01	Implement actions aimed at protecting the coast from erosion phenomena, storm surges and the critical issues resulting from climate change. Identify structural and non-structural coastal

		hazard mitigation interventions based on exposed assets. Provide for monitoring activities of structural interventions with particular attention to water and sediment quality aspects.
Energy	(A/5)OSP_E|01	To allow the exploitation over time of the methane fields already authorised in a safe manner for man and the environment, reducing conflicts and increasing synergies with other sectors of the marine economy, in accordance with the guidelines and forecasts of PiTESAI.
	(A/5)OSP_E|02	To support the experimentation and the use of technologies for the generation of energy from renewable sources at sea, with particular reference to wind power, compatibly with the policies in force for the protection of the environment and the landscape.
Fishing	(A/5)OSP_P|01	To support the sustainable management of artisanal fishing, through the regulated management of fishing areas, and the increase of the income of the sector's operators with particular attention to the development of income-generating activities such as fishing tourism and ichthyic tourism, promoting fishing traditions, maritime culture and respect for the environment
	(A/5)OSP_P|02	To support the sustainable management of fishery, through specific local regulations on the use of gears, different from those of artisanal fishing, within the national management plans for target species (small pelagics, demersal and bivalve molluscs)
Aquaculture	(A/5)OSP_A|01	Identify the most suitable areas (AZA) in order to defuse possible conflicts with other uses of the sea and ensure the protection of the marine environment. Promote the maintenance and sustainable development of aquaculture activities in synergy with other uses in the area
Coastal and maritime tourism *with particular reference to seaside tourism, nautical tourism and cruise tourism*	(A/5)OSP_T|01	Safeguard the tourist use of the coasts through the improvement and/or maintenance of the quality status of bathing waters (Directive 2006/7/EC) and a strategy to combat coastal erosion.
	(A/5)OSP_T|02	Developing pleasure boating, with a view to diversifying the tourism offer, while ensuring accessibility to waterways and environmental sustainability
	(A/5)OSP_T|03	To support the activities functional to the development of the cruise sector

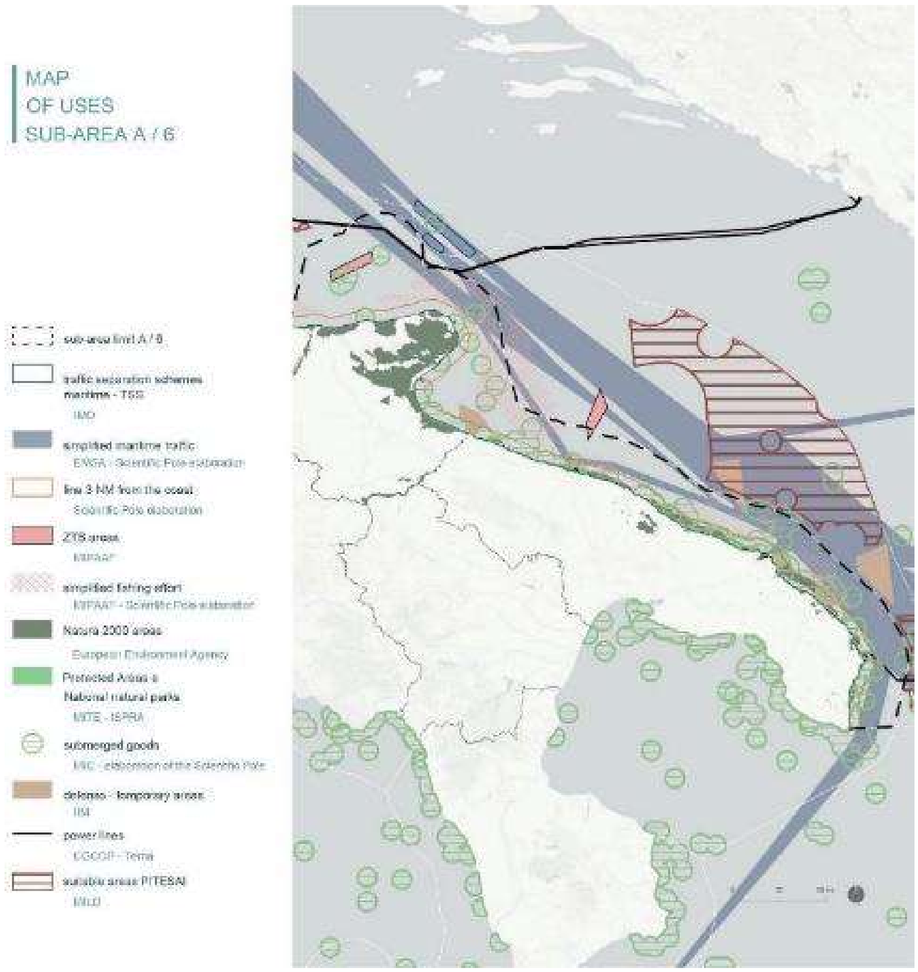
	(A/5)OSP_T|04	Promote the recovery and enhancement of the archaeological heritage of the coast and the emergencies of historical and architectural value of considerable interest. Enhance the historical and cultural heritage of the coast by promoting the recovery of trabucchi respecting their natural destination and compliance with their traditional value.
	(A/5)OSP_T|05	Promote sustainable mobility linking coastal and marine fruition also through the development of cycle tourism in an overall context of diversification of the tourist offer.

The Planning Units identified for Sub-area A/5:



2.10.6 Sub-area A/6 - Territorial waters of eastern Apulia

The main uses of the sea and coast present in the sub-area are depicted in the Figure. The figure in question shows a synthetic and simplified representation of the maritime activities existing in the area, aimed at providing an overall framework and understanding the planning choices made in the area. In the maritime area in question, the main uses of the sea are: coastal and maritime tourism, maritime transport and related port activities, fishing, protection of the environment and natural resources, protection of the landscape and cultural heritage, and activities related to military defense. The sources of the spatial data used are reported in Figure and represent information available at national level through the contribution of the Ministries involved in the MSP process.



The specific objectives for sub-area A/6 are reported in the following table

Reference sector	Code	Specific objective
	(A/6)OSP_N|01	Contribute to the achievement and maintenance of the environmental objectives deriving from the Marine Strategy Framework Directive (MSFD) and the Water Framework Directive (WFD) (Dir. 2000/60/EC), also by filling the knowledge gaps in the descriptors and providing structural interventions for the modernization and proper management of urban and industrial discharges
	(A/6)OSP_N|02	Conserving, restoring and monitoring marine biodiversity (e.g. *Posidonia oceanica* meadows, coralligenous and deep

Environmental protection and natural resources		biocoenosis, marine mammals) in line with the objectives of the Biodiversity Strategy and with the provisions of the FAP, enhancing, expanding and strengthening the system of protected areas and the Regional Ecological Network within a framework of overall ecological coherence
	(A/6)OSP_N|03	To improve the environmental quality of the coastal system by raising its ecological gradient; to integrate the aspects of land-sea interaction and integrated management of the coastal strip, with particular reference to environmental and naturalistic aspects, also with regard to terrestrial habitats and species
	(A/6)OSP_N|04	Protecting the marine environment from the impacts of human activity
	(A/6)OSP_N|05	Promote measures to manage waste that can be found in the sea and on beaches, through policies to combat "Marine Litter", including better waste management, reducing packaging waste, increasing recycling rates (of plastics in particular), improving the treatment of waste water, promoting the recovery of waste already dispersed
Landscape and cultural heritage	(A/6)OSP_PPC|01	Increasing the degree of naturalness of the coastal system, redesigning and redeveloping rural coastal landscapes and historic urban *waterfronts*, restoring natural and historic-cultural coastal places of scenic value when degraded by uncontrolled human development
	(A/6)OSP_PPC|02	Enhance the aesthetic-perceptual structure of the landscape and promote reciprocal and complementary relationships between inland and coastal landscapes in order to develop land-sea interaction and the fruition of cultural heritage, with particular regard to coastal sites and cultural heritage related to the defense system (historical centres, castles, fortified palaces, towers, city walls), often inserted in valuable urban and environmental contexts; prevent transformations that alter or compromise the functional, historical, visual, cultural, symbolic and ecological components and relations that characterise and identify the structure of the regional coastal landscape
	(A/6)OSP_PPC|03	Recovering dune systems, cliffs, wetlands, water basins and canals, as well as marginal areas close to the coast that are severely degraded and reinforcing ecological connections, also through the relocation of existing infrastructures lacking in landscape and identity value
	(A/6)OSP_PPC|04	Strengthen the interventions aimed at promoting slow mobility systems also for the connections between the coast and the hinterland
	(A/6)OSP_PPC|05	Safeguard the great sceneries characterizing the regional image: safeguard the panoramic views of relevant landscape value, characterized by particular environmental, naturalistic and historical-cultural values
	(A/6)OSP_PPC|06	Encourage the protection and enhancement of coastal scenic beauty, in compliance with the uses already permitted, preserving the horizon line as a valuable element of the coastal seascape, also by identifying maritime stretches of water as additional contexts for the protection of the coastal landscape, enhancing the *skyline*, visual cones, intervisibility of places. panoramic points and natural and anthropic visual landmarks,

		main settlements, castles, towers, lighthouses and any other architectural and cultural asset, located in a privileged orographic position, from which it is possible to get panoramic views of the landscapes characterizing the regional identity
	(A/6)OSP_PPC|07	Protecting the submerged archaeological heritage also through the strengthening and adjustment of the knowledge base, the deepening of impact assessments and the strengthening of seabed monitoring actions related to the implementation of interventions (e.g. beach nourishment, dredging, small movements) that may have an impact on known and potential sites
	(A/6)OSP_PPC|08	Strengthening interventions to promote and conserve *in situ* the underwater cultural heritage and archaeological, monumental and cultural heritage values through the protection of context values and conserving the seascape and coastal landscape to integrate the landscape and cultural dimensions of heritage assets
Maritime safety, navigation and surveillance	(A/6)OSP_S|01	Increasing legality and safety in sea areas and within port activities and infrastructures, also by supporting a widespread presence of Coast Guard and other Law Enforcement Agencies.
Coastal and maritime tourism	(A/6)OSP_T|01	Promote a quality tourism focused on innovative products and on products characterized by a strong territorial imprint and that sees in the achievement of high quality standards (such as the maintenance of the state of quality of bathing water, the maintenance and respect for nature) the elements for its promotion
	(A/6)OSP_T|02	Promoting the seasonal adjustment of tourist flows through the enhancement of the hinterland and the reduction of *hotspots* of high concentration of tourist flows and establishing criteria based on an ecosystem approach for the use of state-owned areas for tourism and recreational purposes
	(A/6)OSP_T|03	Promoting pleasure boating through the networking of dedicated sustainable infrastructures, the promotion of innovation in the shipbuilding sector and the promotion of an experiential tourism on the coastal strip by protecting the landscape characteristics of the coastal system and the architectural features of the seaside towns
	(A/6)OSP_T|04	Supporting the integrated development of sustainable tourist-sport activities (e.g. cycling tourism, rowing, sailing, *kite-surfing*, *windsurfing*, recreational diving) through appropriate spatial planning of the same, providing adequate infrastructural support on land (landing places, support structures, etc.) and enhancing the use of new technologies
	(A/6)OSP_T|05	Promote the panoramic viewpoints as a resource for the tourist fruition of the territory, as points from which it is possible to catch panoramic views of the whole regional landscape
	(A/6)OSP_T|06	Strengthen interventions to promote the experiential tourism of the sea "from the sea", enhancing the perception of the coastal landscape from the sea with appropriate transport systems (environmentally friendly propulsion systems), and through the protection of intervisibility

	(A/6)OSP_T|07	Strengthen the actions to promote underwater tourism by enhancing the use of new technologies
Fishing *some aspects also relevant to aquaculture*	(A/6)OSP_P|01	To promote the conservation and rational management of the biological resources of the sea and inland waters in respect of the protection of the environment and marine ecosystems, also through the planning of the fishing effort, the adoption of selective fishing systems and the study and control of the interrelationships between the marine, lagoon, lake and river environment and fishing and aquaculture
	(A/6)OSP_P|02	To support and apply the integrated management approach of the coastal strip through effective governance tools (including local ones) of coastal resources and territories, supporting generational change and the adaptation of related infrastructures and services
	(A/6)OSP_P|03	Combating illegal fishing in line with EU regulations, in particular for the protection of fish stocks during the spawning and growth phases, including through the establishment of biological rest areas and *nursery* and restocking areas
	(A/6)OSP_P|04	Encouraging a reduction in the use of plastics, tackling ghost fishing and the spread of microplastics
	(A/6)OSP_P|05	Reinforce efforts to promote the recycling of waste products and the proper disposal of waste from fisheries, recreational boating, etc.
	(A/6)OSP_P|06	To guarantee in all the area to the fishing sector the necessary aids for the maintenance and transmissibility of the traditional fishing systems and of the equipments linked to them (traditional reed pots, fishing with the "lampara", etc.).
Aquaculture	(A/6)OSP_A|01	Identify suitable areas for aquaculture (AZA) to be used for breeding purposes, as well as the service areas necessary to carry out this activity
Coastal defense *considered within the framework of Integrated Coastal Zone Management*	(A/6)OSP_DC|01	To protect the morpho-dynamic equilibrium of coastal environments from erosive phenomena through the predisposition of a cognitive framework that frames the phenomenon of coastal erosion in its complexity, areal and temporal dimension, identification of areas at risk and predisposing/incident factors (subsidence, solid transport, etc.), determination of the interference of the phenomenon with other processes (e.g. loss of habitat) at the scale of the coastal physiographic unit
	(A/6)OSP_DC|02	Elaborate at the scale of the physiographic unit methodologies and strategies of intervention to contrast coastal erosion, subsidence of coastal plains and defense against flooding of coastal areas generated by meteo-sea events, according to the population and the exposed elements as well as the constraints present, ensuring the connection with the management plan of the flood risk and with the planning of civil protection
	(A/6)OSP_DC|03	The sea as a great public park: to regulate the use of the areas of the maritime domain, preserving them from incongruous uses and from illegal activities, promoting free use and the development of eco-compatible tourist and recreational activities, guaranteeing the safeguard of the environmental, naturalistic and landscape aspects of the Apulian coastline

	(A/6)OSP_DC|04	Guaranteeing an 'active protection' of the coast in order to contrast the ever-increasing demand for coastal land transformation through: (i) Rewarding systems to support the adaptation of the existing built environment to weather and climate changes; (ii) Modification of the seabed system of existing structures in order to reduce interference with wave motion and coastal dynamics; (iii) Identification of areas with elements at risk (buildings, structures, etc.) within or close to the maritime state property; (iv) Identification of buffer strips; (v) Adoption of mechanisms for the acquisition of public property areas and the relocation of the public domain.(iv) Identification of buffer strips; (v) Adoption of mechanisms for the acquisition of areas of public property and the delocalisation/retreat of elements at risk; (vi) Activation of pilot projects on stretches of coastline (even limited stretches), through economic/urban incentives aimed at restoring the natural capacity of the coast to adapt to climate change, including those caused by the rise in sea level; (vii) Regulation of interventions on existing or new structures within the buffer strips; (viii) Restoration and creation of green infrastructures with strategic objectives for the fight against coastal hydrogeological instability such as coastal cordons and coastal wetlands
	(A/6)OSP_DC|05	Promote the natural nourishment of the coast and the management and artificial nourishment of the coastal strip by enhancing the sediments as a strategic resource and developing appropriate management programs for sediments from dredging activities
	(A/6)OSP_DC|06	Promote coastal contracts as voluntary planning tools to pursue, through integrated actions, both the protection and enhancement of the territories and local development
	(A/6)OSP_DC|07	Promoting the implementation of programs for the reclamation of large industrial areas, the reconversion of areas in crisis/decommissioning and the carrying out of emergency response exercises for the defense of the sea and coasts from pollution by hydrocarbons and other harmful substances
	(A/6)OSP_DC|08	Raising the urban quality of coastal areas, through redevelopment of *waterfronts* and *waterfront areas*
	(A/6)OSP_DC|09	Ensuring the preservation of the coastline, also ensuring the protection of the visibility of the coastline both from inland and from the sea and limiting the possibility of providing for new settlement loads on the coastal front outside the consolidated margins of urban settlements
	(A/6)OSP_DC|10	To support the decrease of terrigenous inputs in the sea area
	(A/6)OSP_DC|11	Encourage the transformation of fixed structures used as bathing establishments into easy-to-remove structures, in order to allow the pursuit of the objectives of protecting the significant landscape value and restoring the balance during the winter season
	(A/6)OSP_TM|01	Guaranteeing, by seizing all the opportunities given by the establishment of interregional EPZs, the development of commercial maritime traffic involving the regional commercial port system, in the context of TEN-T networks and international

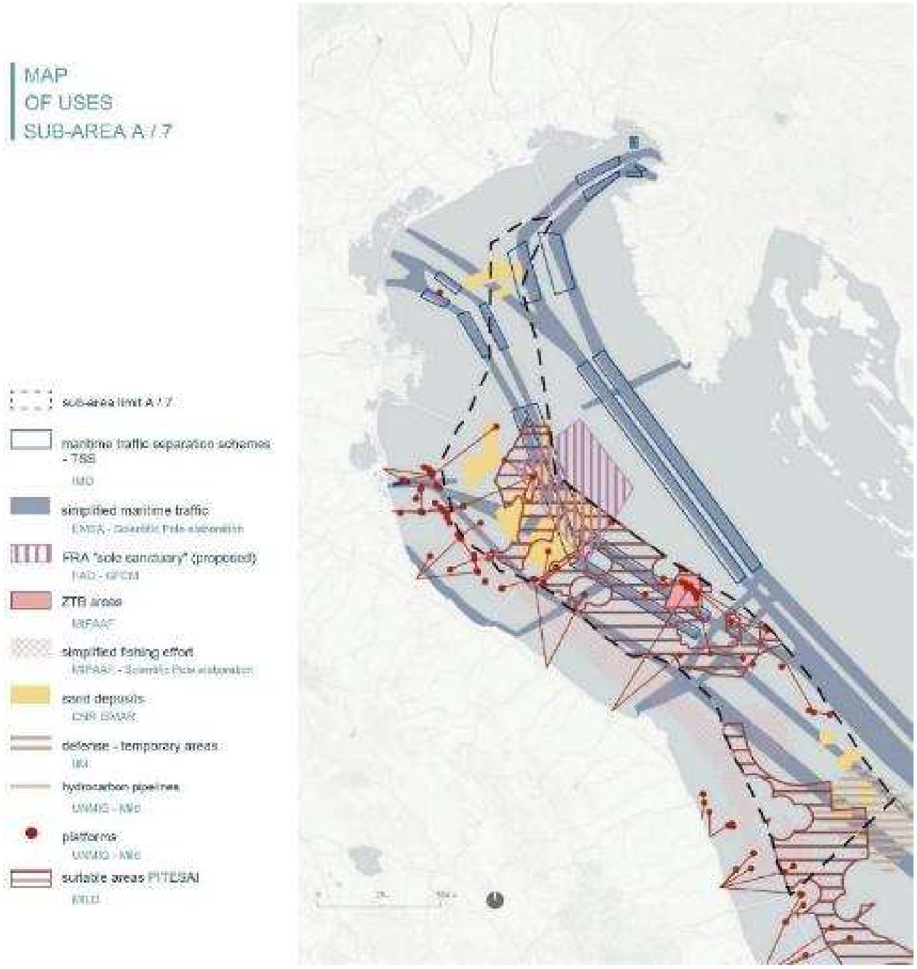
Maritime transport and ports		and global traffic scenarios, with a view to sustainable development
	(A/6)OSP_TM|02	Enable the development of shipbuilding activities in line with the sector's production trends
	(A/6)OSP_TM|03	Manage the periodicity of maintenance of the seabed functional to the activities of the commercial and tourist port system ensuring the sustainable management of sediments
	(A/6)OSP_TM|04	Promoting cross-border cooperation by establishing an active and long-term partnership through the improvement of multimodal connections and maritime transport
	(A/6)OSP_TM|05	Enhancement of the port areas through a redevelopment process, with development of passenger and cruise ports and urban integration and application of the standards defined by MITE for *green ports* adapted to the different regional port realities
	(A/6)OSP_TM|06	To promote the recycling of obsolete nautical and naval units through the definition and research of new standards for the execution of activities adopting the principles of circular economy
	(A/6)OSP_TM|07	Promote the reduction of CO_2 and noise emissions from vessels (decrease in speed, use of non-traditional energy sources and fuels, etc.).
	(A/6)OSP_TM|08	Combating the introduction of non-indigenous species through shipping (biofouling and ballast water)
Energy	(A/6)OSP_E|01	Promoting research in the field of sustainable exploitation of wave energy, compatible with the protection of the landscape and biodiversity
	(A/6)OSP_E|02	Promoting the transformation of ports into facilities with a positive energy balance, including through the production of energy from wave motion, encouraging the reduction of CO2 emissions and other pollutants related to the combustion of fossil fuels linked to port activities
	(A/6)OSP_E|03	Reconcile the protection of the marine-coastal habitat, landscape and visual integrity with innovative forms of energy production from renewable sources (e.g. *offshore* wind on existing and disused platforms integrated with the production of green hydrogen and similar).
Defense	(A/6)OSP_D|01	Allow certain areas to maintain their military functions, reducing conflicts with other present uses
	(A/6)OSP_D|02	Compatibly with institutional use, promote the representative redevelopment and usability of fortifications and military sites of cultural value (e.g. Taranto Castle)

The Planning Units identified for Sub-area A/6:

2.10.7 Sub-area A/7 - Northern Central Adriatic Continental Shelf

The main uses of the sea and coast present in the sub-area are depicted in the Figure. The figure in question shows a synthetic and simplified representation of the maritime activities existing in the area, aimed at providing an overall framework and understanding the planning choices made in the area.

In the maritime area in question, the main uses of the sea are: maritime transport, fishing, protection of the environment and natural resources, protection of the landscape and cultural heritage, hydrocarbon exploration and production, and activities connected to military defense. The sources of the spatial data used are reported in Figure and represent information available at national level through the contribution of the Ministries involved in the MSP process.

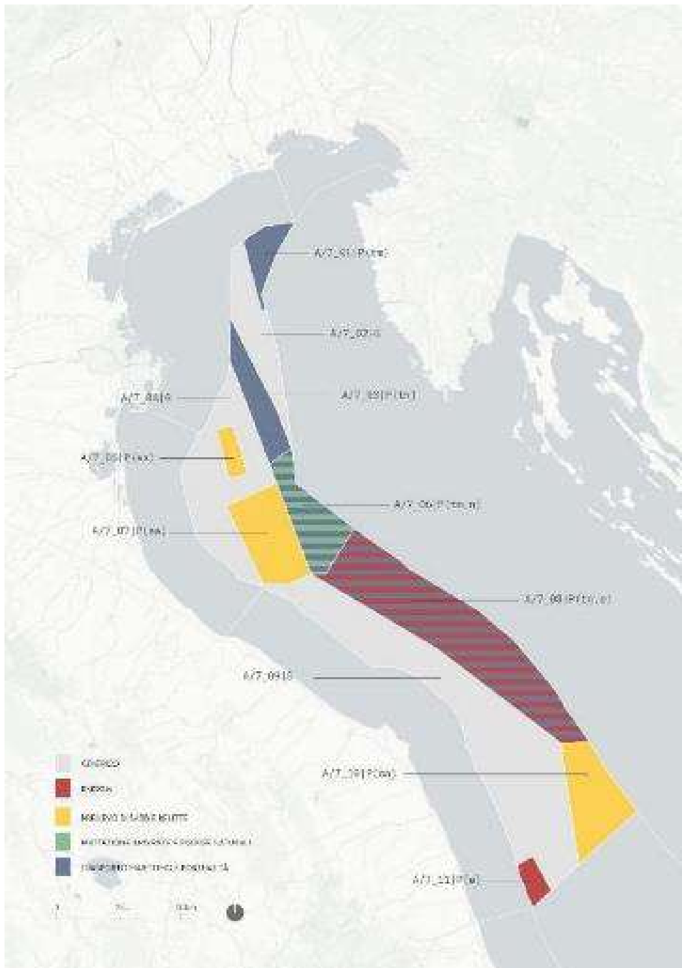


The specific objectives for sub-area A/7 are reported in the following table

Reference sector	Code	Specific objective
Maritime transport and ports	(A/7)OSP_TM|01	Promote sustainable development of maritime transport and reduce its negative impacts, with specific rules to reduce risks and impacts in sensitive areas using, in particular, IMO guidelines
Energy	(A/7)OSP_E|01	Enable the exploitation over time of the already licensed methane fields in a manner safe for human health and the environment, reducing conflicts and increasing synergies with other sectors of the marine economy, in accordance with the PiTESAI guidelines and forecasts.
	(A/7)OSP_E|02	Supporting the experimentation and use of technologies for the generation of energy from renewable sources at sea, with particular reference to wind power, compatibly with the policies in force for the protection of the environment and the landscape
Fishing	(A/7)OSP_P|01	Promote the pursuit of the sustainable use of fishery resources, taking into account the sustainability of stock exploitation, the presence of Essential Fish Habitats (EFH), potential effects on the seabed, non-fished species (bycatch) and ecosystems, as well as existing and planned protected areas and BZs.
	(A/7)OSP_P|01	Promoting transnational action for concerted measures for the protection of resources and the sustainability of fisheries
Environmental protection and natural resources	(A/7)OSP_N|01	Consolidate the existing system of protected areas and conservation measures, within a framework of overall ecological

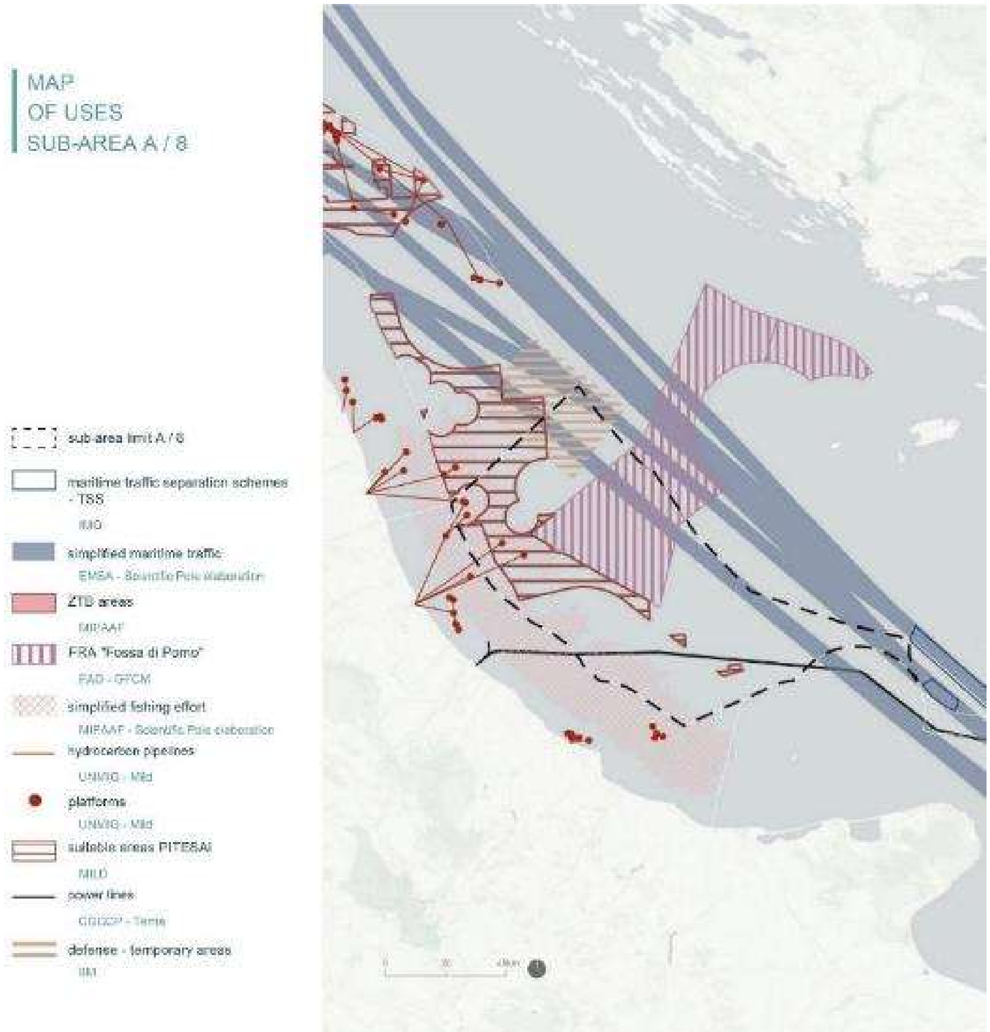
		coherence and by promoting the implementation of the main spatial measures foreseen in the MSFD Program of Measures
Withdrawal of relict sands	(A/7)OSP_SA|01	Properly address the use and protection of underwater sand for beach nourishment, to be considered as a strategic resource for coastal defense and adaptation plans
Landscape and cultural heritage	(A/7)OSP_PPC|01	Promote the conservation, recovery and enhancement of the landscape and underwater archaeological heritage, as well as the emergencies of historical and cultural value of considerable interest.

The Planning Units identified for Sub-area A/7:



2.10.8 Sub-area A/8 - Central-Southern Adriatic Continental Shelf

The main uses of the sea and coast present in the sub-area are depicted in the Figure. The figure in question shows a synthetic and simplified representation of the maritime activities existing in the area, aimed at providing an overall framework and understanding the planning choices made in the area. In the maritime area in question, the main uses of the sea are: maritime transport, fishing, protection of the environment and natural resources, protection of the landscape and cultural heritage, hydrocarbon exploration and production, and activities connected to military defense. The sources of the spatial data used are reported in Figure and represent information available at the national level through the contribution of the Ministries involved in the MSP process.

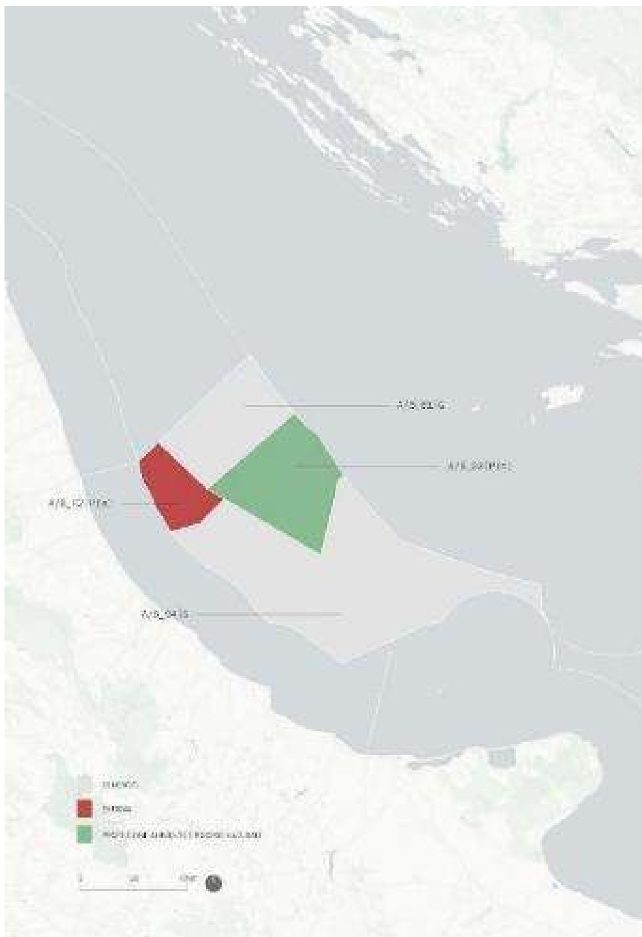


The specific objectives for sub-area A/8 are reported in the following table

Reference sector	Code	Specific objective
Maritime transport and ports	(A/8)OSP_TM|01	Promote sustainable development of maritime transport and reduce its negative impacts, with specific rules to reduce risks and impacts in sensitive areas using, in particular, IMO guidelines
Energy	(A/8)OSP_E|01	Enable the exploitation over time of the already licensed methane fields in a manner safe for human health and the environment, reducing conflicts and increasing synergies with other sectors of the marine economy, in accordance with the PiTESAI guidelines and forecasts.
	(A/8)OSP_E|02	To support the experimentation and use of technologies for the generation of energy from renewable sources in the sea, with particular reference to wind power, compatibly with the policies in force for the protection of the environment and the landscape
Fishing	(A/8)OSP_P|01	Promote the pursuit of sustainable use of fishery resources, taking into account the sustainability of stock exploitation, the presence of Essential Fish Habitats (EFH), the potential effects on the seabed, non-fished species (bycatch) and ecosystems, as well as protected areas and existing FRAs (Pomo Pit).

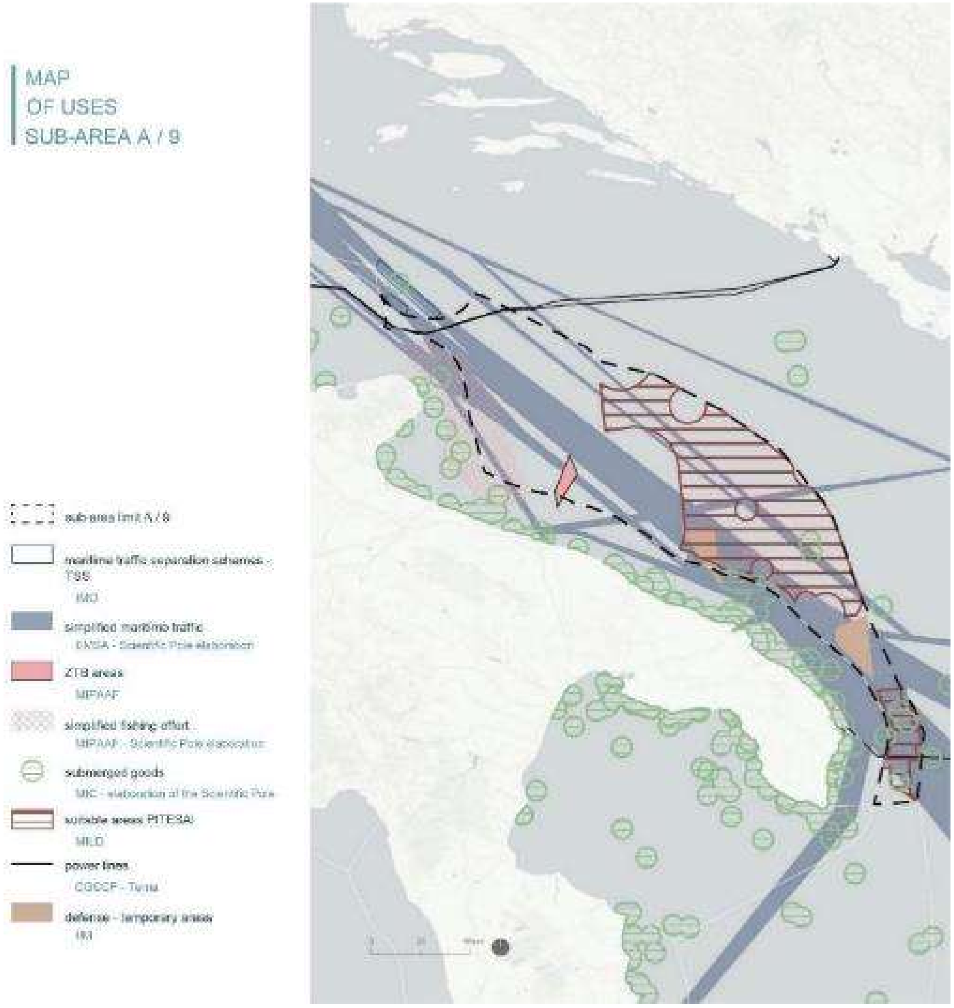
	(A/8)OSP_P|02	Promoting transnational action for concerted measures for the protection of resources and the sustainability of fisheries
Environmental protection and natural resources	(A/8)OSP_N|01	Consolidate the existing system of protected areas and conservation measures, within a framework of overall ecological coherence and by promoting the implementation of the main spatial measures foreseen in the MSFD Program of Measures
Landscape and cultural heritage	(A/8)OSP_PPC|01	SO 5.a To support the conservation, recovery and valorisation of the underwater landscape and archaeological heritage, as well as of the emergencies of historical and cultural value of remarkable interest.

The Planning Units identified for Sub-area A/8:



2.10.9 Sub-area A/9 - Southern Adriatic Continental Shelf

The main uses of the sea and coast present in the sub-area are depicted in the Figure. The figure in question shows a synthetic and simplified representation of the maritime activities existing in the area, aimed at providing an overall framework and understanding the planning choices made in the area. In the maritime area in question, the main uses of the sea are: maritime transport, fishing, protection of the environment and natural resources, protection of the landscape and cultural heritage, hydrocarbon exploration and production, and activities connected to military defense. The sources of the spatial data used are reported in Figure and represent information available at the national level through the contribution of the Ministries involved in the MSP process.

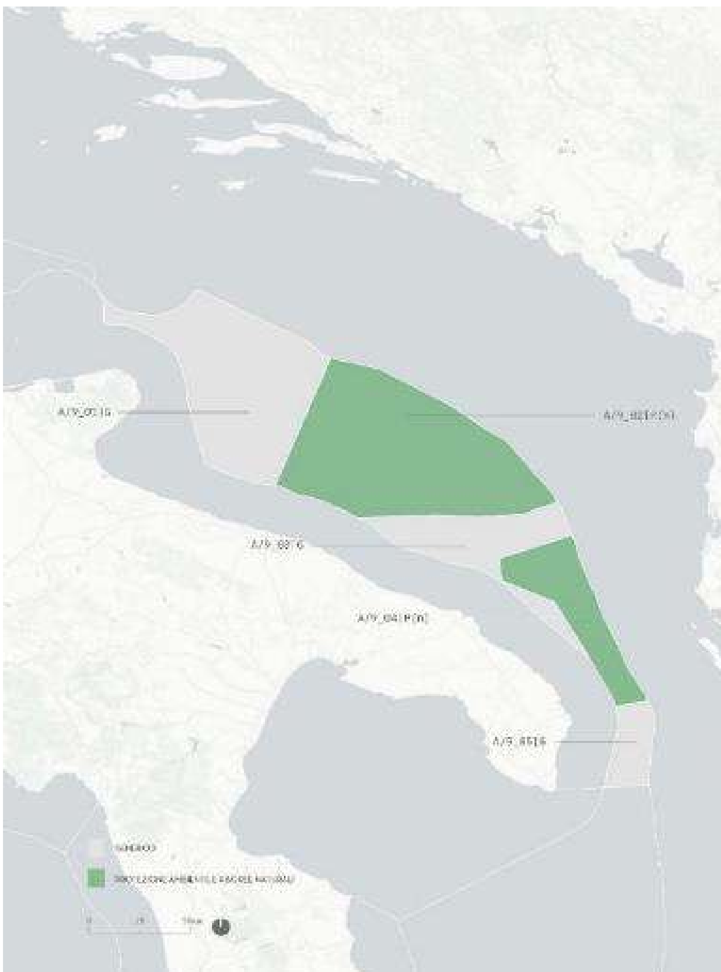


The specific objectives for sub-area A/9 are reported in the following table

Reference sector	Code	Specific objective
Maritime transport and ports	(A/9)OSP_TM|01	Promote sustainable development of maritime transport and reduce its negative impacts, with specific rules to reduce risks and impacts in sensitive areas using, in particular, IMO guidelines
Energy	(A/9)OSP_E|01	Supporting the experimentation and use of technologies for the generation of energy from renewable sources at sea, with particular reference to wind power, compatibly with the policies in force for the protection of the environment and the landscape
Fishing	(A/9)OSP_P|01	Promote the pursuit of the sustainable use of fishery resources, taking into account the sustainability of stock exploitation, the presence of Essential Fish Habitats (EFH), potential effects on the seabed, non-fished species (bycatch) and ecosystems, as well as existing and planned protected areas and BZs.
	(A/9)OSP_P|02	Promoting transnational actions for concerted measures for the protection of resources and the sustainability of fisheries
Environmental protection		Consolidate the system of existing protected areas and

and natural resources	(A/9)OSP_N|01	conservation measures, within a framework of overall ecological coherence and promoting the implementation of the main spatial measures foreseen in the MSFD Program of Measures, with particular reference to the deep sea
Withdrawal of relict sands	(A/9)OSP_SA|01	Properly address the use and protection of underwater sand for beach nourishment, to be considered as a strategic resource for coastal defense and adaptation plans
Landscape and cultural heritage	(A/9)OSP_PPC|01	To promote the conservation, recovery and enhancement of the underwater landscape and archaeological heritage, as well as emergencies of historical and cultural value of considerable interest.

The Planning Units identified for Sub-area A/9



3. The environmental sustainability objectives of the MSP

3.1 The Environmental Sustainability Objectives of the MSP (Maritime Spatial Plan)

Environmental sustainability in the context of maritime spatial planning is assessed through the verification of the capacity to contribute to the pursuit of the environmental and sustainable development objectives of a general level, relevant to the Plans themselves, deduced from the policies, strategies, etc., and from the references on environmental sustainability established at the different levels, international, EU and national (as defined in Chapter 1 of the RA), considering all the environmental aspects on which the implementation of the Plan could generate effects. Considering the important role played by the Marine Strategy Framework Directive (MSFD, 2008/56/EC) and by the 11 strategies determined by it for achieving Good Marine Environmental Status (GES), which Maritime Spatial Planning must contemplate and observe, for the purposes of determining the spaces and uses of the sea in order to favour social and economic development while guaranteeing the achievement of environmental sustainability objectives, the 11 environmental objectives, related to the 11 qualitative descriptors, and the respective environmental targets of the Marine Strategy have been considered as the main reference for defining the environmental sustainability objectives of the MSP:

Qualitative descriptors	**Environmental Objective of the Marine Strategy**	**Environmental targets (*ex* Min. Decree 15 February 2019)**
Biodiversity (D1)	Biodiversity must be preserved	○ Increasing the number of protected marine species and habitats with a satisfactory conservation status ○ Improving the condition of populations of fish and cephalopod species, including those of commercial interest ○ Improving coastal fish stocks
Non-indigenous species (D2)	The presence of non-native species must be limited	○ Implementing a system for early detection and reporting of non-native species in port areas and aquaculture zones ○ Implementing traceability systems for imports, translocations and movements of non-invasive species
Fish and molluscs of commercial interest (D3)	Fish stock must be preserved	○ Reducing fishing mortality of target species exploited by commercial fishing ○ Containing the impact on fish resources and biodiversity of illegal fishing ○ Regulating recreational fishing ○ Regulating the minimum landing size of commercial selachii
Trophic networks (D4)	Elements of trophic networks must be preserved	○ Improving the status of trophic components in order not to alter the structural and functional conditions of marine ecosystems
Eutrophication (D5)	Minimising anthropogenic eutrophication	○ Treating wastewater properly ○ Reducing nutrient loads into the sea from diffuse sources
Integrity of seabed (D6)	The integrity of the seabed must be preserved	○ Limiting physical loss on biogenic substrates ○ Limiting abrasion from biogenic bottoms fishing

Hydrographic conditions (D7)	Hydrographical conditions must be preserved	o Limiting the impacts of new infrastructure at sea resulting from permanent changes in hydrological and physiographic conditions
Contaminants (D8)	Contaminant concentrations must be contained	o Reducing contaminant concentrations with values above Biological Quality Standards
Contaminants in products for human use (D9)	The concentrations of contaminants in fish and other fishery products intended for human consumption must be contained	o Limiting the concentration of contaminants in fishery products
Marine Wastes (D10)	The presence of marine waste must be reduced	o Reducing the presence of marine waste on shorelines, in the surface layer of the water column, on the seabed, in the water column as micro-waste and in marine animals
Underwater noise (D11)	Underwater noise levels must be contained	o Implementing the National Register of Impulsive Sounds o Defining the base level for continuous low-frequency sounds

Considering the transversality with other environmental policies and planning issues that affect environmental factors on land and in any case in relation to the sea, such as mainly water issues, flooding, coastal erosion, atmospheric emissions from maritime traffic, underwater archaeological assets, natural hazards, it is deemed necessary to identify additional environmental components to be taken into account for the context analysis and for the identification of general environmental sustainability objectives, such as: water, soil, air and climate change, human health, landscape and cultural heritage, including underwater archaeological assets.

Thus, on the basis of the above definition, the Environmental Sustainability Objectives

[29] (O.A) of the MSP presented below are essentially the result of the following process:

- analysis of regulations, strategies, conventions on environmental sustainability established at different levels, international, EU and national (Chapter 1 of the RA) and in particular Environmental Objectives and Targets (ex Min. Decree 15 February 2019) of the Marine Strategy;
- indications formulated in the scoping phase by the SCAs[30] ;
- comparison with cross-cutting principles (and related sectoral objectives) identified in the Plan.

The environmental sustainability objectives, therefore, were obtained from the analysis and development of the environmental components described above. During the preliminary consultation with the relevant authorities in environmental matters, which led to the drafting of this document, the environmental aspects and themes/components identified and the related objectives were integrated in order to identify the specific

[29] In the ISPRA Guidelines reference is made to "*environmental protection objectives*" pertinent to the Plan, "*deduced from the regulations, from the references on the subject of sustainability established at the various levels and from the programmatic and planning framework pertinent to the P/P, taking into account what has already been developed in the preliminary report and the consultations of the preliminary phase*" (ref. letter e - Annex VI Legislative Decree 152/2006).

[30] Following the preliminary consultation with the relevant authorities in environmental matters (SCA), the environmental aspects and identified themes/components and their objectives were integrated in order to identify the specific environmental sustainability objectives for the Plan, against which a set of indicators for monitoring and criteria for prioritising and selecting operations are proposed in the following chapters.

environmental sustainability objectives for the Plan, against which a set of indicators for monitoring and criteria for prioritising and selecting operations are proposed in the following chapters.

	Environmental Sustainability Objectives (ESOs)		**Target**	**Policy and/or regulatory reference**
Marine and coastal environment	Preserving and sustainably using the oceans, seas and marine resources for sustainable development	**OA 1.a**	Sustainably manage and protect marine and coastal ecosystems to avoid significant negative impacts, including by enhancing their resilience and acting to restore them, in order to achieve healthy and productive oceans.	Agenda 2030 (Objective 14), Directive 2008/56/EC (Marine Strategy), Regulation EU no. 1380/2013 (Common Fisheries Policy) SNSvS - OSN II.1 Maintaining the vitality of the seas and preventing impacts on the marine and coastal environment
		OA 1.b	Effectively regulate fishing and put an end to overfishing, illegal, unreported and unregulated fishing and destructive fishing methods.	
		OA 1.c	Implement science-based management plans to restore fish stocks in the shortest possible time, at least to levels that produce the maximum sustainable yield, as determined by their biological characteristics	
	Protecting and preserving the marine environment, preventing its degradation or, where possible, restoring marine ecosystems in areas where they have suffered damage	**OA 1.d**	Take effective and immediate action to reduce the degradation of natural environments, halt the destruction of biodiversity and protect endangered species	Agenda 2030 (Objective 14), Directive 2008/56/EC (Marine Strategy) European Biodiversity Strategy (COM(2020) 380 SNSvS - OSN II.1
	Preventing and reducing inputs to the marine environment, with a view to progressively eliminating pollution, to ensure that there are no significant impacts or risks to marine biodiversity, marine ecosystems, human health or uses of the sea	**OA 1.e**	Prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine litter and nutrient pollution of waters	Agenda 2030 (Objective 14), Directive 2008/56/EC (Marine Strategy) Directive 2000/60/EEC (Water)

Biodiversity and natural areas	Protecting marine habitats, species and ecosystems as a whole	**OA 2.a**	Preserve and possibly improve the quality of marine ecosystems as a whole (ecosystem approach) and, in particular, preserve and possibly improve the conservation status of habitats and species, including through the adoption of specific conservation objectives and measures	Directive 92/43/EEC (Habitats), Directive 2009/147/EC (Birds), International Conventions (Bonn, Berne, Barcelona), (Objective 14), Directive 2008/56/EC (Marine Strategy) SNSvS - OSN I.1 Maintaining and improving the conservation status of species and habitats for ecosystems, both terrestrial and aquatic
	Increasing the area of MPAs and ensuring management effectiveness	**OA 2.b**	Creating new Marine Protected Areas and completing the Natura 2000 Network at sea to protect 30% of Italy's seas by 2030 with strict protection of 10%.	European Biodiversity Strategy (COM(2020) 380 Directive 92/43/EEC (Habitats) SNSvS - OSN I.3 Increasing the protected land and marine area and ensuring effective management
	Halting the spread of invasive exotic species	**OA 2.c**	Strengthening marine pollution prevention measures and improving the quality of marine ecosystems	Legislative Decree No. 230 of 15/12/2017 SNSvS - OSN I.2 Halting the spread of invasive exotic species
	Promoting sustainable fishing activities by encouraging the recovery and protection of fish stocks	**OA 2.d**	Establishing additional no-take areas for professional fishing with the greatest impact on marine habitats and species, particularly in the EFH (*Essential Fish Habitats*) of commercially important fish stocks. Adopt measures to minimise *by-catch* of rare species (e.g. sharks, turtles, small cetaceans and seabirds)	Three-year National Programme for Fisheries and Aquaculture, PO FEAMPA 21-27, Council Regulation No. 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea SNSvS - OSN I.4 Protect and restore genetic resources and natural ecosystems related to agriculture, forestry and aquaculture
Waters	Preventing and reducing pollution and achieving improvements in water status	**OA 3.a**	Protecting and restoring water-related ecosystems by 2030. Water quality is to be improved and water pollution reduced, especially that generated by hazardous chemicals. Cross-border cooperation will be promoted in order to achieve integrated water management at all levels	Agenda 2030 (Goal 6); Directive 2000/60/EC SNSvS - II.4 Implementing integrated water resources management at all planning levels
	Reduction of potential negative consequences of flood events for human health, land, property, environment and cultural heritage	**OA 3.b**	Enhanced protection and improvement of the aquatic environment, including through specific measures for the gradual reduction of discharges, emissions and losses of priority substances and halting or phasing out of discharges, emissions and losses of priority hazardous substances	Framework Directive 2000/60/EEC (Water), Directive 2007/60/EC (Flood Risk), Directive 2014/101/EU (Framework for Community action in the field of water policy)

Soil	Preserving coastal zones for the benefit of present and future generations	**OA 4.a**	Achieving neutrality in soil degradation on a global scale. Soil management, therefore, can only be defined as sustainable if human activities are able to support, enhance and regulate the ecosystem services provided by soil, without compromising soil functionality and biodiversity.	Agenda 2030 (Goal 15), COM(2006)231 SNSvS - OSN II.2 Halting soil consumption and combating desertification
		OA 4.b	Preventing the impacts of coastal erosion through new works, including maritime works and coastal defence works, integrated management of activities and the adoption of specific measures for coastal sediments and coastal works, and the sharing of scientific data to improve knowledge on the status, evolution and impacts of coastal erosion.	Barcelona Convention - ICZM Protocol (2008)
Air and climate change	Total decarbonisation by 2050 and net reduction of greenhouse gas emissions of at least 55% by 2030	**OA 5.a**	Integrating climate change measures into national policies, strategies and plans.	Climate and Energy Framework 2030 New EU climate change adaptation strategy, Strategy for a climate-neutral economy by 2050 European Green Deal PNRR EU strategies for energy system integration and hydrogen SNSvS - OSN II.6 Minimising emissions and reducing air pollutant concentrations SNSvS - OSN IV.1 Increasing energy efficiency and energy production from renewable sources while avoiding or reducing impacts on BBCC and landscape SNSvS - OSN II.6 Minimising Emissions and Reducing Pollutants
	Climate neutrality by 2050	**OA 5.b**	Increasing energy efficiency and energy production from renewable sources while avoiding or reducing impacts on cultural heritage and landscape	
Human health	Decrease population exposure to environmental and anthropogenic risk factors	**OA 6.a**	Reduction of premature mortality from environmental causes by one third through studies and research on environmental risk factors for primary prevention, with a view to environmental sustainability and circular economy.	Agenda 2030 (Goal 3), Legislative Decree no. 116 of 30 May 2008 (Bathing Waters) SNSvS - OSN IV.2 Increasing the sustainable mobility of people and goods SNSvS - OSN III.1 Decrease population exposure to environmental and anthropogenic risk factors SNSvS - OSN III.3 Regenerating cities, ensuring accessibility and ensuring sustainable connections
		OA 6.b	Protect human health from the risks of poor bathing water quality also through environmental protection and improvement.	

Landscape and Cultural Heritage	Ensuring the potential development, sustainable management and custodianship of territories, landscapes and cultural heritage and promoting the development of culture by fostering its public enjoyment and valorisation.	**OA 7.a**	Adopting a general policy to assign a function to cultural and natural heritage in collective life and to integrate protection into general planning programmes.	Unesco Convention concerning the protection of the world cultural and natural heritage (Paris, 16 November 1972); Legislative Decree no. 42 of 22 January 2004 (Cultural Heritage and Landscape Code); European Landscape Convention (Florence, 2000) Valletta Convention; SNSvS - OSN III.5 Ensuring the development of the potential, sustainable management and custodianship of territories, landscapes and cultural heritage Convention for the protection of the architectural heritage of Europe (Granada, 1985), Cultural heritage and landscape code (Legislative Decree 42/2004)
		OA 7.b	Developing scientific and technical studies and research and perfecting intervention methods to deal with dangers threatening the cultural or natural heritage.	
	Strengthening efforts to protect and safeguard the world's cultural and natural heritage	**OA 7.c**	Promoting the recovery and strengthening the protection of the cultural heritage of the coastal strip.	
		OA 7.d	Ensuring and strengthening the protection of underwater cultural heritage.	Convention on the protection of the underwater cultural heritage (2001 – Law 157/2009) Valletta Convention

For the purposes of checking the Plan's consistency with the guidelines on the environment and sustainable development, a matrix has been drawn up in which the respective potential synergy - inconsistency - indifference is briefly reported for each environmental sustainability objective identified for each environmental component potentially affected by the Plan's implementation and for each type of strategic objective of the Plan. It represents, in actual fact, an internal consistency check between the planning and SEA environmental assessment paths where possible conflicts between the environmental sustainability objectives and the strategic objectives are highlighted, the possible criticalities of which are found in the matrix in **Annex IV.** The criteria adopted, shown below, not only provide a specific definition but also use a colour scale to facilitate the reading of the matrix:

Direct consistency	indicates that the objectives of the Maritime Spatial Plan pursue goals and/or dictate provisions that contribute to the realisation of the goals and provisions of the environmental objectives.
Indirect consistency	indicates that the objectives of the Maritime Spatial Plan pursue goals and/or dictate provisions that are compatible or have strong elements of integration with those of the environmental objectives.
Indifference	indicates that the objectives of the Maritime Spatial Plan pursue goals and/or dictate provisions unrelated to those of the environmental objectives.
Inconsistency	indicates that the objectives of the Maritime Spatial Plan pursue aims and/or dictate provisions that conflict with those of the environmental objectives.

From the analysis of the matrix it is easy to deduce how the elaboration of plan objectives and environmental objectives was conducted in an integrated manner, converging, in most cases, plan requirements with environmental protection requirements. The process of integration has led to a convergence of the objectives as evidenced by the numerous direct and indirect consistencies that can be summarised in the matrix. Thus, the environmental goals relating not only to the conservation of nature and biodiversity, but also to the promotion of the quality of the marine environment, are integrated with the development needs of the economic - social system that revolves around the uses that characterise the marine space. It is highlighted how Maritime Spatial Planning, developed through the ecosystem approach, is indispensable to ensure in the long term a sustainable balance between nature and human activities such as fishing, aquaculture, maritime transport together with those activities that are growing rapidly such as offshore wind energy and that therefore need to be evaluated in a perspective of increasing dedicated space.

The analytical exercise allowed to detect many potential synergies and consistencies and some potential inconsistencies related to punctual elements that fail to perfectly integrate environmental objectives and plan objectives. With respect to these potential inconsistencies, further moments of evaluation of the effects and consistency with the Do No Significant Harm principle (DNSH), will be able to provide guidelines to maximise the Plan's contribution to sustainability objectives. A deeper and more punctual reading of the matrix tells us that, as previously stated, consistencies (452), direct and indirect, are numerically much more consistent than inconsistencies (44), and indifferences (428) appear rather relevant, a number that is easily justifiable if we consider that many environmental objectives deal with quite specific and defined themes that in many cases do not find valid correlations with the plan objectives.

Regarding the environmental sustainability objectives, the elaboration of the data obtained from the matrix shows us that the reference objectives of the environmental component "**Marine and coastal environment**" and in particular the objectives **OA_1a** "*Sustainably manage and protect marine and coastal ecosystems to avoid significant negative impacts, including by enhancing their resilience and acting to restore them, in order to achieve healthy and productive oceans"* and **OA_1d** "*Take effective and immediate action to reduce the degradation of natural environments, halt the destruction of biodiversity and protect endangered species*" have the highest number of consistencies (30 and 31), highlighting how the objectives related to the conservation, protection and restoration of marine ecosystems represent one of the Plan's fundamental goals; in fact, among the other environmental sustainability objectives with a high number of consistencies, we find not only those related to the conservation of habitats and ecosystems, such as those mentioned above, but also the objectives whose main goals are related to both the reduction and containment of pollutants, **OA_1e** (25) "*Prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine litter and nutrient pollution of waters*" and **OA_3a** (24) "*Protecting and restoring water-related ecosystems by 2030. Water quality is to be improved and water pollution reduced, especially that generated by hazardous chemicals. Cross-border cooperation will be promoted in order to achieve integrated water management at all levels*", as well as the integration of policies related to combating climate change and increasing energy efficiency through renewables, **OA_5a** "*Integrating climate change measures into national policies, strategies and plans. Increasing energy efficiency and energy production from renewable sources while avoiding or reducing impacts on cultural heritage and landscape*" and finally to the preservation and protection of cultural heritage and landscape, **OA_7b** (30) "*Developing scientific and technical studies and research and perfecting intervention methods to deal with dangers threatening the cultural or natural heritage*".

On the whole, it can be seen that most of the environmental sustainability objectives present a fairly high number of consistencies with the plan objectives, ranging from 17 to 23; the remaining objectives, on the other hand, present a lower number of consistencies (from 12 to 15), these values, in fact, must necessarily be contextualised with the values of the relative inconsistencies, which have a rather low incidence of between 0 and 8. This clarifies how even the lowest levels of consistencies do not necessarily imply high levels of inconsistency, since, as described above, it is the "indifferences" that are predominant.

On the basis of the above, in contrast to the more easily pursued objectives described above, we should find the negatively influenced environmental sustainability objectives represented by objective **OA_7d** "*Ensuring and strengthening the protection of underwater cultural heritage*" with a low number of consistencies (12) and objectives **OA_2b** "*Creating new Marine Protected Areas and completing the Natura 2000 Network at sea to protect 30% of Italy's seas by 2030 with strict protection of 10%*" and **OA_2a** "*Preserve and possibly improve the quality of marine ecosystems as a whole (ecosystem approach) and, in particular, preserve and possibly improve the conservation status of habitats and species, including through the adoption of specific* *conservation objectives and measures*” with the highest number of inconsistencies (8 and 5 respectively), but the numerical analysis shows that there are no conditions to consider them as negatively affected by the plan, testifying to what was previously described on the synergy of the elaboration of the different types of objectives and the convergence of the objectives' aims. In general, the sector that seems to present the most potential inconsistencies with the environmental sustainability objectives is the energy sector/use with a total of 21 potential inconsistencies. In spite of guidelines aimed at moving away from fossil fuels, these activities risk interfering negatively with the environment and landscape, both directly and indirectly.

Most of the potential inconsistencies (13) are due to the poor integration of the environmental/target objectives with the objective “OS.E2 - *Pursue the environmental, social and economic sustainability of hydrocarbon surveying, exploration and production activities at sea”,* which is in potential conflict with the objectives of environmental and landscape-cultural protection and enhancement, highlighting how, maintaining or increasing hydrocarbon surveying, exploration and production activities at sea is in contrast both to the objectives of protecting and defending the environment and the landscape and cultural heritage and to the objectives relating to their development, pushing, conversely, towards an increase in energy production through renewable and lower-impact sources (e.g. floating wind power).

Similarly, an increase in tourism activities or an increase in port activities that foresee an increase in large ship passages or an increase in tourism activities that foresee an increase in the number of presences risk clashing with the objectives whose aim is to restore and recover marine ecosystems and preserve their quality. Therefore, the objective of the Tourism sector/use **OS.T2** - “*Promoting coherent planning actions on land and sea, also for tourism purposes*”, the aim of which is to promote actions aimed at increasing the attractiveness of ports near cities of art, is in contrast with the environmental objectives aimed at containing and reducing marine pollution **OA_2c** “*Strengthen measures to prevent marine pollution and improve the quality of marine ecosystems*”. The potential inconsistencies summarised in the annexed matrix may guide the definition of specific objectives and uses in relation to the different contexts.

In conclusion, it is clear that the development of the Plan's objectives took place in an integrated manner with the consideration of the environmental sustainability objectives, highlighting how in most cases there is a clear convergence, witnessed by the presence of numerous direct but also indirect consistencies, between the OS.PPC objectives “Landscape and Cultural Heritage” and the OA_7 - environmental component “Landscape and cultural heritage”, OS.P “Fisheries” and the OA_1 - environmental component “Marine and coastal environment” and OA_2 - environmental component “Biodiversity and natural areas subject to protection regimes”, OS.DC “Coastal Defence” and the OA_7 - environmental component “Landscape and Cultural Heritage”, while the objectives OS.N “Environmental Protection and Natural Resources”, OS.SS “Sustainable Development” and OS.RI “Research and Innovation”, due to their transversal nature, present a convergence with practically all the groups of environmental sustainability objectives, where the consistencies, both direct and indirect, show that both groups of objectives work in synergy to achieve the same goals.

Potential inconsistencies are limited to those objectives whose aims, although set in the context of safeguarding natural resources, do not have environmental protection as their primary purpose, leading to potential conflicts between objectives. In the following chapters, possible impacts and mitigation measures necessary to mitigate and make acceptable such potential inconsistencies will be defined.

3.2 Evaluation and Verification of External Consistency of the MSP

The external consistency verification analysis, in the RA, assumes a fundamental role in defining any potential synergies and/or conflicts between the Maritime Spatial Plan and other relevant plans or programmes. The external consistency verification activity is fundamental in outlining and defining the overall congruity of the Plan with respect to the planning, programmatic and regulatory context in which it is developed. Specifically, horizontal external consistency is verified, i.e. the consistency of the plan objectives with the objectives/principles of environmental sustainability inferred from plans/programmes drawn up for the same territorial area is assessed. Through this tool, the existing relations and the level of synergy/conflictuality of the Plan, and in particular of its objectives, with the objectives of other relevant plans/programmes of the same level will be verified, i.e. in all those plans whose area of influence is the national surface and that concern the maritime sector and those sectors interconnected to it on the basis of land-sea interactions, with the aim of identifying potential synergic factors and possible critical or conflicting aspects. It is therefore evident that the interrelationships between the MSP and detailed level planning deriving from general regulations of a national nature will not be found in the matrix of external consistency, but the superordinate objectives/goals of the national regulations will be included.

In the following paragraphs, the context analysis and the consequent definition of the interferences between the plan and the environment will analyse and highlight those that are regional and/or provincial constraints and regulations, thus defining, no longer mere consistency, but the actual site-specific interaction.

The aforementioned analysis can be readily found in the thematic cartography attached to the Environmental Report. As previously described, the objectives considered are of two types, strategic and of environmental sustainability that derive from the superordinate acts of mandate from which the Plan derives; specifically, the consistency between the strategic objectives of the Plan and the strategic objectives of the other Plans/Programmes was assessed. Given the large and articulated planning, for a faster and more efficient reading, two types of analysis were carried out through two matrices:

- External consistency with respect to Plans/Programmes directly related to the marine sector, where the congruity of the Plan's strategic objectives with the objectives/goals of Plans whose programming is carried out in marine areas is analysed:
    - National Operational Programme (NOP) of the European Maritime, Fisheries and Aquaculture Fund (EMFAF),
    - The National Strategic Plan for Ports and Logistics;
    - National cold ironing plan;
    - Coastal Erosion Master Plan;
    - Plan for the collection and management of ship-generated waste and cargo residues from ports;
    - Plans to protect the sea and coastal areas from accidental pollution by hydrocarbons and other harmful substances;
    - Three-year national fisheries and aquaculture programme 2022-2024;
    - Coastal management plans;
    - Strategic Plan for Italian Aquaculture 2014-2020;
    - Interreg maritime cross-border cooperation programme Italy France 2021-2027;
    - Interreg cross-border cooperation programme Italy Croatia 2021-2027;
    - Pharos4MPAs Interreg Mediterranean Programme;
    - Interreg next med programme
    - Interreg ADRION Programme.
- External consistency with respect to sectors not directly related to the marine sector, where the consistency of the strategic objectives of the Plan with the objectives/goals of the Plans whose programming is mainly carried out in inland areas of the coast is analysed:
    - National Integrated Energy and Climate Plan;
    - National Recovery and Resilience Plan (NRRP) under the Next Generation EU;
    - National Operational Programmes (NOPs) of the European Regional Development Fund (ERDF);
    - National Operational Programmes (NOPs) of the European Social Fund Plus (ESF+);
    - Rural Development Programme (RDP) of the European Agricultural Fund for Rural Development (EAFRD);
    - PTE (Plan for Ecological Transition);
    - Plan for the Sustainable Energy Transition of Eligible Areas (PiTESAI);
    - Infrastructure Annex to the Economic and Financial Document (DEF) 2021 "Ten years to transform Italy";
    - National Strategic Plan for Sustainable Mobility (PNSMS);
    - Strategic Programme to Combat Climate Change and Improve Air Quality;

- National Climate Change Adaptation Plan (PNACC);
- Hydrographic District Flood Risk Management Plan;
- Water Management Plan of the Hydrographic District;
- District Basin Plan;
- Hydrogeological Structure district plans (Art. 67 Legislative Decree 152/2006);
- Water Protection Plan;
- Regional Landscape Plan (PPR);
- Planning of Protected Natural Areas;
- Conservation measures Natura 2000 Network;
- Management plans for Natura 2000 sites;
- PON "Infrastructure and Networks" 2014-2020;
- Extraordinary tourist mobility plan 2017-2022;
- Tourism Strategic Plan 2017-2022;
- National Air Pollution Control Programme;
- Regional Transport Plan.

The verification of external consistency was conducted through the construction and use of double-entry matrices through which the priorities and objectives of the Plan are compared with the objectives of the relevant Plans/Programmes in order to assess their consistency, possible irrelevance or potential conflict:

- **Direct consistency**, indicates that the Maritime Spatial Plan pursues objectives and/or dictates provisions that contribute to the realisation of the goals and provisions of the instrument examined.
- **Indirect consistency** indicates that the Maritime Spatial Plan pursues objectives and/or dictates provisions that are compatible or have strong elements of integration with those of the instrument examined.
- **Indifference**, indicates that the Maritime Spatial Plan pursues objectives and/or dictates provisions unrelated to those of the instrument examined.
- **Inconsistency**, indicates that the Maritime Spatial Plan pursues objectives and/or dictates provisions contrary to those of the instrument examined.

Assessments are expressed graphically using the following symbols and colours:

Direct consistency	indicates that the Maritime Spatial Plan pursues objectives and/or dictates provisions that contribute to the realisation of the goals and provisions of the instrument examined.
Indirect consistency	indicates that the Maritime Spatial Plan pursues objectives and/or dictates provisions that are compatible or have strong elements of integration with those of the instrument examined.
Indifference	indicates that the Maritime Spatial Plan pursues objectives and/or dictates provisions unrelated to those of the instrument examined.
Inconsistency	indicates that the Maritime Spatial Plan pursues objectives and/or dictates provisions contrary to those of the instrument examined.

3.2.1 External Consistency of Plans not directly related to the marine sector

The MSP is part of a context now characterised by the presence of numerous plans that define and determine policies and interventions on territories more or less connected to the marine environment. Therefore, it is evident that some of the objectives of the plans under consideration may potentially conflict with the objectives of the MSP. The EU policies of the last decades, in synergy with the growing awareness of the importance of environmental balances, have been developed by acquiring the concepts of environmental sustainability, directing the development and orientation of all sector plans towards energy sustainability, respect for natural resources, the reduction of pollution, and emissions in general, with a view to a circular economy whose aim is the progressive reduction of impacts on the environment while promoting the evolution of the economy and its various sectors. Thus, we can easily understand how the evolution of these policies over time has led to the definition of increasingly specific objectives, which in some cases are not reflected in the objectives of already approved plans, generating inconsistencies. Therefore, the MSP, through the tool of the ecosystem approach, must ensure a balanced integration between the sustainability of the environment and the economic sustainability of human activities that characterise the marine environment (fishing, aquaculture, tourism, etc.); it is therefore the indispensable tool to achieve the social and economic sustainability of the aforementioned activities while respecting the marine ecosystem.

From a reading of the external consistency matrix in **Annex III** to the RA, it appears that the consistencies, direct and indirect, between the objectives of the main plans considered are the absolute majority compared to the inconsistencies found. On the basis of what has been defined above, it is easy to understand that these inconsistencies are exclusively linked to certain matrix crossings involving specific areas and uses. In fact, based on the objectives of EU policies on atmospheric emissions and energy transition, from the matrix analysis, inconsistencies are found between the objectives of the plans considered and the objective "OS.E2 - *Pursue the environmental, social and economic sustainability of hydrocarbon surveying, exploration and production activities at sea*", the achievement of which clashes with the principles/objectives of all those plans that are aimed at protecting and preserving the environment and ecosystems, restoring habitats and promoting the energy transition from fossil fuels to renewable energy sources.

In particular, there is inconsistency between the goal and the main national energy plan, the National Integrated Energy and Climate Plan (PNIEC) and the Plan for Ecological Transition, whose goals promote sustainable energy sources. Similarly, there is a constant inconsistency in almost all of the Plan's objectives with respect to one of the main goals of the Plan for the Sustainable Energy Transition of Eligible Areas (PiTESAI), namely to "*Identify a defined reference framework of areas where hydrocarbon surveying, exploration and cultivation activities are permitted on national territory, aimed at enhancing the environmental, social and economic sustainability of the same*", putting it in contrast with the EU and national lines of abandoning the search and extraction of hydrocarbons in favour of sustainable development and, in particular, the promotion of plants from renewable sources, decarbonisation, and the protection of habitats, species and the coastal strip, taken up and defined in the objectives of the plan. Potential inconsistencies were also highlighted in relation to tourism development plans. In fact, the increase in the flow of tourists, including through the enhancement of tourist mobility, and dedicated infrastructures may not fit in with the prospects of safeguarding the coastal landscape and protecting the coastline from erosion as envisaged by the objectives of the MSP.

3.2.2 External Consistency of Plans directly related to the marine sector

On the other hand, with regard to the plans directly related to the marine sector, from the analysis of the consistency matrix, it clearly emerges that there are no particular inconsistencies, but the plans integrate or, at most, do not cause interference of any kind between the implementation of the objectives of the MSP and the implementation of the plans considered. Thus, from the point of view of the general planning context, both EU and national, the Plan objectives are consistent with what is already provided for by the existing plans, highlighting the interest in achieving common goals by directly or indirectly integrating, or even simply not hindering, the achievement of the same. As in the previous case, the structured inconsistencies are found with the objective OS - EN2 "*Pursue the environmental, social and economic sustainability of hydrocarbon surveying, exploration and production activities at sea*", the achievement of which leads to an inconsistency with the principles/objectives of the plans whose goals are innovation, sustainability, environmental protection and landscape enhancement.

3.3 Assessment and Verification of internal consistency of the MSP

The purpose of the verification and assessment of internal consistency is to establish all possible correlations between the environmental sustainability objectives and the specific objectives of the various sub-areas and the respective measures, both national and regional, that the Plan envisages applying, so as to verify the actual correspondence between the planned measures and the environmental sustainability objectives set.

The verification process, being particularly complex, is developed from the earliest stages of drafting the Plan and represents a structural phase in its origin. In fact, during the planning process, the verification is carried out as the planning activity is developed, so that both the objectives and the proposed measures are adjusted in real time, simultaneously with the development of planning. In this way, the verification and evaluation of internal consistency guides the construction of the Plan, leading to the definition of measures that are consistent with environmental sustainability objectives.

At the conclusion of the aforementioned operations to verify consistency and construct the Plan, the result obtained, which stems from the information obtained from the context analysis, highlights not only the actual correspondence but also the cause/effect relationship between all the phases that have characterised the planning process, thus confirming the validity of the planning strategy through the direct correlation between measures and proposed objectives. All of the above is visually represented through the elaboration of matrices that allow for a quicker reading of all the relationships existing between the environmental sustainability objectives and the specific objectives of the sub-areas first and, on a more detailed level, between the environmental sustainability objectives and the measures/actions, national and regional, then. Through the matrices, the links and relations between the objectives assumed by the Plan for the specific maritime space and sub-area and the planned measures have been reconstructed, thus making the decision-making process accompanying its elaboration more transparent.

This analysis also makes it possible to verify the existence of possible contradictions within the Programme, synergies or elements to be taken into account during implementation.

The relationship between the specific objectives by sub-area and the environmental sustainability objectives/targets is defined in the matrix in **Annex IV** to the RA, where the construction of the matrix has taken into consideration the genesis of the specific objectives, highlighting not only the maritime area and the sub-area of reference but also the theme/sector/use referred to the general objectives of the Plan and the specific uses referred to the planning unit, thus making explicit the path through which the specific objectives were defined; finally, eleven columns have been inserted, highlighting the cases where the objective is expected to have effects on other uses/sectors.

Similarly, on the basis of the Plan, the matrices in Annexes IV and V, concerning both national and regional measures, highlight not only the strategic objective (for national level measures) or specific objective (for sub-area level measures) to which the measure in question intends to contribute, the main reference use of the measure and the possible interaction with other uses that the measure will regulate, but also identify the category of the measure among the following:

- **Spatial measures/actions (S),** related to the definition of the spatial areas in which activities can take place;
- **Temporal measures/actions (T),** related to the definition of limits or conditions governing the performance of activities over time;
- **Technical and technological (TE) measures/actions,** related to the use or adoption of specific technological equipment or techniques;
- **Monitoring, control and surveillance (M) measures/actions,** related to the acquisition of data on the conduct of maritime activities, compliance with rules or regulations, the acquisition of data on the state of the marine environment, and how to monitor activities in marine waters;
- **Multi-level governance measures/actions (G),** which concern procedural and organisational procedures;
- **Economic and financial measures/actions (E),** which identify financial resources to support maritime activities (including within existing programming, such as regional POR-FESR and/or FEAMP)
- **Other types of measures (A)** (e.g. training, education, communication).

The next column indicates the type of measure from among the following:

- I - addresses, mainly addressed to public administrations or planning instruments

- P - requirements that the plan provides for regulating the uses of maritime space (e.g. in terms of the manner - including spatial and temporal - in which uses may be exercised)
- I - incentives
- A - actions, i.e. concrete initiatives (e.g. consultations, studies, analyses) carried out by or on behalf of competent administrations, possibly in partnership with private entities;

and the main implementers of the measure, i.e. the party responsible for implementing the measure; finally, for national measures, the reference measures/descriptors of the Marine Strategy updated to the new implementation cycle are specified and eleven columns are inserted, where it is highlighted where the target is expected to have effects on other uses/sectors.

For the purpose of verifying internal consistency through the matrices described above (specific objectives and measures of the Plan/environmental sustainability objectives) the analysis will be developed by highlighting potential positive or negative, direct or indirect influences, specifying any synergic effects or potential conflicts and whether there are objectives or measures/actions envisaged by the Plan that are not fully in line with one or more of the environmental sustainability objectives defined in the VAS, according to the criteria below:

EVALUATION CRITERIA FOR THE ACTIONS MATRIX - ENVIRONMENTAL OBJECTIVES

Legend of criteria	
Potential negative direct influence	**ND**
Potential negative indirect influence	**NI**
Potential insignificant or nil influence	**I**
Potential positive indirect influence	**PI**
Potential positive direct influence	**PD**

Thus, it is evident how consistencies between objectives and/or measures and environmental sustainability objectives/Targets are defined through their potential influence, both positive and negative, and not through an absolute value judgement that unequivocally defines their weight in achieving the result. Thus, the attribution of a potentially direct negative influence implies two opposing principles whose realisation could conflict when they are applied in the same Planning Unit at the same time, thus incentivising maritime and cruise transport as through the pursuit of the specific objective **(A/2)OSP_TM|03** "*To re-launch the Veneto cruise economy through the resumption of traffic with O/D Venice by solving the terminal problem*" or the pursuit of the specific objective **(A/6)OSP_D|01** "*To allow the maintenance of the military functions of some areas, reducing conflicts with other present uses",* determine a clear contrast with almost all the environmental objectives, as found in the matrix in Annex V; in particular, these objectives cannot coexist with, among others, the presence or new establishment of Marine Protected Areas which are the objective of sustainability OA_2b, or with those environmental sustainability objectives that pursue the reduction of marine pollution, OA_1e.

Nevertheless, the objective/measure of the Plan retains its strategic validity, and its implementation shall be carried out in a way that does not conflict with what is defined by the Environmental Sustainability Objectives/Targets. Similarly, the indirect potential negative influence represents the potential negative interference between the specific objective/measure and the environmental sustainability objective/Target, the coexistence of which could be possible if certain measures are taken that could make it possible for them to be implemented at the same time while minimising the potential negative effect.

Therefore, favouring pleasure boating for tourism purposes, specific objective (A/1)OSP_T|02 "*To develop pleasure boating, with a view to diversifying the tourism offer, while ensuring accessibility to waterways and environmental sustainability*", could be in conflict with the management and protection of marine ecosystems, environmental sustainability objective OA_1d "*Undertake effective and immediate action to reduce the* *degradation of natural environments, halt the destruction of biodiversity and protect endangered species*", but if the specific objective/measure is achieved by promoting the principles of environmental sustainability then the two objectives could co-exist, both achieving their goals. With regard to potential positive influences, both direct and indirect, it is evident that the definition of one or the other depends on the urgency of the result and the goals to be achieved, i.e. whether these coincide directly or are more or less complementary. Thus, whether a specific objective/measure directly implements the environmental sustainability objective, e.g. implementing policies aimed at the conservation of habitats and species with the sustainable management and protection of marine and coastal ecosystems, or whether the objective/measure assists and complements the environmental sustainability objective (contributing to decarbonisation with marine renewable energy compatible with environmental sustainability/Reducing the degradation of natural environments and the destruction of biodiversity). Through the above analysis, therefore, both the efficiency of the choices made at the planning stage aimed at pursuing the environmental sustainability objectives, the definition process of which has been outlined above, and the potential conflicts are highlighted, the analysis of which will be necessary in the subsequent evaluation phases, especially with reference to the evaluation of the negative impacts on the environmental components; therefore, the correspondences, whether positive or negative, will later be verified and explored in more detail in the chapters dedicated to the evaluation of impacts..

More specifically, the assessment criteria with respect to the environmental objectives have been set starting from the principles from which the MSP was born and evolves in Directive 2014/89/EU (Maritime Spatial Planning) starting with the definition of "Integrated Maritime Policy" (IMP) which refers to "(...) *a Union policy whose aim is to foster coordinated and coherent decision-making to maximise the sustainable development, economic growth and social cohesion of Member States, and notably the coastal, insular and outermost regions in the Union, as well as maritime sectors, through coherent maritime-related policies and relevant international cooperation* (...)" and the ecosystem approach, which considers humans as an integral part of ecosystems and promotes the exchange and sustainable integration between ecosystem and resource management. In particular, the aforementioned directive states that "(...) *The application of an ecosystem-based approach will contribute to promoting the sustainable development and growth of the maritime and coastal economies and the sustainable use of marine and coastal resources"*.

Thus, if we consider, as later described in the chapters on impacts, that anthropic activities (aquaculture, fishing, removal and/or deposition of marine sediments, etc.) entail, in any case, the generation of impacts on the surrounding environment, on the basis of the IMP that envisages a sustainable development of the marine economy and of the ecosystem approach that considers a reciprocity between man, his activities and the ecosystem in which he lives, all those objectives/measures/actions that entail or envisage a decrease, improvement or containment, including through planning and sustainable management tools, of the pressures caused by the uses in question have been assessed with a positive consistency.

On the other hand, those objectives/measures/actions that envisage an increase in anthropic activities *tout court* without envisaging environmental sustainability actions or policies, such as the increase in port infrastructures or the promotion of cruise tourism by increasing the number of ships and landings, or that in addition to increasing activity are in clear conflict with current environmental policies, such as the increase in hydrocarbon prospecting, research and cultivation activities at sea, are assessed with a potentially negative influence.

Finally, it should be emphasised that the possible negative influence of a specific objective may also correspond to a positive influence in the corresponding measure/action, as the objective may conflict with the principles of environmental sustainability but its implementation may include justifications, arrangements or specifications that put it in line with the environmental sustainability objectives.

4. Environmental context of reference of the MSP

4.1 Geographical and territorial overview

The "Adriatic" area (Fig. 4.1) is delimited in the East by the limits of the continental shelf already formally agreed upon with neighboring countries (Yugoslavia, 1969; Albania, 1992; Greece, 1977 and 2020) and in the South by the boundary line between the marine sub-regions "Adriatic Sea" and "Ionian Sea-Central Mediterranean" of the Marine Strategy Directive, as also indicated in Legislative Decree 201/2016.

The Maritime Area affects the administrative boundaries represented by the following:

- boundaries of the maritime area covered by the Plan (Adriatic), as defined under the Marine Strategy Directive (Framework Directive 2008/56/EC);
- boundaries of coastal regions overlooking the maritime area under consideration: Friuli-Venezia Giulia, Veneto, Emilia-Romagna, Marche, Abruzzo, Molise, and Puglia (up to Capo d'Otranto).
- Boundaries of coastal municipalities in the former provinces of Trieste and Udine, Metropolitan City of Venice, Rovigo, Ferrara, Ravenna, Forlì-Cesena, Rimini, Pesaro-Urbino, Ancona, Macerata, Fermo, Ascoli Piceno, Teramo, Pescara, Chieti, Campobasso, Foggia, Barletta-Andria-Trani, Metropolitan City of Bari, Brindisi, and Lecce (up to Capo d'Otranto).
- boundaries of the Maritime Directorates of Trieste (Maritime Compartments of Trieste and Monfalcone), Venice (M.C. of Venice and of Chioggia), Ravenna (M.C. of Ravenna and of Rimini), Ancona (M.C. of Ancona, of Pesaro and of San Benedetto del Tronto), Pescara (M.C. of Pescara, of Ortona and of Termoli) and Bari (M.C. of Manfredonia, of Molfetta, of Bari, of Brindisi and of Gallipoli, up to Capo d'Otranto).

The Adriatic Sea is a semi-enclosed basin between the Italian and Balkan peninsulas, which, through the Otranto Channel, extends in a SE to NW direction to the Gulfs of Venice and Trieste. The overall length is about 430 nautical miles (about 800 km), while the average width is about 50 nautical miles, with a maximum of 120 nautical miles (about 220 km). On a level with the Gargano promontory, the Adriatic Sea is divided into a continental shelf zone to the North, with depths not exceeding -200 m, and a southern sector, opposite the Apulian coast, where the basin reaches greater depths (about 1200 m). It is precisely the physical and morphological characteristics of the basin that determine the fact that the Adriatic has the highest tidal values in the Mediterranean, especially when the astronomical component is added to the meteorological one due to the non-uniformity of atmospheric pressure and wind action.

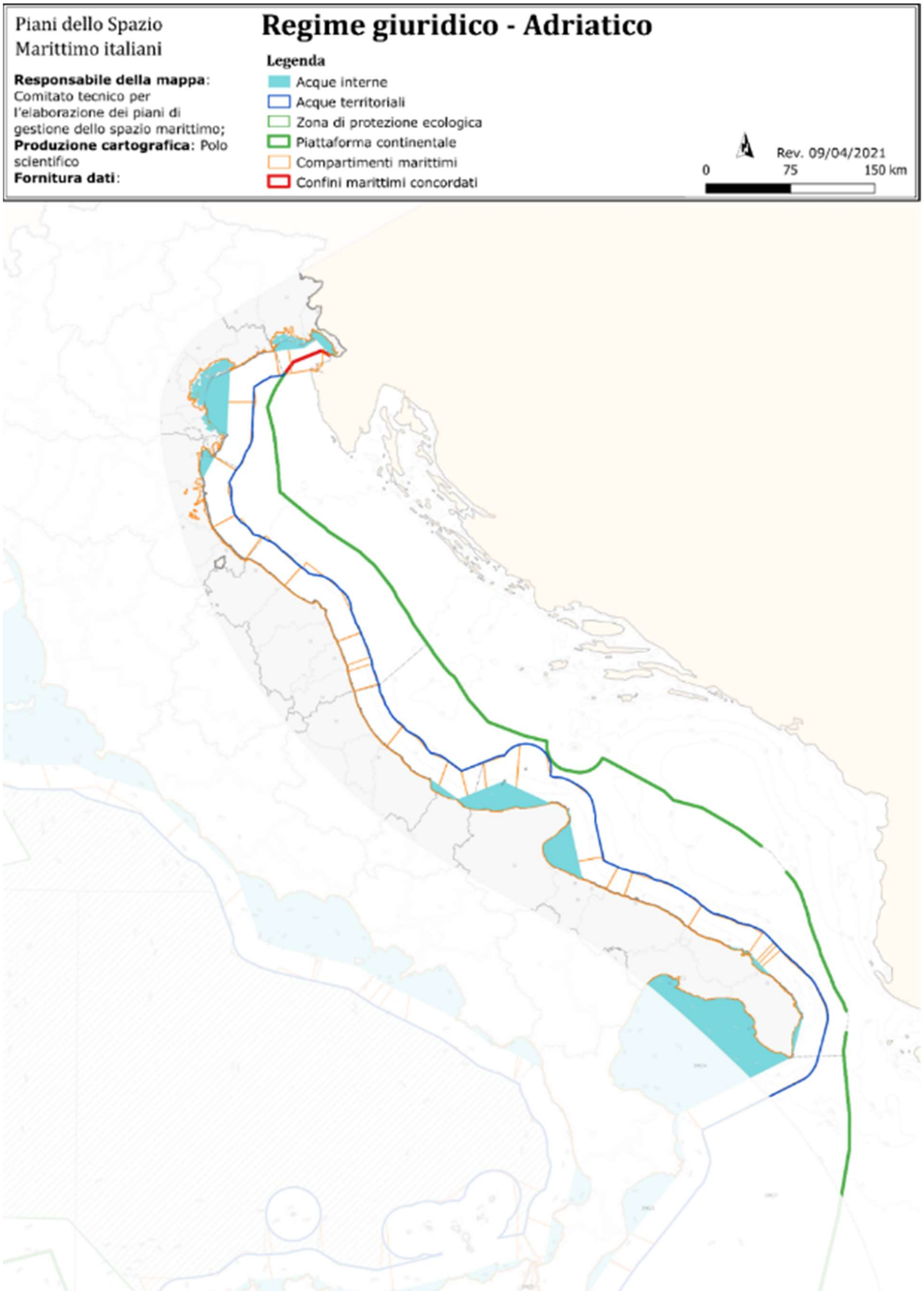


Figure 4.1 Legal boundaries of the "Adriatico" area

4.2 The current status of the environment in the territory of reference of the MSP

4.2.1 Indicators for the characterization of the state of the environment

In order to ensure the characterization of the context of reference, descriptive indicators of the state of the environment will be used at the sub-area and planning unit level. Therefore, starting from the table presented in Section 4.9 of the RP, from a comparison with the Environmental Sustainability Objectives (see Chapter 3 of the ER) and with the set of indicators for monitoring[31] the MSP (Chapter 7 of the Plan), a number of indicators have been selected to describe the characteristics of the ecological system, measure the presence or rather the concentration of elements of particular environmental importance or sensitivity (protected natural areas or areas of biological/naturalistic interest, cultural assets, specific and areal, etc.) without yet referring to uses and forecasts of the Plan. The values considered are intended as an assessment tool, relative and not absolute, useful to identify the PUs (Planning Units) most sensitive to anthropogenic transformations. This will allow in section 4.3 below to characterize the level of environmental sensitivity of the different areas.

The greatest difficulty encountered was in identifying the territorial scope of reference of the indicators, especially those referring to the terrestrial environment, since the MSMP focuses its action on territorial waters. The following table therefore provides a reference of the indicators chosen to characterize the state of the environment in its current state and the reference area considered:

Environmental component	Environmental indicator	Parameters to be assessed	Source	Context of reference considered
Biodiversity	*Posidonia oceanica*	Surface in ha	---	Sub-Area
	Protected areas (Rete Natura2000, MPA, ZTB...)	Surface in ha	MITE	Planning Unit
	Marine waste	Beached marine waste	ISPRA	Sub-Area
Water	Trophic state of the system	Nitrate/Phosphate concentrations	ISPRA	Sub-Area
	Quality of water	Concentration of contaminants	ISPRA	Sub-Area
Air	Air quality	Concentration of atmospheric pollutants	ISPRA	Sub-Area
Soil	Coastal dynamics	Assessment of coastal erosion	ISPRA	Sub-Area
	Coastal profile	Presence of coastal works	ISPRA	Sub-Area
	Subsidence	Seaside towns with subsidence	ISPRA	Sub-Area
Landscape and Cultural heritage	Soil consumption	Soil consumed (2020) and soil consumption (2019-2020) in landscape protection areas[32]	ISPRA	Region
	Presence of assets and restricted and/or protected areas	Number of (specific) assets restricted under Leg.D. 42/2004	MiC	Strip of reference (300 m from the shoreline)
		Surface in ha of (areal) assets restricted under Leg.D. 42/2004	MiC	Strip of reference (300 m from the shoreline)
		Number of submerged assets	MiC	Planning Unit

[31] The Monitoring Plan is "*a tool aimed at tracking in space and time the efficiency of MSP implementation and suggesting improvement measures if these are deemed necessary through mid-term reviews*." It must "*embrace possible variations in space and time of environmental, social, economic and management priorities, should these emerge during the first cycle of its implementation. Thus, the role of monitoring played in informing and communicating changes in the status of implementation of management measures and their objectives, as well as boundary conditions that may affect them and require revision, is once again emphasized*."

[32] https://annuario.isprambiente.it/sys_ind/696 e https://annuario.isprambiente.it/sys_ind/697

4.2.2 Context of reference: Ecologically or Biologically Significant Marine Areas (EBSA)

The Convention on Biodiversity (CBD) defines a number of Ecologically or Biologically Significant Marine Areas (EBSAs) in the Mediterranean (Fig. 4.2). These are special marine areas of high ecological value that provide a wide range of ecosystem services, are rich in biodiversity, and serve important purposes in supporting the healthy functioning of the seas. Marine areas of ecological or biological importance (EBSAs) are critical to understanding where and when to take action to effectively protect and safeguard marine biodiversity. The "Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (EBSAs)," held in Malaga, Spain in 2014 and organized by Unep/Map and Convention on Biological Diversity (CBD), highlighted and confirmed Aichi's eighth goal, which requires that "*by 2020, 10 % of marine and coastal areas, including areas of particular importance for biological diversity and ecosystem services provided, be conserved through ecologically representative and well-connected networks of effectively and equitably managed protected areas, and by other effective area-based conservation measures*."

The scientific criteria for identifying EBSAs where defined at the ninth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 9) are:

1. Uniqueness or rarity.
2. Of particular importance because of the life history stages of the species.
3. Importance due to threatened, endangered or declining species and/or habitats.
4. Vulnerability, fragility, sensitivity or slow recovery.
5. Biological productivity.
6. Biodiversity.
7. Naturalness.

More than 150 areas in seven different marine regions, including the Mediterranean, have been identified that meet the scientific criteria for EBSAs. In its Decision X/29 on Marine and Coastal Biodiversity, the Conference of the Parties (Cop) to the CBD noted that "*The application of scientific criteria in EBSAs is a tool that Parties and relevant intergovernmental organizations can use to advance the application of ecosystem approaches in marine areas located within and beyond the limits of national jurisdiction*." Cop CBD also said that "*the application of EBSA criteria is a scientific and technical activity, that areas that meet these criteria can be the subject of improved conservation and management measures, and that this can be done through various means, including marine protected areas and impact studies."* The CBD Parties stressed that *"the identification of EBSAs and the choice of conservation and management measures are the responsibility of states and relevant intergovernmental organizations*." In order to achieve effective sustainable economic development, the management and planning of maritime areas needs a broader network that includes not only Marine Protected Areas (MPAs), but also all other types of areas of high environmental value, where various ecological functions are interconnected. This network of areas of high ecological value must be connected through so-called "blue corridors" that connect important ecological features such as resting areas, ecological corridors and currents, and must be free of factors that impede such connectivity, e.g., busy shipping lanes or areas intensively exploited by trawling, polluted areas, physical infrastructure, and noise barriers. The network of MPAs, which are the best known and most effective tool adopted to date to protect marine ecosystems, partially overlaps with the network of important areas. Effective Maritime Spatial Planning (MSP) should usefully complement the objectives of this ecological network through careful management of activities, forms of marine resource use or economic sectors, especially in areas where the pressures they generate could harm valuable ecosystems. In addition, it should:

- play a key role in achieving Good Environmental Status (GES) in Mediterranean waters;
- avoid detrimental effects on areas considered as priority;
- minimize adverse effects on larger areas of high ecological value.

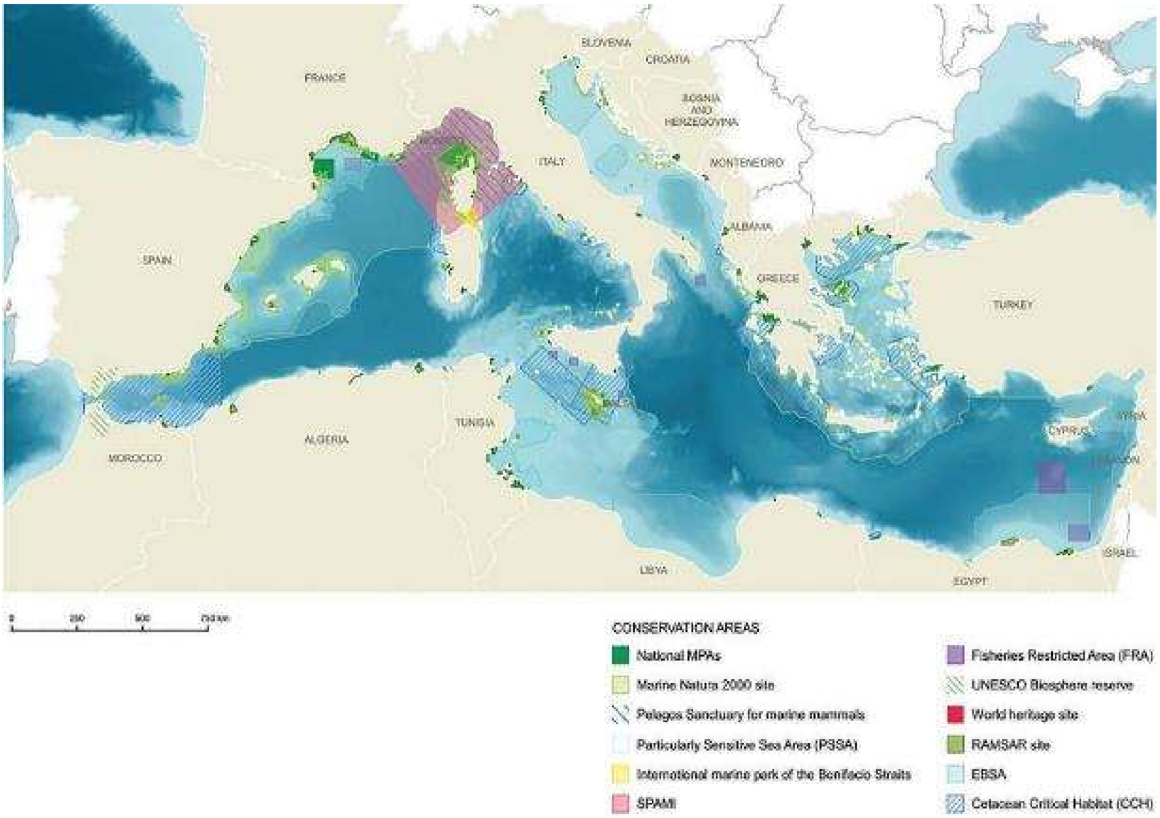


Fig. 4.2 Ecologically or Biologically Significant Marine Areas (EBSA) in the Mediterranean. (Source PHAROS4MPAS – Interreg Mediterranean National Report 2019)

The entire Central Mediterranean Sea area was identified by COP 12 (Korea 2015) of the Convention on Biological Diversity as an "Ecologically or Biologically Significant marine Area" (EBSA)[33], a definition that does not yet set direct limits, as it does not imply an economic or legally protected status, but recommends that states pay special attention to management practices for biodiversity conservation.

The EBSA of the Adriatic Sea is defined as an area relevant to the support of services provided by the sea, based on criteria, including biodiversity. It was chosen to carry out the description of the main environmental components in the "Adriatic" maritime area through the priority areas with environmental protection value. These areas were identified through management tools related to the Natura 2000 Network (e.g. SCI, SPAs), sea protection (Marine Protected Areas) and fisheries management (such as Biological Protection Zones (ZTBs) and Fisheries Restricted Areas (FRAs)). Priority areas that fall outside the EBSAs are described by taking sub-areas as reference. The boundaries of the sub-areas should be considered as permeable boundaries, from the point of view of uses, from the point of view of the environment/ecosystem, and from the point of view of the governance system, so as to ensure maximum coherence with respect to the planning of the wider area and neighboring sub-areas. For some Biological Protection Zones (ZTBs) and Fisheries Restriction Areas falling within the "Adriatic" maritime area, the unavailability of data did not allow to report the delimitation of these areas in the relevant cartography. The "Adriatic" [34] maritime area due to its very high ecological, landscape and cultural value, is affected by numerous environmental protection instruments and is divided into 9 SUB-AREAS, 7 of which within territorial waters.

[33] See (UNEP, 2014, *Decision adopted by the Conference of the Parties to the Convention on Biological Diversity XII/22. Marine and coastal biodiversity: ecologically or biologically significant marine areas (EBSAs*), Dec-COP-12-DEC-22, https://www.cbd.int/doc/decisions/cop-12/cop-12-dec-22-en.pdf)

[34] Cfr. Carta delle aree EBSA e Ambiti Prioritari con valenza di tutela ambientale - MSP_ADR_AMBD002_EBSA

Priority environmental **SETTINGS** are:

- 3 EBSAs.
- 4 Marine Protected Areas
- 7 Biological Protection Zones (Min. Decree 22 January 2009 of MIPAAF-O.J. General Series No. 37 of 14-02-2009).
- 1 FRA (Recommendation: GFCM/41/2017/3)

4.2.3 Marine and Coastal Environment

4.2.3.1 Qualitative descriptors: Biodiversity (D1)

The Marine Strategy Framework Directive (MSFD 2018-2024) implemented via Legislative Decree 190/2010 requires for Descriptor 1 that biodiversity be maintained. It also requires that "*the quality and presence of habitats as well as the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions*." In application of the Marine Strategy Directive, for this Descriptor Italy has defined that in order to achieve its Good Environmental Status (GES), the following environmental targets must be set (Min. D. of February 15, 2019, No. 36):

- increase the number of marine species and marine habitats of interest as regards conservation and maintenance (Habitats Directive, Birds Directive, SPA/BD Protocol of the Barcelona Convention);
- achieve an improvement in the condition of populations of representative species of fish and cephalopods, including those that are vulnerable or commercially exploited (also in relation to the relevant environmental goal of Descriptor 3 - Fish and Molluscs/Crustaceans of commercial interest);
- achieve an improvement in the demographic characteristics of coastal fish species' populations compared to their conditions in Marine Protected Areas.

The description of the “Biodiversity” of the “Adriatic” marine area is based on solely marine species and habitats and of greater management value, also according to the MSFD, present in the Annexes in the Habitats Directive 92/43/EEC indicated here below:

- Annex I: habitat types whose conservation requires the designation of Special Area of Conservation (ZSC).
- Annex II: species of community interest whose conservation requires the designation of Special Area of Protection (ZPS).
- Annex IV: species that require strict protection.
- Annex V: species whose taking in the wild and exploitation may be subject to management measures.

Based on the European Commission decision No. 2017/848 (laying down criteria and methodological standards on Good Environmental Status (GES) of marine waters and specifications and standardised methods for monitoring and assessment,), the groups of species and the types of habitats to be taken into consideration are shown in the following tables:

Table 4.1 Marine species

Invertebrates	Cnidaria	*Corallium rubrum*
Invertebrates	Bivalve mollusks	*Patella ferruginea*
Invertebrates	Bivalve mollusks	*Lthophaga lithophaga*
Invertebrates	Decapod crustaceans	*Pinna nobilis*
Invertebrates	Echinoderms	*Centrostephanus longispinus*
Reptiles	Turtles	*Caretta caretta* *Chelonia mydas*
Mammals	Carnivores	*Monachus monachus*
Mammals	Cetaceans	*Balaenoptera physalus*
Mammals	Cetaceans	*Dephinus dephis*

Mammals	Cetaceans	*Globicephala melas*
Mammals	Cetaceans	*Grampus griseus*
Mammals	Cetaceans	*Physeter catadon*
Mammals	Cetaceans	*Stenella coeruleoalba*
Mammals	Cetaceans	*Tusiops truncatus*
Mammals	Cetaceans	*Ziphius cavirostris*
Mammals	Cetaceans	*Steno bredanensis*

Tables 4.1 and 4.2 show the list of species and habitats of community interest under Directive 92/43/EEC monitored in the Italian seas. The marine component is represented by a total of 17 species (5 invertebrates, 2 reptiles, 10 mammals) and 8 habitats of marine waters, tidal and reef environments.

Table 4.2 Benthic marine habitats

Code	Description
1110	"Sandbanks which are slightly covered by sea water all the time"
1120	"Posidonia beds (*Posidonion oceanicae*)"
1170	"Reefs"
1180	"Submarine structures made by leaking gases"
8330	"Submerged or partially submerged sea caves"
1140	"Mudflats and sandflats not covered by sea water at low tide"
1160	"Large shallow inlets and bays"
1130	"Estuaries"

Figure 4.3 below shows the coralligenous habitats and the other habitats of community interest pursuant to the Habitats Directive in Italian seas[35].

Fig. 4. 3 Distribution of coralligenous and protected Habitats. (Source MITE-ISPRA)

As regards fish, coastal, pelagic, demersal and deep-sea species are considered. As regards cephalopods, coastal and continental shelf species are considered.

As regards the biodiversity of the "Adriatic" marine area, the focus was on marine species and benthic habitats referred to in Directive 92/43/EEC and Directive 2009/147 "Birds".

The information and data are derived from the monitoring programs referred to in Art. 11 of Leg. Decree 190/2010, as amended, collected by ISPRA, the Regional Agencies for the Protection of the Environment, the

[35] See Annex Map of the distribution of seabed Habitats - MSP_ADR_AMBD006_Habitat_fondo

CNR, and then supplemented with those from other Plans, research projects and cognitive surveys at the national and international level, taking into account that for bird species, mammals, reptiles, fish species and cephalopods not exploited for commercial purposes but susceptible to incidental catch.

EBSA "Ecologically or Biologically Significant Marine Areas" North Adriatic[36]

The EBSA is an area located in the northern section of the "Adriatic" marine area and supports important endemic species and communities. It consists of:

- the **SUB-AREAS A/1-A/2-A/3-** and the northern parts of **A/4 e A/7 (**territorial waters).

The priority environmental **SETTINGS** are**:**

- MPA/ZTB "Miramare".
- ZTB/ZSC Tegnùe "Porto Falconera-Caorle".
- ZTB/ZSC "Tegnùe di Chioggia".
- ZTB "Fuori Ravenna e aree limitrofe" (Outside Ravenna and neighbouring areas).
- ZTB "Le Barbare".

The North Adriatic EBSA is defined as a special area for the support of services provided by the sea based on criteria of uniqueness or rarity, importance for species' life stages, importance for threatened or endangered species/habitats, vulnerability, fragility, sensitivity or slow recovery, biological productivity, biodiversity and naturalness. It is characterized by the presence of areas of high environmental value such as 'trezze' or 'tegnùe' (rocky outcrops), seagrass meadows, subpopulations of bottlenose dolphin, breeding colonies of European shag, nesting sites of common tern, resting and feeding areas for sea turtles, nursery areas of blue shark listed in Annex III of the SPA / BD Protocol, common thresher shark and sandbar shark (UNEP / MAP-RAC / SPA, 2014a). In the Mediterranean Sea, the Gulf of Trieste represents the northern distributional boundary of *Posidonia oceanica*. The most extensive seagrass meadow is found near Koper on the Slovenian coast of the Gulf of Trieste, while on the Italian side Posidonia has been defined as scattered and confined since 1938.

It is currently restricted to a narrow area in front of the Grado lagoon, in small isolated patches. The Adriatic seagrass beds are generally characterized by *Posidonia oceanica* on mattes and mosaic mattes and on biogenic structures, i.e., concomitant presence of Posidonia plants and coralligenous bioconstructions characterized, among others, by the presence of green algae and brown algae, mainly belonging to the genera *Padina* and *Flabellia*, as well as Madreporaria such as *Cladocora caespitosa* and *Balanophyllia europaea*.

The trend in habitat extension is stable, although there are moderate signs of regression along coastal waters characterized by urban, industrial and agricultural pressures. In the northern portion of the basin, remnant plants of *Posidonia oceanica* (L.) *Delile* (total area covered: about 5 ha) are found at a depth of 3 to 4.5 m and grow only on the rocky substrate, while the surrounding incoherent seabed is colonized by dense grasslands of *Cymodocea nodosa*. The intrinsic biological value of *Posidonia oceanica* of the Upper Adriatic is related to its genetic identity. On the reefs north and south of Pula there is a vigorous community of date mussel (*Litophaga litophaga*) species listed in Annex IV "Animal and plant species of Community interest requiring strict protection" of the Habitats Directive, Annex II of the SPA/BIO Protocol of the Barcelona Convention and Annex II of CITES. European Regulation 1967/2006 prohibits its capture, transport and sale.

Thanks to environmentalists' persistent campaigns against poaching and to timely patrols by law enforcement officers at sea, such date mussel communities are recovering and beginning to gain ground again in what is their natural habitat. Along the eastern coast are expanses of violescent sea-whip (*Paramuricea clavata*), covering rocky walls and seabeds from 30 to 100 m in depth. It is a heliophobic organism that prefers low-light conditions and crystal-clear waters, characteristics typical of the southern Adriatic. The northern Adriatic and, in particular, the study area, hosts peculiar coralligenous formations, subject to specific protection measures, called "trezze" or "tegnùe". These unique hard-bottom bioconstructions in a predominantly sandy/muddy context colonize primary hard substrates consisting of elongated and sinuous morphological

[36] See EBSA Area Map Ecologically or Biologically Significant Marine Areas" North Adriatic MSP-_ADR_AMBD004_EBSA A4

structures, local calcareous sediments cemented by methane seepage, which host the growth of calcareous bioconcretions. The outcrops are mainly concentrated between the Po Delta and the Gulf of Trieste, at a distance from the coast varying between 0.5 to 21 km and at depths between 7 to 25 m. The tegnùe constitute an important and peculiar example of Mediterranean coralligenous formations, characterized by high biodiversity and specific and morphological variability, consisting mainly of coralline algae (e.g., *Peyssonneliaceae*) that grow in low light conditions.

They are threatened by numerous anthropogenic activities that can generate mechanical (e.g., abrasion, siltation), chemical-biological (exposure to organic pollutants, inorganic pollutants, pesticides, fertilizers, presence of invasive non-native species) or climate change-related (sudden increases in peak temperatures, acidification) effects. These threats affect the stability of populations, putting their conservation at risk and generating the need to subject them to specific environmental protection measures.

Knowledge of the distribution of *maërl* and rhodolith in the Adriatic Sea is still scarce and uneven.

From Venice to Grado, the habitat is characterized by a total of 12 taxa, found as both fossil and living thalli, with an uneven distribution between 9 and 24 m in depth. In particular, these bioconstructions turn out to be characterized by the rhodolith *Lithophyllum racemus*, while on pelitic-sandy sediments the two characteristic species of the maërl association are *Lithothamnion corallioides* and *Phymatolithon calcareum*, together with *Lithothamnion* minervae. Fish spawning and growth areas (Essential fish habitats) are particularly sensitive to pressures such as seafloor abrasion and selective mining, particularly due to fishing activities, but also from pressures such as changing sedimentary rates, introduction of non-synthetic substances and compounds, and underwater noise. Therefore, 5 biological protection zones have been established in this area: (ZTB) "Miramare" which is also a Marine Protected Area (MPA), the Tegnùe of "Porto Falconera-Caorle", the "Tegnùe di Chioggia", the "Outside Ravenna and neighbouring areas" and the "Le Barbare". The Biological Protection Zones (ZTB), often mistakenly referred to as an alternative solution to Marine Protected Areas, instead represent management measures aimed more at the conservation of fish stocks of species of commercial interest through the regulation or prohibition of certain fishing activities, rather than the conservation of biodiversity, natural capital and the integrity of marine ecosystems as is the case with Marine Protected Areas. In the ZTB "Miramare", fishing with gillnets, fishing with surrounding nets and fishing for shrimp and cuttlefish with fish traps is allowed. The possibility of fishing with this gear is related to the biological characteristics of the main species being caught and the territorial context. Some fishable species make wide and rapid movements and are not resident in the ZTB (bluefish caught with encircling nets and cuttlefish caught with pots and gillnets). Mantis shrimp, which live in burrows dug in the sediment, are caught with gillnets and mantis shrimp traps, and fishing is already regulated locally.

The area is also a concentration area of the juvenile stages of red mullet, common pandora, squid and cuttlefish which, due to their small size at the juvenile stage, are not caught with the permitted selective gear.

Professional fishing with gillnets and sport fishing with hooks are suitable to contain the development of predatory species, such as European bass. Sport fishing with up to a maximum of 5 hooks per fisherman is allowed. For more information on the Miramare MPA, please refer to the relevant section.

In the "Caorle-Porto Falconera " ZTB, fishing is regulated in the area of the ZTB and the "Marine Oasis City of Caorle," established by the Veneto Region and the City of Caorle. There is total protection and prohibition of all forms of fishing in this area. Anchoring, mooring and bathing are also prohibited. Diving activities are provided only in the presence of staff of the managing body. The "Porto Falconera-Caorle" ZTB has been designated a Special Area of Conservation (ZSC) by Ministerial Decree dated 27/07/2018.

The "Tegnùe di Chioggia" ZTB is divided into two distinct zones, the first of which provides for the total protection of four small areas where there are rocky outcrops of an organogenic nature, such as those in front of Caorle, with fish populations that require greater protection from overfishing. The use of selective set gears ensures protection of juvenile forms of all species and helps reduce illegal fishing with towed gear in a high fishing pressure area. The "Tegnùe di Choggia" ZTB has been designated a Special Area of Conservation (ZSC) by Ministerial Decree dated 27/07/2018. Professional fishing, the use of traps, gillnets and longlines is allowed in the "Outside Ravenna and surrounding areas" ZTB . Sport fishing is allowed with a maximum of 5 hooks per fisherman. Fishing is also allowed with collective boats. The "Le Barbare" ZTB is located about 30 miles off the coast of Ancona, on about 70 m deep seabeds, and has the characteristic of including hydrocarbon extraction platforms which, due to the depth, constitute special environments with the presence of hard substrate species. In addition, also due to the lure effect of night lights, large pelagic species, from bonito to tuna and greater amberjack, are present in the area. Fishing with towed nets and deep-set longlines is prohibited in the area, while fishing with traps and bottom-set nets, which are more selective gears, and with surrounding nets and surface longlines for pelagic resources, is allowed.

Visual, aerial and satellite surveys have also shown in this area the presence of marine mammals as non-migratory and/or within fixed migratory routes. Only one cetacean species, the bottlenose dolphin (*Tursiops truncatus*), is considered non-migratory in the northern-central Italian Adriatic Sea. Other species, such as the common dolphin (*Delphinus delphis*), striped dolphin (*Stenella coeruleoalba*), minke whale (*Balaenoptera physalus*), sperm whale (*Physeter macrocephalus*), Risso's dolphin (*Grampus griseus*), zyphi (*Ziphius cavirostris*) and pilot whale (*Globicephala melas*), are considered sporadic or wandering, while they are much more frequent in the southern portion of the basin. The characteristics of the Mediterranean, particularly temperature and productivity, influence the distribution of cetacean species. Of the 78 known species, 22 have been recorded in the Mediterranean basin and can be divided into three categories:

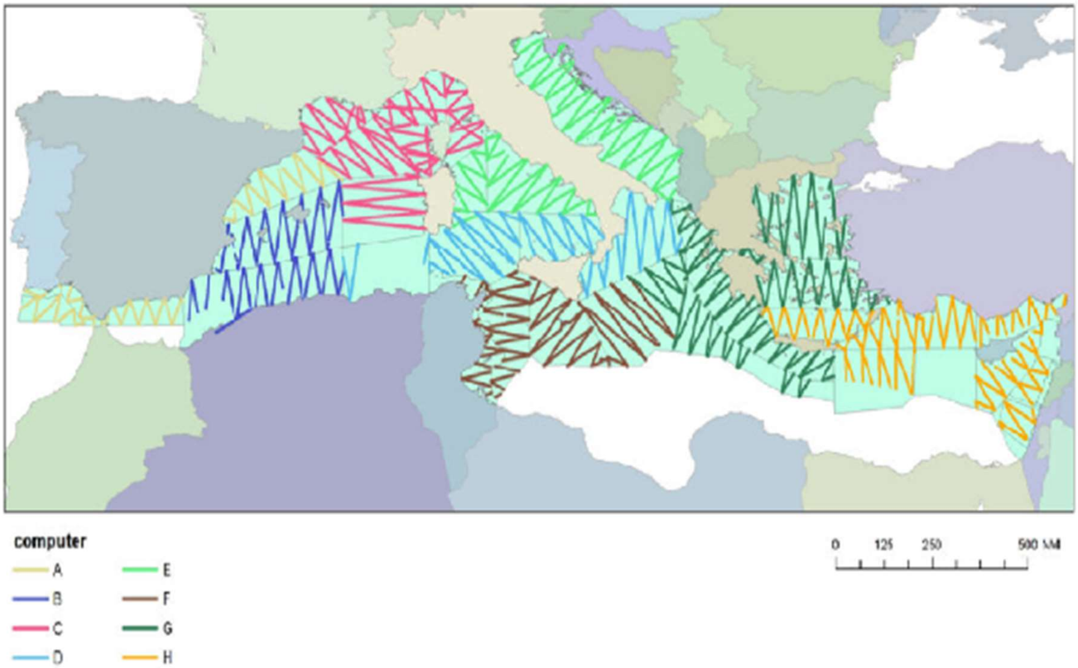
1. regular species, with resident populations, include 10 species including one belonging to the suborder *Mysticeti* (the minke whale, *Balaenoptera physalus*) and nine belonging to the suborder *Odontoceti* (the sperm whale, *Physeter macrocephalus*; Cuvier's zyphi whale, *Ziphius cavirostris*; the long-finned pilot whale, *Globicephala melas*; the Risso's dolphin, *Grampus griseus*; the common bottlenose dolphin, *Tursiops truncatus*; the striped dolphin *Stenella coeruleoalba*; the short-beaked common dolphin, *Delphinus delphis*; and the Indo-Pacific rough-toothed dolphin, *Steno bredanensis*, which has been observed only in the Levantine Basin). As for *Steno bredanensis* it is reported that it has only recently been included as a regular species and is considered (perhaps) a relict population in the eastern basin. Orca (*Orcinus orca*) can also be considered a regular species resident in the Strait of Gibraltar, the presence of which is widely verified by sightings;
2. visiting species are named for their Atlantic origin and make occasional appearances mainly in the Western Mediterranean basin (the false killer whale *Pseudorca crassidens*, the common minke whale *Balaenoptera acutorostrata*, and the humpback whale *Megaptera novaeangliae*);
3. wandering species are those observed sporadically in different areas of the Mediterranean (the dwarf sperm whale *Kogia sima*, the northern bottlenose dolphin *Hyperoodon ampullatus*, the Blainville's beaked whale *Mesoplodon densirostris*, the Gervais's beaked whale *Mesoplodon europaeus*, the Sei whale *Balaenoptera borealis*, the North Atlantic right whale *Eubalaena glacialis*, and the gray whale *Eschrichtius robustus*). In addition, the Indo-Pacific humpback dolphin species (*Sousa chinensis*), which moved a few times to the Mediterranean after the opening of the Suez Canal (1869) (Morzer Bruyns, pers. comm. in Marchessaux, 1980) was included in a fourth category called 'alien species'.

The most common species in the Mediterranean are the common minke whale (*Balaenoptera physalus*), striped dolphin (*Stenella coeruleoalba*), bottlenose dolphin (*Tursiops truncatus*) and common dolphin (*Delphinus delphis*). Cuvier's zyphi whale (*Ziphius cavirostris*), long-finned pilot whale (*Globicephala melas*) and Risso's dolphin (*Grampus griseus*) are present but less abundant.

Below are maps of cetaceans and other types of megafauna from the first synoptic survey of the entire Mediterranean Sea conducted in June and July 2018 from the Accobams Survey Initiative (ASI) project.

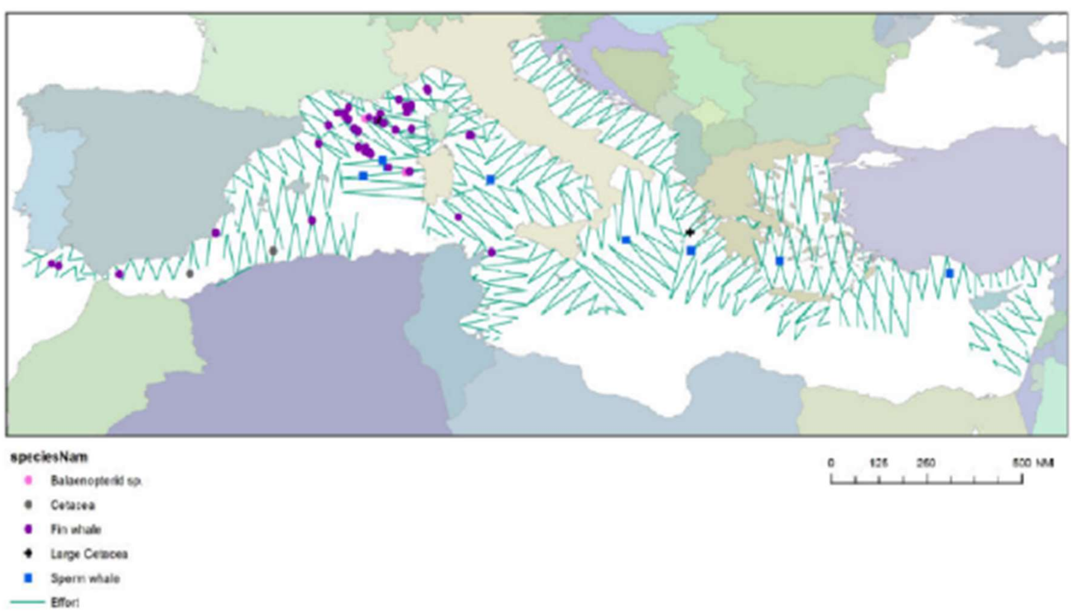
The information should be regarded as highly preliminary. Estimates of species abundance and distribution will be available after statistical processing through project- and model-based analyses.

Only then will the results be subject to interpretation for conservation issues (Figs. 4.4-4.5-4.6-4.7).



Large cetacean species

Fig. 4.4 Maps of sightings and acoustic detections collected during the aerial survey and SOTW - Large cetacean species. (Source ASI 2018)



Medium size cetacean species

Fig. 4.5 Maps of sightings and acoustic detections collected during the aerial survey and SOTW - Medium size cetacean species. (Source ASI 2018

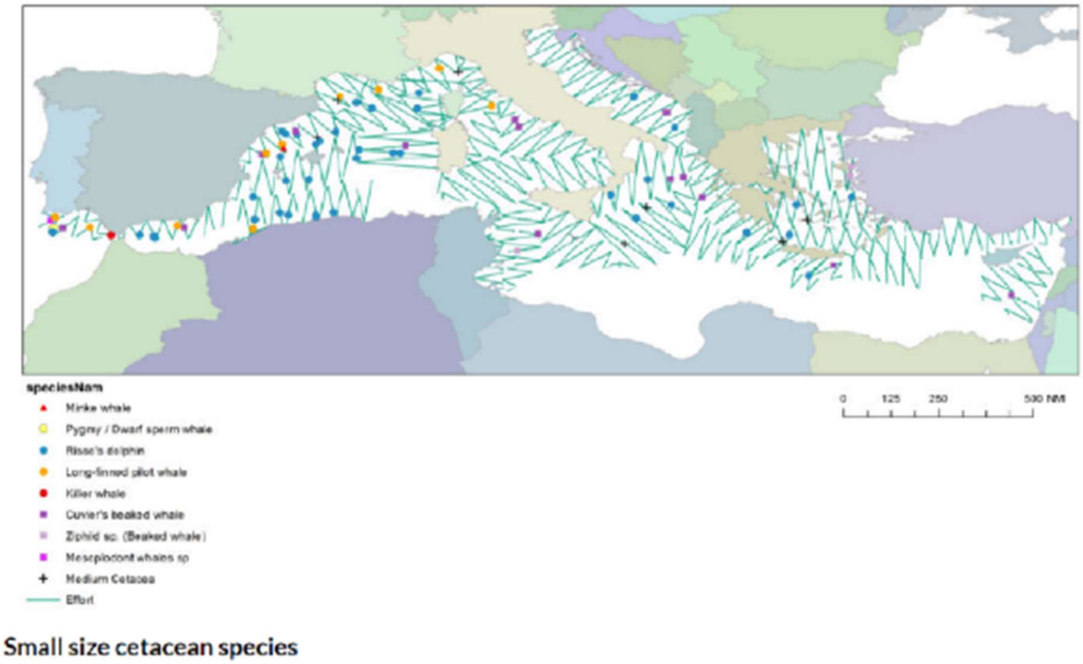


Fig. 4.6 Maps of sightings and acoustic detections collected during the aerial survey and SOTW - Small size cetacean species. (Source ASI 2018)

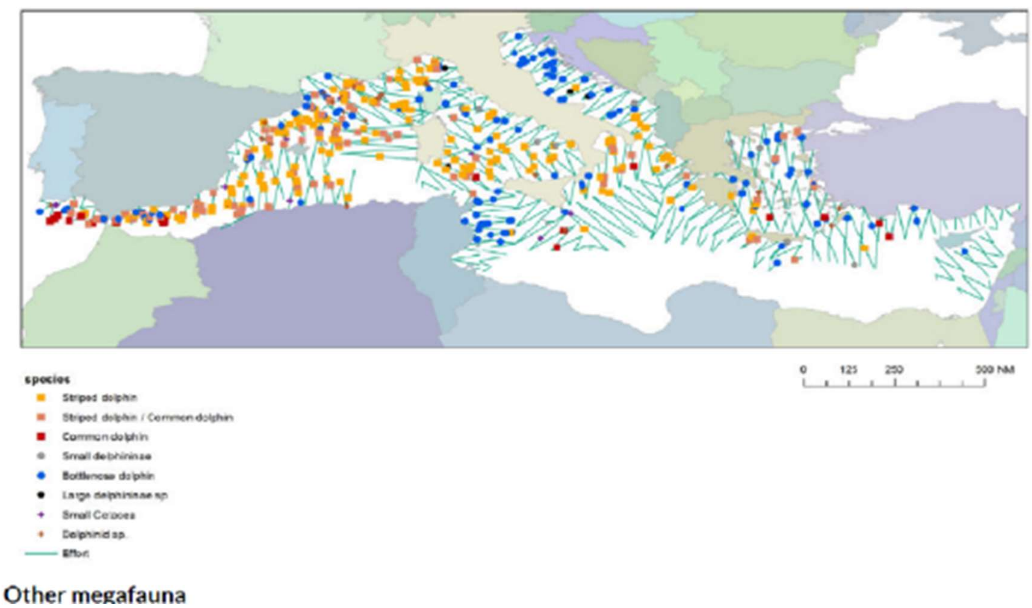


Fig. 4.7 Maps of sightings and acoustic detections collected during the aerial survey and SOTW - Other megafauna. (Source ASI 2018)

The conservation status of cetaceans has been a concern for many years because various threats, such as accidental mortality in fishing gear, vessel collisions, chemical pollution, noise pollution, and general habitat degradation, affect different species to varying degrees (Avila et al., 2018, Marsili et al., 2018). As a result, all cetacean species in the Mediterranean Sea have been included in the IUCN (International Union for Conservation of Nature) Red List of Threatened Species, the largest database of information on the conservation status of animal and plant species worldwide. Of the nine cetacean species in the Mediterranean Sea, *Ziphius cavirostris*, *Globicephala melas*, *Grampus griseus* and *Steno bredaniensis* are in the "Data

Deficient" category; *Stenella coeruleoalba*, *Balaenoptera physalus* and *Tursiops truncatus* are in the "Vulnerable" category; and *Delphinus delphis* and *Physeter macrocephalus* are considered "Endangered."

Overfishing has an indirect effect on Mediterranean cetacean populations and, as such, its impact is difficult to measure, but it stands as one of the most worrisome threats. The Mediterranean Sea is the most overfished sea in the world. About 63 percent of its fish stocks are exploited at biologically unsustainable levels and its demersal resources are at serious and real risk of depletion (FAO, 2022).

Many of the exploited species are important prey for cetaceans, and as cetacean resource use options decline in the future, it is likely that the effect of overexploitation will impact intra- and interspecific competition for food resources. In addition, many of the species mentioned above have similar distributions and share common food resources. Common dolphins, for example, occupy both pelagic and neritic habitats. Their pelagic distribution is similar to that of striped dolphins and their neritic distribution is similar to that of bottlenose dolphins, and therefore they must coexist with both species (Notarbartolo-di-Sciara and Birkun, 2010). This provides ample grounds for species interaction and competition for food resources. In response to a conservation crisis in the protection of marine mammals and broader global ocean biodiversity, the Marine Mammal Protected Areas Task Force of the International Union for the Conservation of Nature (IUCN) launched the “Important Marine Mammal Areas” (IMMAs) initiative in 2016. IMMAs identify portions of habitat that are important to one or more marine mammal species, and that have the potential to be delineated and managed for conservation, and are increasingly used in environmental impact assessments, marine planning exercises, and international, national, and supra-regional conservation, policy, and management initiatives, including the Convention on Migratory Species and the Convention on Biological Diversity, as well as the design and management of marine protected areas (MPAs) and the extension of MPA networks.

Between 2016 and 2021, 173 IMMAs located in 90 countries or territories were identified (Fig. 4.8).

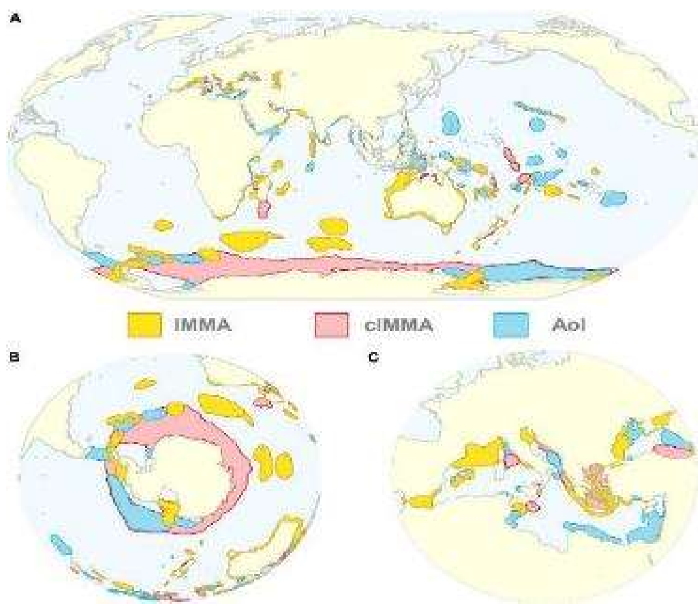


Fig. 4.8 The IMMA network as of December 2021 seen as a global projection (A), south polar orthographic projection (B) and Mediterranean projection (C). Important marine mammal areas (IMMAs) are shown in gold, candidate IMMAs (cIMMAs) in red and Areas of Interest (AoIs) in blue. Source (M. J. Tetley et al., 2022)

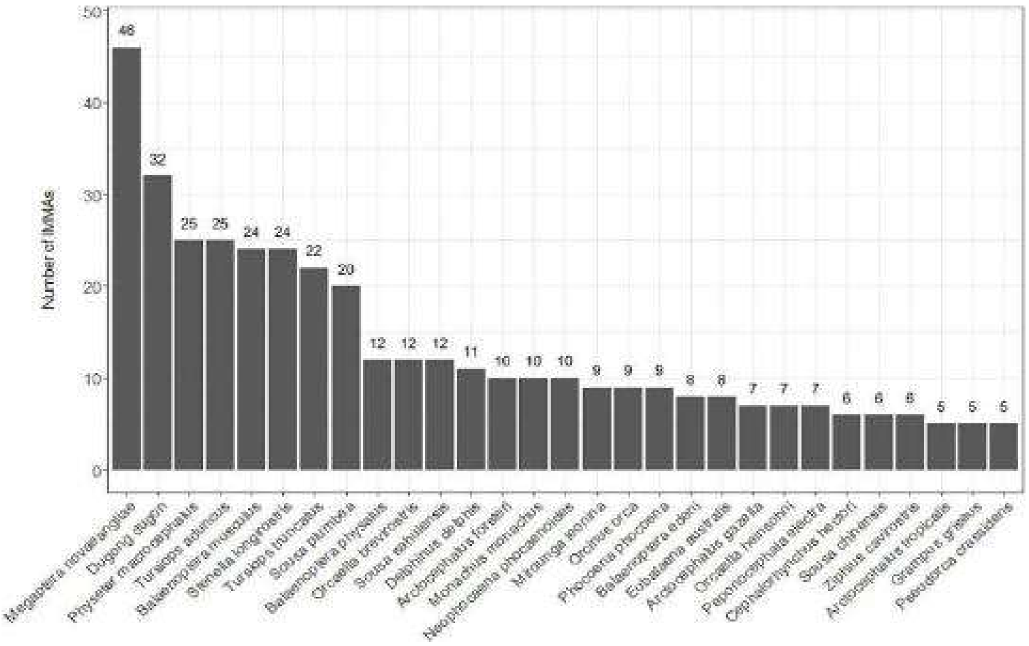


Fig. 4.9
The marine mammal species most frequently used as qualifying species in the identification of the 173 IMMAs identified by the Marine Mammal Protected Areas Task Force as of December 2021. Source (M. J. Tetley et al., 2022)

The IMMAs identified to date provide important habitats for 58 of the 131 recognized marine mammal species. About two-thirds of all IMMAs (65 percent) have been identified based on an important habitat for a marine mammal species that is threatened and on the IUCN Red List. Approximately 61% of IMMAs are within the waters of the Exclusive Economic Zone, while 39% fall in areas outside Italy's jurisdiction (Fig. 4.9) (M. J. Tetley et al., 2022). The north-central Adriatic is a favorable habitat for *Caretta caretta* sea turtles, which find abundant food and shallow waters there. Foraging areas for this species cover about 9% of the entire Mediterranean basin (i.e., ~ 217,000 km^2) (Fig.4.10).

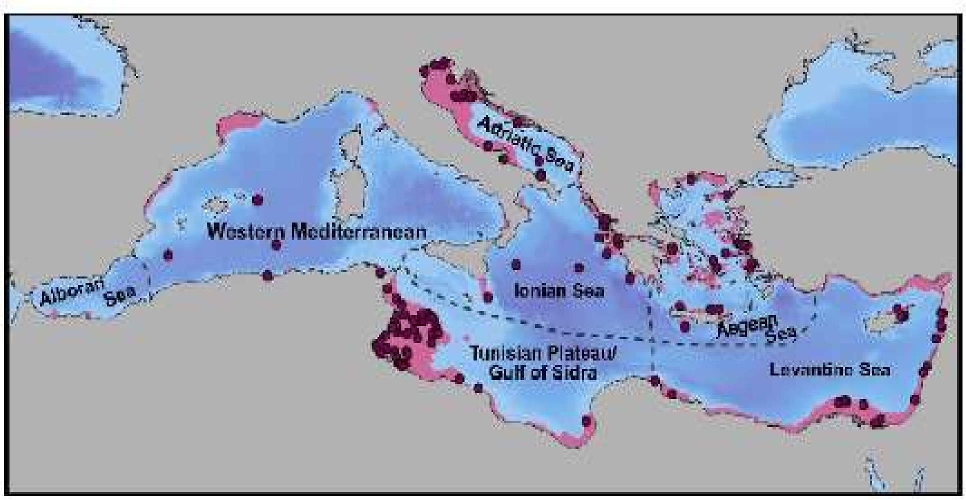


Fig. 4.10 The distribution of foraging grounds (pink polygons) of adult Loggerhead sea turtles *Caretta caretta*, under current climatic conditions (1991-2020) in the Mediterranean Sea. Locations (red dots) representing the foraging grounds of adult sea turtles, derived from available published satellite data, are shown, based on which the distribution map of foraging grounds was drawn. Marine Ecoregions encompassing the Mediterranean are delineated by black dashed lines. (Source S. Lo Brutto, et al. 2021)

The highest percentage of this area is in the central and eastern Mediterranean. More specifically, the Adriatic Sea, the Central Mediterranean, and the Tunisian Plateau host 31.75% and 24% of the total foraging area in the basin, respectively. The Eastern Mediterranean, Levantine Sea and parts of the Aegean Sea comprise substantial percentages of foraging areas for *Caretta caretta* turtles, 19.19% and 13.05% of the total area, respectively. In the Western Mediterranean, the extent of foraging grounds is more limited at 7.13% of the total foraging area, mainly along the French and Spanish coasts.

The assessment of the risk produced by the use of different types of fishing gear showed that more than 40%, or 40.94% of the foraging areas, were exposed to medium to very high levels of threat, with variations noted throughout the Mediterranean Sea (V. Almpanidou, A. Chatzimentor. 2021) (Fig. 4.11).

In Adriatic waters, the extensive movements of *Caretta caretta* include migration of adults for foraging to the mouth of the Po River in spring and summer, and for breeding to the Croatian islands and vice versa, as well as seasonal migrations of both breeding-age adults and juveniles southward during cold seasons. Genetic diversity studies indicate that colonies from the Greek islands, western Turkey as well as Crete, Cyprus and eastern Turkey transit the northern Adriatic, while no colony of Atlantic origin arrives there.

Sporadic occurrences of the other two sea turtle species, *Chelonia mydas* and *Dermochelys coriacea*, have been recorded over the years throughout the Adriatic Sea. The foraging area enclosed within the Adriatic Sea was the most severely affected by fishing, with 73.47% of its area subjected to high and very high risk.

More than 50 percent of the foraging area hosted within the Aegean and Ionian Seas was exposed to very high levels of risk (54.38 percent and 51.52 percent of the foraging area, respectively), with lower percentages being found in the Levantine Sea and the Tunisian Plateau/Gulf of Sidra. However, it should be noted that the results in the Levantine Sea and Tunisian Plateau/Gulf of Sidra should be interpreted with caution due to the low coverage of fisheries data. Although in the northern Adriatic turtles appear to be mainly threatened by the high rate of bycatch during fishing activity (Lucchetti et al., 2017), an additional potential threat is pollution, as suggested by several trials showing the presence of high levels of diffuse contaminants in their tissues (Bucchia et al., 2015; Cocci et al., 2018, 2019, 2020). Plastic pollution is now a major threat to the ecological balance of marine ecosystems. Small plastic particles can enter the food web through various marine organisms, possibly affecting their physiology and health. In particular, the sea turtle (*Caretta caretta*) is an "indicator species," i.e. useful as an indicator of the general level of pollution in marine ecosystems.

Swallowed small plastic particles accumulate in the final section of the turtles' digestive tract before excretion. During their transit and accumulation, the small debris also interacts with the resident microbial community, possibly affecting host health. The marine pathogens detected have been found to be associated with increased plastic contamination, supporting the hypothesis that plastic debris may act as a vector for environmental pathogenic bacteria in marine organisms (E. Biagi, M. Musella et al., 2021). High numbers of plastic particles have been detected in the feces of wild-caught *Caretta caretta* and *Chelonia mydas* turtles living in the northwestern Adriatic Sea, collected after their arrival at a local rescue center for their rehabilitation. This is a number of microparticles ranging between 10 and 15 per 100 ml - a fairly high number compared to data generally reported for the gastrointestinal contents of dead stranded turtles (Duncan et al., 2018). (Fig. 4.11.)

The Adriatic basin is, in fact, one of the most polluted marine sites on the planet due to its high productivity and anthropogenic impact, with an average concentration of > 400,000 plastic particles up to 5 mm per km (MSFD Technical Subgroup on Marine Litter Group et al., 2013; Alessi and Di Carlo, 2018; Liorca et al., 2020). The presence of a high level of plastic pollution in the faeces of turtles in the Adriatic Sea, and the recognized importance of the sea turtle as a flag species for the health status of the marine environment, indicate and confirm the high level of plastic pollution in the Adriatic Sea systems.

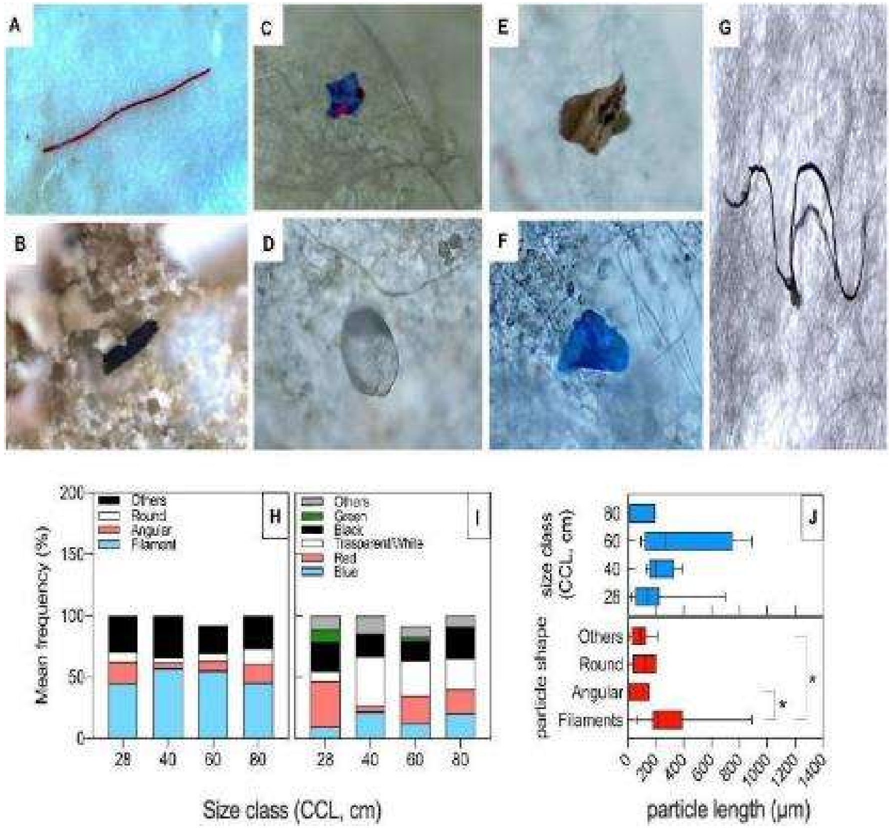


Fig. 4.11 Shapes and colors of particles isolated from fecal samples of Loggerhead sea turtles from the north-western Adriatic Sea. (A-G) Microscope images showing representative elements of particles isolated from sea turtle fecal samples: (A) Red filaments; (B) Black angular fragments; (C) Angular fragments with unclassified color (others); (D) Transparent round fragments; (E) Unclassified shape and color; (F) Blue fragment with unclassified shape; (G) Black filaments. Average frequency classification by shape (H) and color (I) in different size classes of turtles. (J) PD size distribution among turtle size classes (upper panel) and particle shape category (lower panel). *P < 0.05. (Source E. Biagi, et al. 2021)

EBSA "*Ecologically or Biologically Significant Marine Areas*" – Central Adriatic[37]

It includes **SUB-AREA A/8 (territorial waters)** and the priority environmental SETTING**:**

- ZTB/FRA Jabuka/Pomo Pit.

The central Adriatic zone includes the Pomo Pit EBSA that extends in front of the Torre del Cerrano Marine Protected Area. The Jabuka/Pomo Pit is the largest Fishery Restricted Area established in agreement with the Croatian government in the seas bordering our peninsula (Reg. EU 2019/982, Recommendation: GFCM/41/2017/3. 'Seabed' fishing is prohibited and is restricted to the "fondaletto" (restricted seabed area) within the following limits: "special authorization to fish in the Pomo Pit", reserved only for boats equipped with onboard and functioning VMS and AIS (Automatic Identification System: automatic identification system is an automatic tracking system used in the naval field, in aid of radar systems, in order to avoid collisions between vessels under navigation) systems. It is a sensitive and critical spawning and nursery area for the demersal resources of the Adriatic Sea, particularly for hake; for the large population of Norway lobster (*Nephrops norvegicus*), especially important for juveniles in depths of more than 200 m; for the nursery area for blackbellied angler (*Lophius budegassa*) and horned octopus (*Eledone cirrhosa*). The hake nursery areas are located on the slopes in areas adjacent to the Jabuka/Pomo Pit at depths between 150 and 200 m. The pit could function as a favorable environment for some key life cycle stages of the porbeagle shark (Lamna nasus), which is critically endangered (IUCN, 2007), and is listed in Annex II of the SPA/BD protocol. It is an area of

[37] See EBSA Area Map Ecologically or Biologically Significant Marine Areas" Central Adriatic MSP_ADR_AMBD004_EBSA_A4

high density for the devil fish or Mediterranean manta ray (*Mobula mobular*), considered an elasmobranch endemic to the region, also listed in Annex II of the SPA/BD Protocol.

The Northern-Central Adriatic area represents a hot-spot of Mediterranean biodiversity, especially taking into consideration endemics of certain fish species. In fact, important fish spawning and growth areas (Essential Fish Habitats) of high commercial value are included in the study area. These include the recruitment and spawning grounds of the economically important fishery species *Engraulis encrasicolus* (European anchovy), *Mullus barbatus* (red mullet), *Pagellus erythrinus* (common pandora), *Sardina pilchardus* (European pilchard), *Scomber colias* (Atlantic chub mackerel), *Scomber scombrus* (Atlantic mackerel), *Solea solea* (common sole), and *Trachurus mediterraneus* (Mediterranean horse mackerel).

The Adriatic Sea represents one of the basins with the highest densities of elasmobranchs in the Mediterranean. Sharks include in particular spiny dogfish (*Squalus acanthias*) and smooth-hound (*Mustelus spp.*), species of commercial fishing interest, as well as species of Batoidea, such as the common eagle ray (*Myliobatis aquila*), common stingray (*Dasyatis pastinaca*), bull ray (*Pteromylaeus bovinus*), and pelagic stingray (*Pteroplatytrygon violacea*), which often represent a conspicuous bycatch during pelagic trawling operations. Although elasmobranchs are counted among the marine organisms most vulnerable to threats from excessive anthropogenic pressure, they are underrepresented in lists and regulations that provide active protection.

SUB-AREA A/4 – Priority environmental SETTING: "SCI IT5340001-SCI IT5340022"

Along the Marche coast there are a number of Sites of Community Interest (SCI) such as "Litorale di Porto D'Ascoli" and "Costa del Piceno-San Nicola a mare" (SCI IT5340022), which mainly feature the presence of habitat 1110 (Sandbanks which are slightly covered by sea water all the time).

The SCI "Costa del Piceno-San Nicola a mare" is also characterized by habitat 1170 "Reefs" and the presence of the Twait shad (*Alosa fallax*), a vulnerable species, which is on the IUCN red list.

It is a 100% marine area and has a surface area of about 43 ha. This site is also characterized by the presence of conglomerates and cemented sandstones and by sandy beds. These are biogenic reefs that represent the most relevant biocenotic components of the area, consisting of *Sabellaria alcocki G.* and mussel beds formed by *Mytilus galloprovincialis* (ecosystem engineers). The remaining portion of the area is characterized by sandy beds consisting of habitat 1110 (sandbanks).

For a more detailed description of the SCI, please refer to VincA (Annex IX of the ER).

EBSA "*Ecologically or Biologically Significant Marine Areas*" - Southern Adriatic[38]

The EBSA is an area located in the southern section of the Adriatic sea and supports important species and endemic communities. It includes **SUB-AREE A/6** (territorial waters) and **A/9** (international waters).

The priority environmental SETTING consists of the:

- Biological Protection Zone "Off the coast of Puglia"

The EBSA is located laterally to the Tremiti Islands MPA and opposite the Torre Guaceto Mpa. It borders part of the Biological Protection Area "Off the coast of Puglia." The southern area of the Adriatic as opposed to the northern part features extensive seagrass beds of *Posidonia oceanica*, a species endemic to the Mediterranean Sea under Annex I of the Habitats Directive 92/43/EEC and Annex IV of the Bern Convention, recognized by the Mediterranean Regulation as a protected habitat, and by UNEP as a highly endangered ecosystem in the Mediterranean basin. In addition to playing a role in maintaining nursery habitats of fish species of commercial interest and in climate regulation through the sequestration and storage of significant amounts of carbon, *Posidonia oceanica* seagrass beds also play an important role in the sedimentary processes of Mediterranean coastal environments (De Falco et al., 2017). In addition, *Posidonia oceanica* contributes to the geomorphological variability of beaches throughout the year, as it constitutes a significant component of the

[38] See EBSA Area Map Ecologically or Biologically Significant Marine Areas" Southern Adriatic MSP_ADR_AMBD005_EBSA_A6

volume of coastal barriers, dunes and material exchanged between the emerged and submerged beach during storm surges, through the accumulation of banquettes (Simeone et al., 2013).

Data on the distribution of Cystoseira, Phanerogams and Coralligenous habitats show a clear difference in distribution along Italian coasts (MATTM, 2019). In particular, it can be seen that Phanerogams are the marine habitat with greater spatial extent than Coralligenous and Cystoseira spp. All of the systems reported are regressing, and the habitat that shows particularly high percentage of loss is Cystoseira spp.

Along the north-south Adriatic gradient, coralligenous formations thin out to the Gargano promontory. Past the Gulf of Manfredonia, where a few sparse patches are present, the coralligenous species extends almost uninterruptedly to the coast of Lecce, for about 180 km. The coralligenous habitat of the southern Adriatic has a bathymetric range between 10 and 140 m. This habitat shows a non-continuous distribution: while at shallow depths it is rather scattered, toward the seabed it forms extensive platforms of secondary biogenic substrate, with extremely variable and complex three-dimensional conformation, reaching a height between 1 and 2.5 m on the lower surface. Rather interesting are the coralligenous formations along the coast of Polignano a Mare (BA) and those south of Otranto (LE), where there is a complex system of submerged and semi-submerged sea caves alternating with vertical walls that are particularly rich.

The maximum depth of the lower Adriatic is 1,233 m in the so-called 'Bari Canyon.' This depression has rather asymmetrical contours with the eastern escarpment being steeper. The western area shows substantial differences in its northern and southern portions. The former, where the Gulf of Manfredonia is located, has a wide continental shelf (distance between the coastline and the 200 m depth line equal to 45 nautical miles) and is a shallow escarpment. The latter, on the other hand, has close depth islets, such that the 200 m is reached about 8 miles out from Capo d' Otranto. The presence and distribution of marine flora and fauna, as well as the main ecological characteristics of the basin, are related to environmental and morphological differences. Demersal species are present on both the western and eastern sides of the basin with a distribution of 97% and 3%, respectively. As for trawl fishing, European hake (*Merluccius merluccius*) accounts for 20%, while the species of Norway lobster (*N. norvegicus*), deep-water rose shrimp (*P. longirostris*), red mullet (*M. barbatus*), Jack mackerel (*Trachurus spp*.), and octopus (*Eledone spp.*) contribute 5-10% each to the landed catch (Ungaro et al. 2002). Recent exploration of the deep sea in the EBSA between the southern Adriatic and Ionian Seas has led to the discovery of important white coral beds, one between Italy and Albania (Bari Canyon), and one south of Capo Santa Maria di Leuca. The deep marine environment includes ecosystems that are unique in terms of biodiversity and community organization. White coral habitats, also known as cold-water corals or deep corals, significantly contribute to the biodiversity and heterogeneity of the deep sea environment, playing an important functional role. Indeed, corals, growing slowly over millennia, have built complex three-dimensional structures that provide shelter and ecological niches for numerous species. Numerous studies report greater species' richness and higher abundances in coral areas than in surrounding areas. The coral species that most frequently contribute to the formation of such habitats in the Mediterranean are the colonial *Scleractinia Madrepora oculata*, *Lophelia pertusa*, and the black coral *Leiopathes glaberrima*. Visual, aerial and satellite censuses have, in addition, revealed the sedentary presence and/or within fixed migratory routes of protected marine avifauna, elasmobranchs, turtles and marine mammals. Species, such as the common dolphin (*Delphinus delphis*), striped dolphin (*Stenella coeruleoalba*), common minke whale (*Balaenoptera physalus*), sperm whale (*Physeter macrocephalus*), Risso's dolphin (*Grampus griseus*), Cuvier's zyphi whale (*Ziphius cavirostris*) and long-finned pilot whale (*Globicephala melas*), are very frequent. In addition, the area is characterized by the presence of the species *Pinna nobilis*, *Lithophaga lithophaga, Centrostephanus longispinus, Corallium rubrum, Scyllarides latus* referred to in the Habitats Directive 92/43/EEC.

Pinna nobilis is an endemic clam species found mainly in coastal areas, between 0.5 and 60 m in depth, mainly on soft sediments colonized by seagrass beds, but also on bare sand, mud, maërl, pebbly seabeds or among boulders. They generally have an irregular distribution, with depth appearing to be one of the most significant factors in explaining population density distribution. *Pinna nobilis* is the largest bivalve in the Mediterranean Sea; the shell can exceed 1 m in length. It is a long-lived species, supposedly living up to a maximum age of 20 years, with one of the fastest shell growth rates (up to 1 mm d-1) recorded for bivalves. It is listed in Annex IV of the Habitats Directive (92/43/EEC) as an "Animal and Plant Species of Community Interest in Need of Strict Protection" and therefore its harvest is prohibited except for scientific purposes.

Despite the presence of protection measures mainly aimed at stopping any voluntary harvesting and other pressures of anthropogenic origin, even the Adriatic populations are now in serious danger of extinction due to the Mediterranean-scale epidemic that, since 2018, causes many deaths due to the parasitic protozoan *Haplosporidium pinnae* that, where present, has exterminated about 95% of the pre-existing populations, thus increasing their risk of extinction. The Site of Community Interest IT9110036 located in the area of Torre Mileto, included between the municipal territories of San Nicandro Garganico and Cagnano Varano, was established for protecting the *Sabellaria spinulosa* bioconstruction, which due to its extension and complexity can be assimilated to a "reef," marine habitat code 1170, present in Annex I of Directive 92/43/EEC.

The Special Area of Protection (ZPS) "Scoglio dell'Eremita" ITA9120012 is a seabird nesting area. Although the presence in the Apulian seas of formations referable to habitat 1110 "Sandbanks which are slightly covered by sea water all the time" has been reported (e.g., the association with *Cymodocea nodosa* on well-graded fine sands or the maërl facies), it is still necessary to complete the overall knowledge of this habitat, in order to respond comprehensively to the remarks made by the European Commission.

The ZTB "Off the coast of Puglia" has a restocking function for numerous fish species of commercial interest. Fishing pressure with trawl nets is high and many fish species are concentrated in those few areas where the presence of obstacles on the bottom makes trawl fishing difficult. Puglia’s ZTB has been located in an area where trawling is restricted by high obstacle-hooking risks and a ban on trawling, allowing fishing with selective fixed gear. It also allows to maintain a refuge area for the growth of juvenile forms. Regarding professional fishing, the use of gillnets and longlines is allowed from January 1 to June 30. As regards sport fishing, fishing with a maximum of 5 hooks per fisherman is allowed. Trawl fishing is prohibited.

SUB-AREA A/5 - priority environmental SETTING**: “Torre del Cerrano” MPA**

The Marine Protected Area 'Torre del Cerrano' has two distinct and closely related environmental types: the typical Adriatic sandy seabed, which characterizes the largest portion of the area, and some parts of bottom reefs, determined by both the semi-submerged boulders of the ancient port of Atri and the submerged structures of the provincial Marine Protection Oasis, as well as some outcrops of conglomeratic geological formations. The area is home to a good number of marine animal species, both pelagic and benthic, and a small but large contingent of plant species, as well as specimens of a small and rare Adriatic Gastropod, such as *Trivia adriatica*, and the impressive bioconstructions of *Sabellaria halcocki*. In the underwater environment of the protected area it is easy to come across a variety of fish species, including conger eels, sea bass, sole and bream, which live in contact with the sandy seabed characterized by extensive and important shoals of the Venus clam (*Chamelea gallina*).

For a more detailed description of the SCI and MPAs, please refer to VincA (Annex IX of the ER).

SUB-AREA A/6 - priority environmental SETTINGS**: “Marine Nature Reserve “Tremiti Islands” ZPS/ZTB/SCI (IT9110011) “Tremiti Area” - “Torre Guaceto” MPA**

The Tremiti Islands are home to the only breeding populations of the Scopoli’s shearwater (*Calonectris diomedea*) and Yelkouan shearwater (*Puffinus yelkouan*) in the Adriatic Sea. In 2020, the SPA areas were expanded to protect the foraging areas of these bird species and of the Audouin’s gull (*Larus audouinii*). The presence of black coral and *Pinna nobilis* is reported. The area sees the presence of the marine protected area of the Tremiti Islands, and the "Tremiti Area" ZTB. In the "Tremiti Area" ZTB, professional fishing and trawling with flying nets is allowed in the period between November 1 and March 31 (M.D. 2009); the use of gillnets, longlines, surrounding nets and traps is allowed. Sport fishing is allowed with a maximum of 5 hooks per fisherman. The ‘Torre Guaceto’ Marine Protected Area (MPA) extends for about 2,200 ha up to the 50 m bathymetric line, covering an 8 km stretch of coastline, including the area between Punta Penna Grossa and the Apani rocks, and is characterized by the presence of rocky and sandy seabeds, Posidonia beds and areas of coralligenous formations. The MPA partly overlaps SCI “Torre Guaceto e Macchia S. Giovanni” IT9140005 as well as the “Torre Guaceto” ZPS IT9140008.

For a more detailed description of the SCI and MPAs, please refer to VincA (Annex IX of the ER).

4.2.3.2 Qualitative descriptors: Non-indigenous species (D2)

Descriptor 2 "Non-indigenous species" envisages for the achievement of Good Environmental Status (GES) that "Non-indigenous species introduced by human activities be at levels that do not adversely alter the ecosystem". The criteria are the following:

- **D2C1 – Primary:** dealing with "the number of non-indigenous species which are newly introduced via human activity into the wild, per assessment period (6 years), measured from the reference year as reported for the initial assessment under Article 8(1) of Directive 2008/56/EC, is minimised and where possible reduced to zero."
- **D2C2 – Secondary:** dealing with the "abundance and spatial distribution of established non-indigenous species, particularly of invasive species, contributing significantly to adverse effects on particular species groups or broad habitat types".
- **D2C3 – Secondary:** dealing with the *"*proportion of the species group or spatial extent of the broad habitat type which is adversely altered due to non-indigenous species, particularly invasive non-indigenous species*"*.

Member states establish through regional or subregional cooperation the threshold value for negative alteration of species groups and broad habitat types due to non-indigenous species, and for the number of new introductions of non-indigenous species. "Non Indigenous Species" (NIS) refers to species from a known geographic range that are accidentally or voluntarily introduced into an environment outside their natural range. The IUCN (International Union for Conservation of Nature) defines them as species that "*become established in natural or semi-natural ecosystems or habitats, are an agent of change, and threaten native biological diversity*". If conditions are favorable to them, these species can compete with native (or autochthonous) taxa, becoming dangerously invasive to the point of becoming a threat to biodiversity (Invasive Alien Species - IAS). There are approximately 12,000 exotic species in Europe, approximately 10-15% of which are considered invasive. These species are addressed by Regulation (EU) No. 1143/2014 to protect biodiversity and ecosystem services, and to minimize or mitigate the impact these species might have on human health or on the economy. To date, three lists of exotic plant and animal species of national importance have been published in the Official Journal of the European Union, which together constitute a list of 66 species. In 2018, the Legislative Decree entered into force, establishing rules to prevent, minimize, and mitigate the adverse effects on biodiversity caused by the introduction and spread, whether deliberate or accidental, of invasive alien species within the European Union, as well as to minimize and mitigate the impact these species may have on human health or on the economy.

In the Mediterranean Sea, one of the main causes of biodiversity loss is "Invasive Exotic Species." The environmental assessment at the end of the first cycle of Marine Strategy activities takes into account data collected during monitoring conducted under Article 11 of Directive 2008/56/EC.

Unlike the initial assessment in 2012, which was mainly based on data from scientific literature and expert opinion, in the 2018 reporting the assessment for Descriptor 2 is based on the monitoring conducted by ARPAs for the three maritime areas: Adriatic, Ionian, and Tyrrhenian.

For the purpose of the environmental assessment, data on alien, cryptogenic and doubtful species reported in ARPA sampling - Module 3 referring to the Adriatic marine area are shown (Table 4.3).

ARPA	MOD3 SAMPLING AREAS	MOD3 SAMPLING STATIONS	NUMBER OF SAMPLINGS		
			F	M	B
PUGLIA	PORT OF BRINDISI	2 STATIONS IN PORT	15	15	3
MARCHE	PORT OF ANCONA	PORT, INTERNAL AREA	14	14	3
		PORT, EXTERNAL AREA	15	16	3

EMILIA ROMAGNA	PORT OF RAVENNA	CORSINI PORT, INTERNAL AREA OF BREAKWATER	15	15	3
		MARINA DI RAVENNA, EXTERNAL AREA OF BREAKWATER, SOUTH	15	15	1
VENETO	PORT OF VENICE	2 STATIONS IN PORT, BOTH SHIP DWELL AREAS	14	14	3
FRIULI VENEZIA GIULIA	PORT OF TRIESTE	PORT OF TRIESTE, SACCHETTA BASIN	14	14	3
		PORT OF TRIESTE, SETTIMO BERTH	14	14	3

Table 4.3 Sampling areas and stations relating to the monitoring project MODULE 3 - ARPA 2015-2017. The number of samplings is expressed as days of sampling per parameter per station; F = Phytoplankton; M = Mesozooplankton; B = Benthos. Adriatic marine area. Source ISPRA 2018

A range of frequency of occurrence is given for each species, and an indication of whether it was present/absent in the maritime area before 2012. It should be noted that only newly introduced alien species are considered for the evaluation of Criterion D2C1, and all cryptogenic and uncertain species are excluded. Overall, 24 species are found to be newly introduced after 2012 in at least one of the three maritime areas limited to the sampling areas (Fig. 4.12).

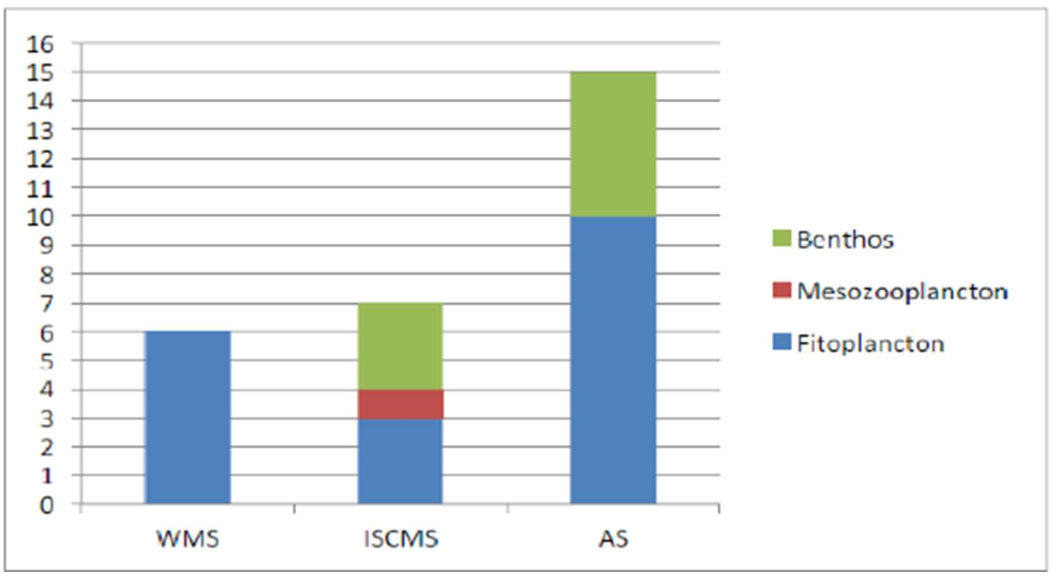


Fig. 4.12 Number of alien species reported in at least one of the subregions of the Italian seas after 2012. AS: Adriatic Sea subregion; ISCMS: Ionian and Central Mediterranean Sea subregion; WMS: Western Mediterranean Sea subregion. (Source: ISPRA 2018)

Monitoring was mainly conducted in areas at higher risk of human-mediated introduction of NIS such as port areas and to a lesser extent aquaculture facilities and monitored phytoplankton, mesozooplankton, and benthos (Table 4.3 and Fig. 4.14).

In parallel with the monitoring activities, the list of NIS present in the Italian seas in 2012 compiled by Italy for the initial assessment was updated following comparison with that produced by the Joint Research Centre (JRC) based on data from the literature. The JRC requested the collaboration of ISPRA to update the NIS list referring to Italian seas. Based on the initial 2012 assessment, a total of 197 NIS belonging to a number of taxonomic groups considered as priority were reported in the Italian seas, of which 117 occur in the Western Mediterranean, 96 in the Central Mediterranean and Ionian Seas, and 94 in the Adriatic Sea. Of these species, about 50 percent are considered IAS. Following the comparison with the JRC, the number of species included in the list of NIS present in the Italian seas as of 2012 rises to 244 alien species, 16 cryptogenic species, 15 uncertain species, as well as 58 species for which further literature verification is needed. For the purposes of 2018 reporting, both the adoption of the old decision and the new decision would not allow for a proper assessment of GHG based on monitoring data alone.

These data, obtained for the first time in areas with the highest risk of introduction (mainly port areas), cannot be compared with 2012 data, so a trend cannot be established.

Fig. 4.13 Module 3 monitoring sampling stations – ARPA (Source: Ispra 2018)

It is of paramount importance to ensure that literature data are updated as they constitute an important body of information that cannot be overlooked, and which is expected of us by Europe with a view to coordinating member countries to update the European Alien Species Information Network (EASIN) catalog.

This activity requires the updating of data regarding the presence and geographic location of NIS, revision of nomenclature, and expert updates on the status - cryptogenic/uncertain/native/alien - status of each species. The current changes to the Mediterranean non-indigenous marine species (NIS) inventory for 2017-2019 are the result of an ongoing literature search and updating of the Hellenic Centre for Marine Research (HCMR) offline database. They take into account recent discoveries, previously missing records, backdated records based on the review of existing material or phylogenetic studies and changes in nomenclature (A. Zenetos and M. Galanidae - 2020). The current update adds 70 species to the established inventory of Mediterranean alien species. In addition to the 25 species that escaped attention in the past, there are 23 new species introduced between 2017- 2019 that have established self-sustaining populations.

In the same period, 22 species that were previously considered random are now well established, (Zenetos et al. (2017), some of them with impressive spatial distribution such as *Oithona davisae*, *Isognomon legumen, Pomacanthus imperator* and *Watersipora arcuata*.

Likewise, a considerable number of species have expanded their distribution into new MSFD areas with the central Mediterranean and the Adriatic being the main venues of this expansion.

A total of 36 species have expanded their distribution into new MSFD regions, 21 of which are already established in the new localities. In particular, 10 species have extended their Mediterranean distribution into the Adriatic Sea, most of which were already widespread in two or three MSFD areas of the basin.

Of these, *Sepiotheuthis lessoniana* and *Biuve fluvipunctata* appear to spread unaided from the nearby Ionian Sea (Stern et al. 2019; Kousteni et al. 2019, respectively), while for the other species, transport vectors are the cause of their expansion. The eastern Mediterranean, which is usually the starting point for the spread of naturally dispersing *Lessepsian* migrants, received 5 species, all most likely associated with pathways. The Indo-Pacific flatworm *Maritigrella fuscopunctata*, which was first observed in Malta (Crocetta et al. 2015) may be an exception, as its presence was already suspected along the Levantine coast and was later confirmed in Israel (Velasquez et al. 2018), such that entry through the Suez Canal cannot be ruled out.

However, the expansion of tropical and sub-tropical species into the cooler waters of the Aegean, Adriatic and Western Mediterranean indicates that the warming of the Mediterranean due to climate change is also facilitating the geographic expansion of NIS species in the region. The warming of Mediterranean waters between 1985-2006 has been estimated at 0.04°C/year, leading to an overall sea surface temperature increase of about 1°C for the eastern basin, with the Aegean and Adriatic Seas among the warmest points in this warming trend (Nykjaer 2009). Most likely, a number of Indo-Pacific species have been favored by the rising temperatures, expressing their expansion records in the northern Mediterranean (e.g. *Sepioteuthis lessoniana Férussac* (in Lesson, 1831), *Biuve fulvipunctata* (Baba, 1938), *Haminoea cyanomarginata* (Heller & Thompson, 1983) and to the cooler waters of the Western Mediterranean (e.g. *Etrumeus golanii*).

The rate of new introductions during 2017-2019 is 8 species per year for the entire Mediterranean, without taking into account random records or species with reporting delays. Only 4 species per year enter through the Suez Canal, while a considerable number of species are introduced through maritime carriers and the aquarium trade. Keeping in mind that invasions are dynamic in nature, the above lists should be considered as an accurate and up-to-date list to inform and assist institutions and policy in decision-making and management.

Although environmental problems caused by IAS are recognized worldwide, knowledge of their current and future impacts on native biodiversity is still largely unknown (Downey and Richardson 2016; Essl et al. 2020). Numerous IAS may colonize, with varying strengths, ecosystems in different bioregions of the world. On the other hand, biological invasions are an ongoing phenomenon and so far have been observed only for too short a period, i.e., mainly in the last century. This means it is difficult to truly understand the response of native species' assemblages and ecosystems. Currently, alien species establishment, habitat loss and degradation, followed by impacts on fisheries, pollution, climate change, and eutrophication, are the most important threats affecting the number of taxonomic assemblages. With a view to actions aimed at curbing "*the introduction or spread of non-native species*," marine transport (ballast water and fouling) and aquaculture (voluntary introductions of reared species and involuntary introductions of associated species) have been identified as the main vectors to be addressed. In the case of aquaculture, it should be noted that introductions of reared species are already regulated by Reg. 708/2007, as amended, while involuntary introductions of associated species, referring mainly to the frequent handling of bivalve molluscs, are not currently limited by any measures. Regarding maritime transport, Italy's ratification of the IMO Convention, which came into force in 2017, could limit the pressure of NIS transported via ballast water. In the absence of regulations, some non-mandatory measures such as guidelines should be defined.

4.2.3.3 Qualitative descriptors: Commercial fish and shellfish (D3)

In the Marine Strategy Framework Directive (EC/2008/56 - Cycle II 2018-2024), species exploited by commercial fisheries are considered within the Qualitative Descriptor for Determining Good Environmental Status No. 3, which states "*populations of all commercially exploited fish and shellfish/crustaceans are within biologically safe limits, exhibiting a population age and size distribution indicative of good stock health*."

In accordance with the MSFD, the new Common Fisheries Policy - CFP (Regulation (EU) No. 1380/2013) has maximum sustainable yield (MSY) among its objectives for all fisheries. For Descriptor 3, in application of the Marine Strategy Directive (2018-2024), transposed by Leg. Decree 190/2010, Italy has determined the Good Environmental Status (GES) requirements (Ann. 1 of M.D. of February 15, 2019, No. 36) with the following definitions:

- G 3.1 All target species exploited by commercial fisheries subject to national and international management plans, together with the main small pelagic species (anchovies and sardines), are subject to sustainable fishing pressure and spawning stock biomass is maintained within precautionary limits. Specifically: (a) for all target species subject to regular analytical stock assessments, indicator levels for fishing mortality and spawning stock biomass should be contained within biologically safe limits defined through "reference points" that are most appropriate depending on the data available and the species, taking into account a "precautionary margin" that considers levels of uncertainty, measured statistically or empirically; (b) for other target species, population indicator values derived from scientific campaigns associated with D3C1, D3C2, D3C3 criteria are above a minimum precautionary margin of the time series in percentiles.

Annex 2 of the above mentioned Ministerial Decree (36/2019) defines the following environmental targets:

- T 3.1 For all target species exploited by commercial fisheries subject to national and international management plans that are subject to analytical assessments, together with the main small pelagic species (anchovy and sardines), that currently have fishing mortality above their sustainable reference limit, estimated taking into account a "precautionary margin" based on levels of uncertainty, measured statistically or empirically (e. g. percentiles approach), the current fishing mortality rate (Fcurr) or "exploitation rate" (E) is reduced in accordance with what is defined by the CFP's Multi-Year Management Plans, whose objectives are to bring stocks back into sustainable conditions.
- T 3.2 Impact is reduced and knowledge of the effects on fish resources and biodiversity of illegal, unreported and unregulated fishing ("IUU fishing") is increased, including through national implementation of Reg. 1005/2008 to fight IUUF.
- T 3.3 A regulation regarding recreational fishing in Italian marine waters is prepared and an initial assessment of its impact is made.
- T 3.4 The Minimum Landing Size ("Minimum Landing Size") of commercial elasmobranchs is regulated.

The "Adriatic" marine area includes the Geographical Sub Areas (GSA) 17 and 18 (FAO-GFCM) and has been divided into 9 sub-areas (MSP) of which 6 are within territorial waters. In line with the total number of fishing units in GSA 17, this area has a percentage incidence of 24.5 percent of all fisheries in Italy.

The distribution of fishing effort is higher in the northern portion of the basin and all the way to the Gargano coast of Puglia. There are 7 Biological Protection Zones in the area distributed from north to south of the basin, in addition to Fisheries Restricted Areas (FRAs), present in national and international waters.

Criteria and methodological standards related to good environmental status of marine waters as well as specifications and standardized monitoring and assessment methods have been updated and defined by the new Commission Decision (EU) 2017/848 of May 17, 2017. The three primary criteria of the Decision (EU) for assessing individual stocks include fishing mortality rate (D3C1), spawning stock biomass (DC3C2), and age and size distribution (D3C3). The new Decision indicates that it is necessary to report the extent to which good environmental status is achieved by considering, for the assessed stocks: the level observed for each criterion, for the set of criteria, and then, at the overall level, the assessed stock pool according to integration methods to be defined at EU level.

- Criterion D3C1 indicates the fishing mortality rate of populations of commercially-exploited species is at or below levels which can produce the maximum sustainable yield (MSY).
- Criterion D3C2 indicates the Spawning Stock Biomass of populations of commercially-exploited species are above biomass levels capable of producing maximum sustainable yield.
- Criterion D3C3 indicates the age and size distribution of individuals in the populations of commercially-exploited species is indicative of a healthy population. This shall include a high proportion of old/large individuals and limited adverse effects of exploitation on genetic diversity.

Regarding the use of the criteria, the Decision (EU) indicates that the extent to which good environmental status has been achieved will be expressed for each of the areas assessed as follows:

a) the populations assessed, the values achieved for each criterion and whether the levels for D3C1 and D3C2 and the threshold values for D3C3 have been achieved, and the overall status of the population on the basis of criteria integration rules agreed at Union level;

b) the populations of commercially-exploited species in the assessment area which were not assessed.

The results of these population assessments will also contribute to those included in descriptors 1 and 6, if the species are relevant to assessments of particular groups of species and benthic habitat types.

The latest assessment of the GES under Art. 8 of the MSFD was carried out by ISPRA in the 2018 MSFD Report and is based on the use of public sources of data such as the results of stock assessments, and related elaborations from the most recent assessments conducted under GFCM and STECF because only part of the monitoring subprograms conducted under MSFD related to Descriptor 3 have been implemented, especially the part not directly functional for status assessment. For the purpose of the GES assessment, the main and accessory stocks defined at the GSA level within the National Management Plans for demersal fisheries (MIPAAFT, 2018), together with sardines and anchovies, as per the updated definition of GES, were considered towards the definition of stocks to be considered. Therefore, the most recent validated assessments available for these stocks were collected from GFCM and STECF reports in relation to parameters such as fishing mortality (generally as Fcurr and F0.1) and spawning stock biomass, estimated as the current value compared to the limits defined by the 33rd percentile according to the methodology already adopted by GFCM for stock assessments and also within the context of ECAP (UNEP-MAP, 2018).

In the absence of established data and methodologies for criterion D3C3 and secondary indicators for criteria D3C1 and D3C2, stock assessment outcomes reported for 2016 and 2015 were considered in 3 categories:

1) Stocks for which fishing mortality and spawning stock biomass parameters are within biologically safe limits (relative to MSY);
2) Stocks for which one or none of the fishing mortality and/or spawning stock biomass parameters falls within biologically safe limits (relative to MSY);
3) Non-assessed stocks: stocks for which the assessment of only one criterion (D3C1 or D3C2, with positive outcome) is available or for which no assessment is available.

Specie (nome comune)	Mare Adriatico	
	GSA 17	GSA 18
Specie demersali		
Lophius budegassa (rana pescatrice)		x
Merluccius merluccius (nasello)	X	
Mullus barbatus (triglia di fango)	x	X
Mullus surmuletus (triglia di scoglio)		
Pagellus erythrinus (pagello fragolino)		
Solea vulgaris (sogliola)	X	
Eledone cirrhosa (moscardino bianco)	x	x
Eledone moschata (moscardino)		x
Ilex condeiti		
Loligo vulgaris		
Octopus vulgaris (polpo)		
Sepia officinalis (seppia)	x	
Aristaeomorpha foliacea (gambero rosso)		
Aristeus antennatus (gambero viola)		
Melicertus kerathurus		
Nephrops norvegicus (scampo)	x	
Parapenaeus longirostris (gambero bianco)	X	
Squilla mantis (canocchia, pannocchia)	x	x
Piccoli pelagici		
Engraulis encrasicolus (acciuga)	P	
Sardina pilchardus (sardina)	P	
Numero di stock complessivi	14	

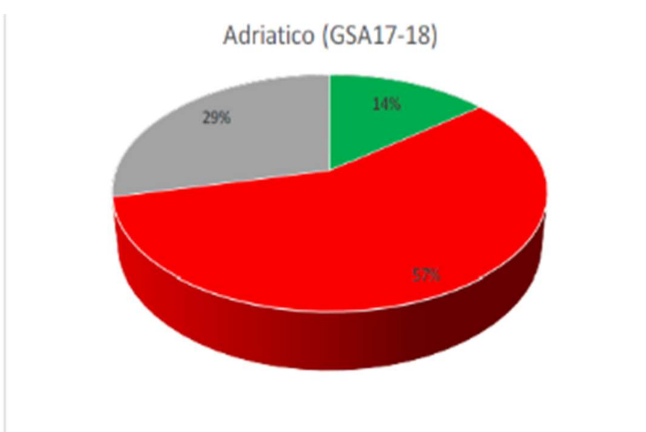
Table 4.4 Stocks of commercial interest considered in the Initial Assessment. For demersal species, priority (yellow; X) and ancillary (orange; x) stocks were highlighted as defined in the Demersal Fishery Management Plans, along with small pelagics (light blue; P). Multiple cells (including multiple GSAs for the same stock) represent stocks for which the assessment is done jointly among multiple GSAs. In the case of Mullus barbatus, the assessment between GSA17 and 18 is unique although only in GSA 17 is the stock considered a target and in GSA18 is instead associated

Source: ISPRA, Summary report MSFD 2018 – D3

The results obtained for the Adriatic Sea region are shown in the following graphs.

Fig. 4.14 Percentage of stocks in the "Adriatic" subregion within biologically safe limits (green), outside biologically safe limits (red) or not assessed (grey)

Source: ISPRA, Summary report MSFD 2018 – D3



As is already known for the Mediterranean context, it is noteworthy that a large proportion of the stocks assessed in the subregions exhibit unsustainable exploitation status. In general, this condition is related to excessive fishing pressure and, only sometimes, to inadequate biomass. In addition, an important percentage of stocks (particularly in the Western Mediterranean and Central Mediterranean-Ionian Sea subregions) have not been submitted to formal analytical assessment conducted via stock assessment.

The Adriatic is the subregion with the highest percentage of stocks within biologically safe limits (14 percent), but at the same time the one with the highest prevalence of stocks in inadequate condition (over 50 percent). A comparison between the latest assessment and the previous one shows a slight improvement in the state of fish stocks, with a trend for some stocks towards reduced fishing mortality but still in most cases unsustainable (ISPRA, 2018). It is noted that, in order to synthesize information from the GSA level to the subregion level, at the initial assessment in 2012 the "one out all out" principle had been applied at indicator level, an approach that has in fact been superseded by the new Decision. In practice, with the application of the new Decision it is possible to show the total number of stocks under sustainable exploitation, those under unsustainable exploitation (status and/or pressure), and those for which quantitative information is lacking.

In ISPRA's Environmental Data Yearbook 2021, the national trend of stocks in an overexploited state from 2007 to 2019 is described. Based on the reported historical series, the percentage of overfished fish stocks is not decreasing over time. Most of the stocks considered show an overfished status that has increased from 77.8 percent in 2007 to 93.6 percent in 2013, indicating a state of non-sustainable fishing for the vast majority of stocks assessed. Thereafter, the percentage of overfished stocks declined, reaching 83.7 percent in 2015, to increase again to 91.4 percent in 2019.

The historical series also shows a gradual growth from 2007 to 2013 in the number of stocks assessed by stock assessment, from 9 to 47 stocks. From 2014 to 2019, the number of stocks assessed is between 35 and 43, a number that also reflects the introduced methodological approach of integrating the information of stocks assessed in the reference year and the two previous years. In general, over the period under consideration (2007-2019) it is observed that the vast majority of the stocks considered are assessed as "in a state of overfishing" by fisheries regardless of the approach used (Figure 4.15, Table 4.5).

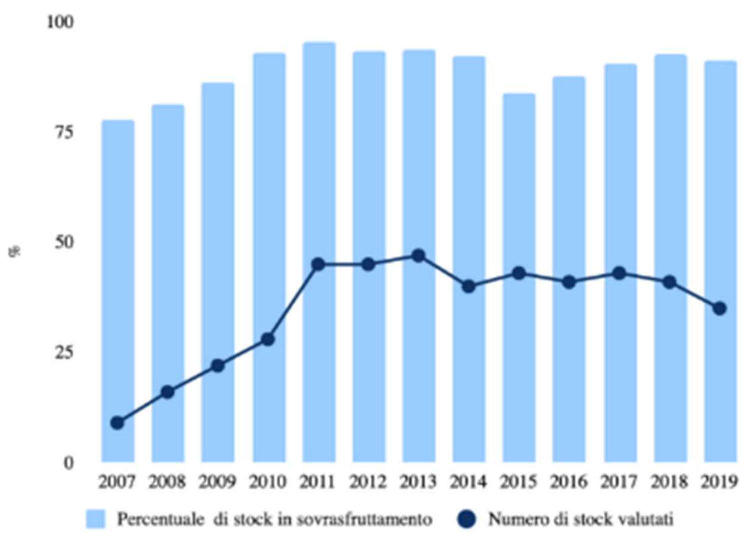


Fig. 4.15 Number of stocks assessed and percentage of stocks in overfished state.

Source: ISPRA processing of internationally validated stock assessment data from STECF and GFCM (Ispra Environmental Data Yearbook 2021)

Considering the percentage of landings corresponding to the assessed fish stocks, it is observed that this percentage averages about 37.5 percent with fluctuations occurring from year to year depending on the stocks considered (Figure 2, Table 1). For 2019, with not a very large number of stocks considered, but given the use in the discussion of the moving average for representing values by years (average of the year in question and two previous years), a coverage of landings of 42.4 percent was achieved, a slight decrease from the previous year when the highest percentage (48.6 percent in 2018) had been recorded.

The performance of the indicator (in absolute value and percentage) is influenced by the number and type of stocks considered in different years (Figures 4.16 and 4.17). Nevertheless, the percentages of overfished stocks show a widespread state of overfishing, an assessment whose magnitude has nevertheless increased over time compared to the first years of the time series considered, thanks to the increased analytical efforts conducted to obtain assessments via stock assessments.

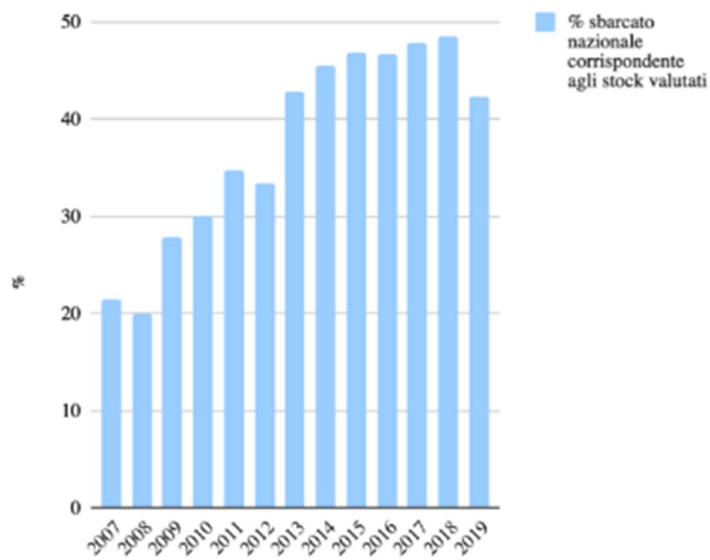


Fig. 4.16 Percentage of national landings corresponding to the stocks assessed. Source: processing of internationally validated stock assessment data from STECF and GFCM (Ispra Environmental Data Yearbook 2021)

Tab. 4.5 National trend in overfished state stock

Source: processing of internationally validated stock assessment data from STECF and GFCM (Ispra Environmental Data Yearbook 2021)

Year	Stocks assessed*	National landings corresponding to the stocks assessed	Number of overfished stocks	Percentage of overfished stock
	n.	%	n.	%
2007	9	21.4	7	77.8
2008	16	19.9	13	81
2009	22	27.8	19	86
2010	28	30	26	93
2011	45	34.8	43	95.6
2012	45	33.4	42	93.3
2013	47	42.8	44	93.6
2014	40	45.5	37	93
2015**	43	46.8	36	83.7
2016**	41	46.8	36	87.8
2017**	43	47.9	39	90.7

2018**	41	48.6	38	92.7
2019**	35	42.4	32	91.4

Table 4.6 also shows a geographic imbalance in the number of fish stocks assessed over the period considered, both by examining Marine Strategy Framework Directive (MSFD) and Italian Geographic Sub-Areas. In 2019, the largest number of stocks assessed (16) was in the Adriatic sub-region, followed by the Western Mediterranean sub-region (12) and the Ionian Sea and Central Mediterranean sub-region (7).

Table 4.6 Trend in overfished stocks divided by MSFD subregions
Source: processing of internationally validated stock assessment data from STECF and GFCM (Ispra Environmental Data Yearbook 2021)

MSFD sub-region	Year	Stocks assessed	Overfished stocks	Overfished stocks
		n.	n.	%
Western Mediterranean	2007	4	3	75.0
Western Mediterranean	2008	7	6	85.7
Western Mediterranean	2009	11	10	90.9
Western Mediterranean	2010	16	15	93.8
Western Mediterranean	2011	23	22	95.7
Western Mediterranean	2012	22	21	95.5
Western Mediterranean	2013	19	18	94.7
Western Mediterranean	2014	14	12	85.7
Western Mediterranean	2015	19	13	68.4
Western Mediterranean	2016	18	14	77.8
Western Mediterranean	2017	20	18	90.0
Western Mediterranean	2018	18	17	94.4
Western Mediterranean	2019	12	11	91.7
Ionian Sea and Central Mediterranean	2007	2	2	100.0
Ionian Sea and Central Mediterranean	2008	5	4	80.0
Ionian Sea and Central Mediterranean	2009	6	5	83.3
Ionian Sea and Central Mediterranean	2010	7	6	85.7
Ionian Sea and Central Mediterranean	2011	10	9	90.0
Ionian Sea and Central Mediterranean	2012	11	9	81.8
Ionian Sea and Central Mediterranean	2013	14	12	85.7
Ionian Sea and Central Mediterranean	2014	11	10	90.9
Ionian Sea and Central Mediterranean	2015	9	9	100.0
Ionian Sea and Central Mediterranean	2016	5	5	100.0
Ionian Sea and Central Mediterranean	2017	6	6	100.0
Ionian Sea and Central Mediterranean	2018	7	7	100.0
Ionian Sea and Central Mediterranean	2019	7	7	100.0
Adriatic	2007	3	2	66.7
Adriatic	2008	4	3	75.0
Adriatic	2009	5	4	80.0
Adriatic	2010	5	5	100.0
Adriatic	2011	12	12	100.0
Adriatic	2012	12	12	100.0

Adriatic	2013	14	14	100.0
Adriatic	2014	15	15	100.0
Adriatic	2015	15	14	93.3
Adriatic	2016	18	17	94.4
Adriatic	2017	17	15	88.2
Adriatic	2018	16	14	87.5
Adriatic	2019	16	14	87.5

The results of scientific assessments of the main commercial stocks continue to describe a situation of overexploitation of fish resources albeit with some signs of improvement and differentiated in different sub-geographical areas (GSAs) (MIPAAF, 2021; PNRDA, 2019).

In particular, for European hake (*Merluccius merluccius*) a generalized state of overexploitation is observed in all Italian GSAs, with fishing mortality much higher than that required to achieve maximum sustainable catch (MSY). Other demersal species such as curled octopus (*Eledone cirrhosa*) and common sole (*Solea solea*) present a less severe and highly diversified situation in the different GSAs, while for the red mullet (*Mullus barbatus*) signs of clear recovery of the stock have been recorded albeit still with thresholds of overexploitation in the Ionian Sea and Sicilian Channel (GSAs 16 and 19). Equally positive situation that of the rose shrimp (*P. longirostris*) undergoing an increase in several GSAs, with signs of overfishing only in GSA 10 and 16, while the giant red shrimp (*A. foliacea*) shows a sustainable level of exploitation in GSA 9 alone and signs of recovery in GSAs 18 (Adriatic) and 19 but worrisome situations in GSAs 10 and 11. More negative among crustaceans are the data on blue and red shrimp (*A. antennatus*) and Norway lobster (*N. norvegicus*), which are everywhere in a critical situation. With regard to European anchovies (*E. encrasicolus*) and European pilchard (*S. pilchardus*) an overfishing situation persists especially in the Adriatic GSAs (less severe that of 18) albeit with interannual fluctuations also related to environmental factors. Among the cephalopods positive data for shortfin squid (*I. coindetii*) in GSAs 17 and 18 (Adriatic), where cuttlefish (*S. officinalis*), on the contrary, shows worrying signs. Other species, such as horse Jack mackerel (*T. trachurus*) or mantis shrimp (*S. mantis*), assessed in only a few GSAs, all showed overfishing-related mortality. As for large pelagics, subject to delegated and controlled management via ICCAT, the clear recovery of the bluefin tuna (*T. thynnus*) stock is now evident, while the situation of swordfish (*X. gladius*) remains negative (MIPAAF, 2021).

In the light of this situation, which does not show appreciable and sufficient signs of recovery in response to the policies implemented in the last 2 decades for the containment and rationalization of the fishing effort (permanent withdrawals from the fleet, technical and management measures), there is a clear need to strengthen measures aimed at achieving MSY for all stocks by 2025, having now missed the 2020 target, by means of stock recovery plans, of both European and national multi-year plans for further adjustment of the fishing effort, without neglecting, where scientific research finds the need, an increase in space-time closures and innovations in technical measures and management models (MIPAAF, 2021).

4.2.3.4 Qualitative descriptors: Food webs (D4)

The Marine Strategy Framework Directive (MSFD) requires for Descriptor 4 that "all elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity." Descriptor 4 has undergone a major revision as part of the recent MSFD updates and in particular the methodological documentation. The methodological criteria have been changed and simplified. Indicators associated with the trophic network are now used as Surveillance Indicators. Italy has therefore revised its approach to D4, selecting the use of the following primary criteria:

1. D4C1: diversity within the Trophic Guild (any group of species belonging to the same trophic level that approximately use the same environmental resources)
2. D4C2: distribution of abundance/biomass of each Trophic Guild.

As stated in the Summary report MSFD 2018 of Ispra, to date, a comparison between the initial assessment conducted in Cycle I in 2012 and the assessment conducted in Cycle II in 2018 is not possible because adequate information and data on the relative environmental status is not available for a number of trophic components. Marine ecosystems around the world are under increasing pressure from a variety of anthropogenic stressors, which include intensive fishing and aquaculture, pollution, habitat loss and degradation, and species invasions. The priority of many national and international regulations/initiatives (e.g.: the European Marine Strategy Framework Directive (MSFD; 2008/56/EC), the Convention on Biological Diversity (CBD), and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)), which promote the conservation of natural ecosystems and sustainable use of biodiversity resources, is to seek to understand how human, environmental and marine species interactions interact and influence each other, and how these dynamics affect the sustainability of the goods and services they provide. In support of these regulations, new comprehensive scientific tools have been developed with the aim of integrating the effects of these stressors into common frameworks to assist policy decisions. In particular, within the context of the ecosystem-based management (EBM) approach there has been an increasing use of ecosystem models. These tools are improving in their ability to predict complex system dynamics, considering the impact of multiple pressures and assessing different policy objectives required by management authorities.

A recent study (C. Piroddi et al. 2017) sets a benchmark on food webs to develop further ecosystem analyses aimed at facilitating the implementation of management policies, such as the Marine Strategy Framework Directive (MSFD; 2008/56/EC). As regards the Mediterranean Sea, although it has been defined as "under siege" due to intense pressures from multiple human activities, there is still insufficient information on the cumulative impact of stressors on the ecosystem and its resources. In the above study, the response of the Mediterranean marine ecosystem to changes in primary productivity (PP) and fishing effort was assessed through the analysis of historical trends (1950-2011) of various functional groups (from phytoplankton and invertebrates to key predator species), using a food web modeling approach.

The results of the study indicate that changes in primary productivity as well as fishing pressure play an important role in driving species dynamics. The study shows how a reduction in the abundance of important (commercial and non-commercial) fish species and key predators is associated with an increase in organisms at the base of the food chain. Ecological indicators, such as community biomass, trophic levels, catch and diversity indicators, show overall ecosystem degradation over time. The approach used was able to reflect temporal trends in fisheries throughout the Mediterranean, with a general increase in total catch and a decline in average size catch. The trophic level of catches for the entire Mediterranean presented a clear "*fishing down*" effect that occurs when top predators and large fish are removed from the ecosystem and gradually replaced by lower trophic level organisms.

4.2.3.5 Qualitative descriptors: Eutrophication (D5)

The Marine Strategy Framework Directive (MSFD) requires for Descriptor 5 that human-induced eutrophication be minimized, especially it adverse effects, such as loss of biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters. The legislation indicates how the assessment of eutrophication in marine waters must take into account coastal waters under Directive 2000/60/EC and its guidelines, so as to ensure comparability of approaches and targets, and must present a combination of information on:

- Levels of nutrients (concentrations in water columns – criterion D5C1);
- Primary effects of nutrient enrichment (chlorophyll ‘a’ concentrations as indicator of algal biomass – criterion D5C2);
- Secondary effects of nutrient enrichment (impacts on organisms caused by hypoxia and/or anoxia phenomena in the bottom of the water column) that have ecological significance (concentration of dissolved oxygen in the bottom of the water column - criterion D5C5).

Eutrophication is among the most widespread and deleterious anthropogenic impacts on marine ecosystems. Ecosystem restoration has become a key action for the 2050 vision of Europe's biodiversity strategy (*European Green Deal).* Nationally, the northern Adriatic Sea represents the most significant area for the eutrophication phenomenon and is divided into 'coastal waters' and 'offshore waters,' in line with the criteria approach of the new EU Decision 2017/48 of the European Commission. It receives the important nutrient inputs transported by rivers and is therefore subject to eutrophic processes in coastal areas south of the Po River.

Eutrophication is a process caused by enrichment in nutrients, particularly nitrogen and/or phosphorus compounds, resulting in an increase in primary production and algal biomass with consequent alteration of benthic communities and, in general, a decrease in water quality. Nitrogen and phosphorus inputs to the marine and coastal environment can result from point sources (such as discharges from wastewater treatment systems, industrial processes, and aquaculture and mariculture facilities) and diffuse sources (e.g., agricultural surface runoff and transportation emissions). Regarding the effects of farming activities, the aquaculture of euryhaline and marine species, in transitional environments and at sea, produces the input or subtraction of nitrogen- and phosphorus-based nutrients. ISPRA monitors this input, while recognizing its overall modest magnitude.

Marine aquaculture influences the trophic status of the environment on which it is located through two processes: input of nitrogen and phosphorus produced by farmed fish in the form of non-ingested feed, feces and excretions; and subtraction of nitrogen and phosphorus by shellfish that use the compounds as food.

The balance is given by how much nitrogen and phosphorus is input by intensive fish farming and how much is subtracted by filtration from farmed mussels. Available data refer to sea bass and sea bream farms (nitrogen and phosphorus input) and mussel farms (nitrogen and phosphorus subtraction); the three species considered account for 70.8 percent of national marine aquaculture and thus provides a strong estimate for the marine production sector (ISPRA, 2021, Environmental Data Yearbook).

In 2018 there was a nitrogen and phosphorus input from fish farms nationwide of 1,610 and 276 tons/year respectively, while the subtraction produced by farmed mussels was 392 nitrogen and 27 tons phosphorus. The environmental situation is to be considered stationary. In 2018, the net nitrogen and phosphorus balance was 1,218 and 249 tons/year, respectively, with a subtraction operated by mussels of nearly 25 percent of the nitrogen balance and 10 percent of the phosphorus balance. The nitrogen and phosphorus subtraction operated by farmed mussels is found to have decreased by 9 and 0.62 tons in 2018 compared to 2016, a reduction of -2.2%. The net balance at the national level is thus about +198 tons of nitrogen released into the environment from aquaculture activities in the marine environment in 2018 compared to 2016, and +31.38 tons of phosphorus. In 2017 this indicator was not collected or published.

The data comparison therefore refers to the first available year, i.e. 2016. Compared to 2016, there has been an increase in nitrogen input from fish farms of about 207 tons per year; in 2016 total nitrogen was 1403 tons and in 2018 it was 1610; similarly, phosphorus from fish farms increased by 32 tons per year, from 244 tons in 2016 to 276 tons in 2018. Nitrogen and phosphorus subtraction by farmed mussels is found to have decreased by 9 and 0.62 tons in 2018 compared to 2016, with a decrease of - 2.2% for nitrogen and phosphorus. The net balance at the national level is thus about +198 tons of nitrogen released into the environment from aquaculture activities in the marine environment in 2018 compared to 2016 and +31.38 tons of phosphorus.

Between 2016 and 2018, nutrient input from fish farming increased by 14 percent, while nutrient subtraction carried out by mussel farming decreased by about 2.3 percent.

This variation is to be considered insignificant in a marine environmental balance (Descriptor 5, Marine Strategy), also considering the low nutrient input from aquaculture sources compared to other anthropogenic sources. The figure was compiled on a regional basis for the 14 Italian regions that host marine aquaculture facilities. The data for fish farming is merged for both types of farming, i.e., activities conducted in cages at sea and those located on land along the coastal strip. The mussel data refer to the most common farming practice in Italy, i.e. with rows suspended in the water column. In particular, for the Adriatic maritime area, in the Molise, Abruzzo, Marche and Emilia-Romagna regions, a balance with nitrogen and phosphorus subtraction is observed due to the substantial mussel production compared to fish production. In the Apulia, Veneto and Friuli-Venezia Giulia regions, the total net balance shows a higher nitrogen and phosphorus input due to the higher production of farmed fish (Figures 4.17 and 4.18).

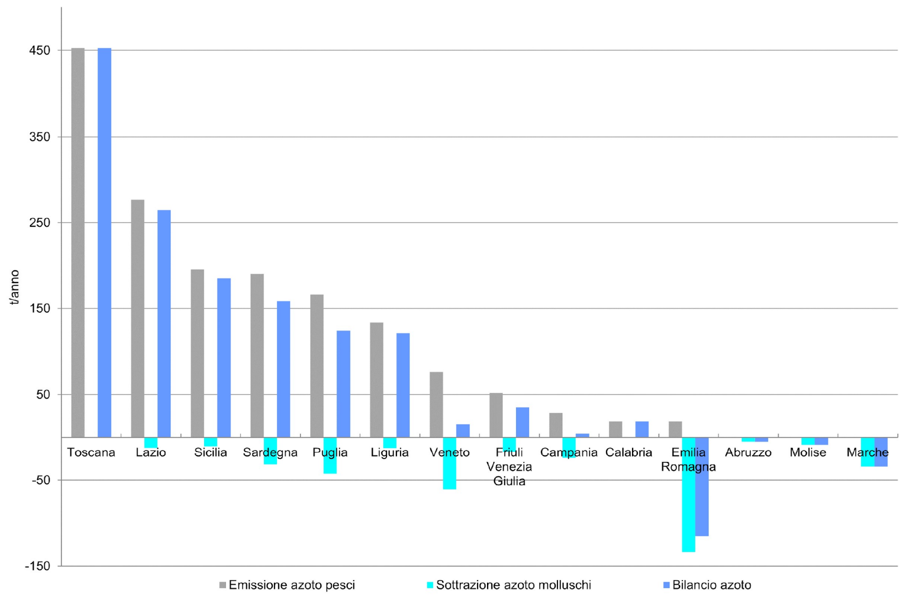


Fig. 4.17 Nitrogen balance (2018)

Source: ISPRA processing of MIPAAF-Unimar data (2018)

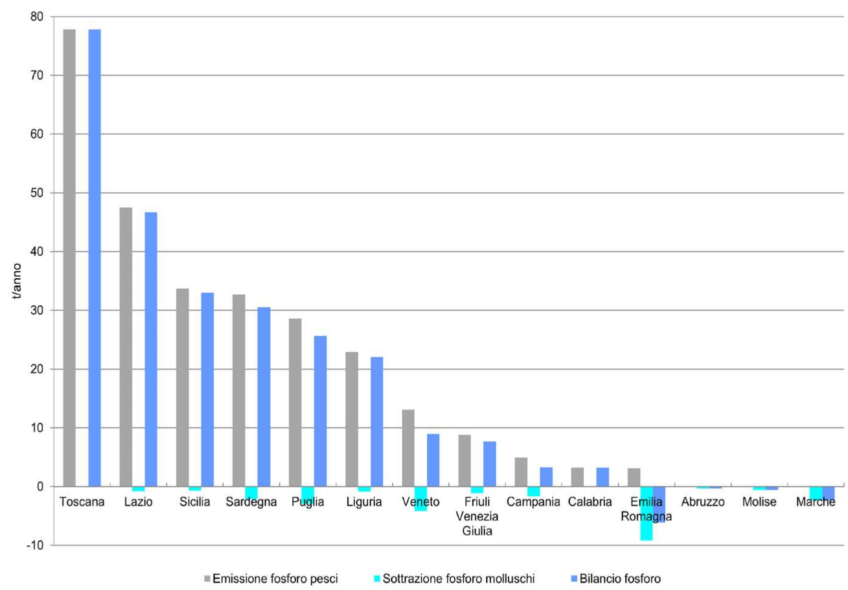


Fig. 4.18 Phosphorus balance (2018)

Source: ISPRA processing of MIPAAF-Unimar data (2018)

With regard to fish, Emilia-Romagna is the region with the most favorable balance, out of all Italian regions, for the lowest nitrogen and phosphorus input from aquaculture facilities (Table 4.7).

Table 4.7: Quantity of nitrogen and phosphorus (t/year) from marine aquaculture facilities (2018)
Source: ISPRA processing of MIPAAF-Unimar data (2018)

Organisms farmed	FISH		MUSSELS
	Nitrogen	**Phosphorus**	**Nitrogen**
Veneto	76.2	13.1	-60,642
Friuli Venezia Giulia	51.8	8.8	-16,829
Liguria	133.4	22.9	-12,225
Emilia Romagna	18.8	3.1	-133,669
Toscana	452.7	77.8	0
Marche	0.0	0.0	-34,482
Lazio	276.6	47.5	-11,849
Abruzzo	0.0	0.0	-4,993
Molise	0.0	0.0	-8,29
Campania	28.7	4.9	-24,074
Puglia	166.8	28.6	-42,677
Calabria	18.9	3.2	0
Sicily	195.8	33.7	-10,267
Sardinia	190.6	32.7	-31,663
ITALY	**1,610.3**	**276.3**	**-391,66**

In the regions of Marche, Abruzzo and Molise, there are no fish breeding facilities.

There are no fish breeding facilities in the regions of Marche, Abruzzo and Molise.

The highest mussel productions, and consequently the highest amounts of nitrogen and phosphorus subtracted from the marine environment, were measured in Emilia-Romagna while the lowest nitrogen and phosphorus subtraction was recorded in Abruzzo (ISPRA, 2021, Environmental Data Yearbook).

In order to quantify the impact of inorganic riverine nutrients on pelagic production levels and bottom oxygen conditions, data on nutrient loads from urban (wastewater) and riverine sources extrapolated from recent work published in 2021 were considered. Based on the Marine Strategy Framework Directive (MSFD) regulation, a set of Pan-European marine models covering almost all Italian and European seas was produced to provide a consistent assessment of potential riverine nutrient impacts and scenarios on marine eutrophication indicators, for riverine nutrient reduction (R. Friedlan, Di. Macias et al, 2021).

The Mediterranean Sea is the EU's southernmost basin, supporting intensive anthropogenic activities such as fishing, maritime traffic and tourism (Liqueteet al., 2016). Although it represents only 1 percent of the ocean's surface, it contains a very high marine biodiversity: between 4 and 18 percent of all marine species are found in the Mediterranean Sea (Bianchi and Morri, 2000; Coll et al., 2010; Bianchi et al., 2012).

Within this context, the Mediterranean Sea has been divided into four subregions (Fig. 4.19).

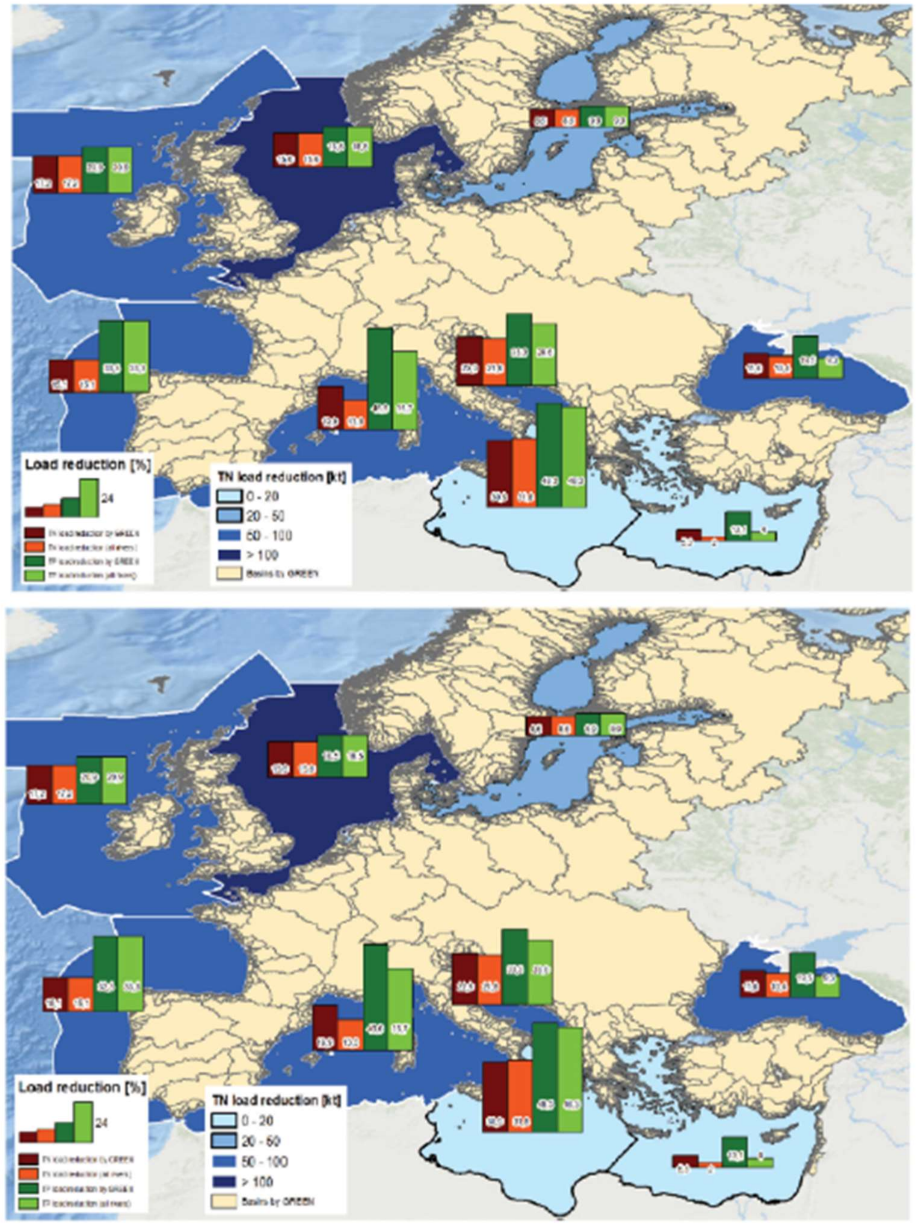


Fig. 4.19 Total reduction in annual TN loads [kt] in individual MSFD regions (bluish colors), bars indicate percentage reduction in TN (red) and TP (green) loads in MSFD regions calculated only for rivers provided by the GREEN basin model (yellow areas; see Grizzetti et al. 2021 for details) and for all rivers flowing in individual MSFD areas (including rivers not covered by GREEN). (Source R. Friedlan, et al., 2021)

Water circulation follows an anti-estuarine pattern with surface inflow of cooler Atlantic waters and deep outflow to the Strait of Gibraltar, which is the only connection to the open ocean. Strong ecological gradients are present in the basins, with a typical decrease in primary productivity from west to east and several production hotspots scattered throughout the region (Siokou-Frangou et al., 2010).

The main nutrient inputs to the surface layer come from the Strait of Gibraltar and the Alboran Sea, from atmospheric deposition (including desert dust), and from freshwater inputs (Macias et al., 2014), especially coming from the Adriatic Sea and the Aegean-Levantine Sea. All the different model systems used have represented the dynamics and behavior of the lower trophic levels in the Mediterranean.

In the Adriatic sea marine area, the level of anthropogenic pressure, nutrient inputs, wastewater treatment and agricultural practices, as well as the location and intensity of applied measures, etc., of different river basins vary widely due to their specific climatic and hydrological characteristics (Fig. 4.20 and Table 4.8). All models for the Italian seas indicate a reduction in N and P loads for the Adriatic (especially North Adriatic) while they are not significant for the other Italian seas.

TABLE 4.8 Relative changes in TN and TP river loads (including all rivers) in the Adriatic Sea together with relative changes in eutrophication indicators assessed by individual ensemble members and combined with the ensemble mean. (Source R. Friedlan,et al., 2021)

MODEL SYSTEM	TN load reduction	TP load reduction	NITRATE (DSC1)	PHOSPHATE (DSC1)	CHLOR. 'A' (DSC2)	BOTTOM OXYGEN (DSC2)	TROPHIC INDEX TRIX
JRC MEDERGOM	21.8	28.6	-0.5	-3.4	-2.3	1.6	-0.4
HCMR ERSEM			-1.7	-2.3	-5.1	-0.3	-0.9
LEGOS ECO 3M-S			-2.6	-4.5	-3.4	0.1	-0.7
OGS MED BFM			-1.9	-5.1	-2.2	0	-0.7
ADRIATIC SEA ENSEMBLE			**-1.7**	**-3.8**	**-3.3**	**0.4**	**-0.7**

All models showed that there is a decrease in Chl-a, while the changes are zero for the other Italian seas (Fig. 4.20A). The relative change in chlorophyll-a showed the same spatial patterns as for inorganic nutrients (Fig. 4.21).

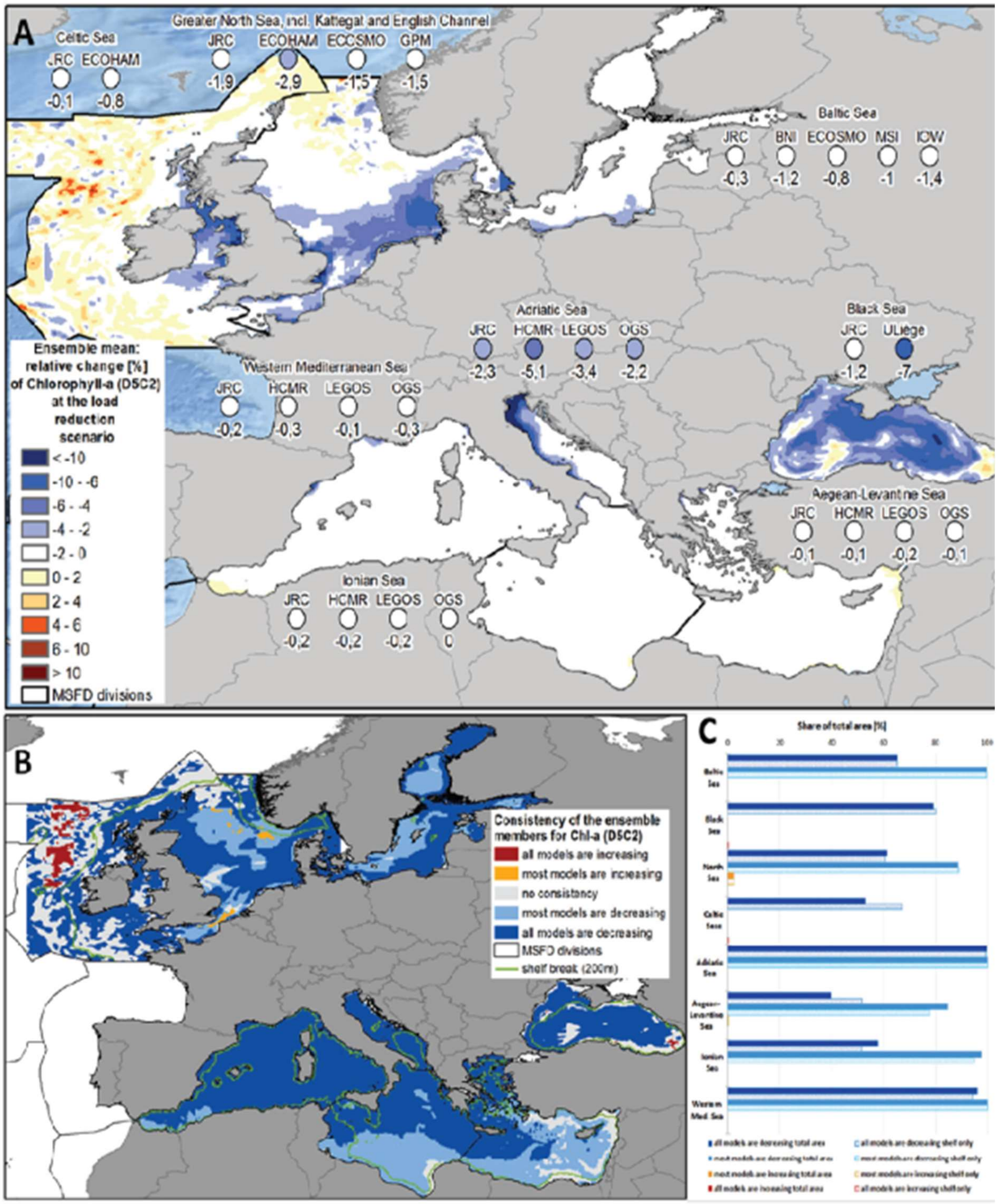


Fig. 4.20

(A) Ensemble mean and model-specific relative change to the load reduction scenario (compared to reference scenario) for MSFD regions of chlorophyll-a (MSFD indicator D5C2).

(B) Consistency map showing, whether all or at least most of the models have the same trend of relative change to the load reduction scenario (compared to the reference scenario) for chlorophyll-a (MSFD indicator D5C2).

(C) Share of total area (bars in bold) and platform region (dashed bar) where all or most models show consistent changes with respect to chlorophyll-a (MSFD indicator D5C2). (Source R. Friedlan, et al., 2021).

Overall, reductions in nutrient supply led to a decrease in chlorophyll-a in all MSFD regions (Fig. 4.21 and Table 4.8). The intensity of the decrease was determined not only by the reductions but also by regional characteristics (Fig. 4.23).

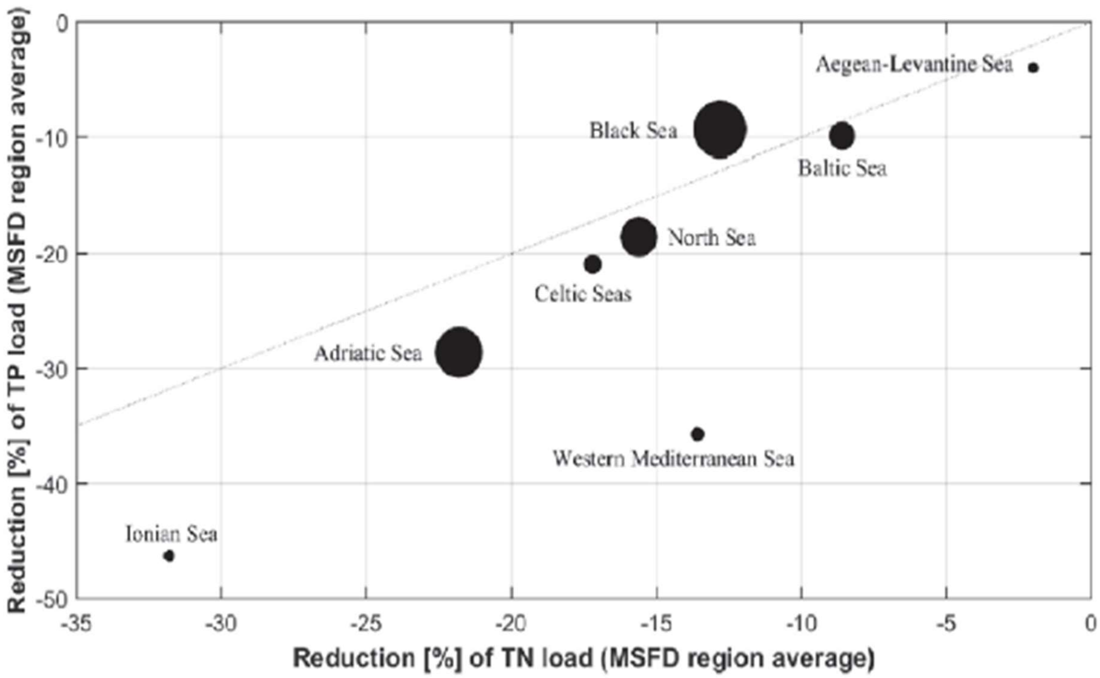


Fig. 4.21 Relative change in chlorophyll-a concentration by MSFD region (ensemble averages only; symbol size refers to intensity of chlorophyll-a change) as a function of reduction in TN and TP river inputs. (Source R. Friedlan, et al., 2021).

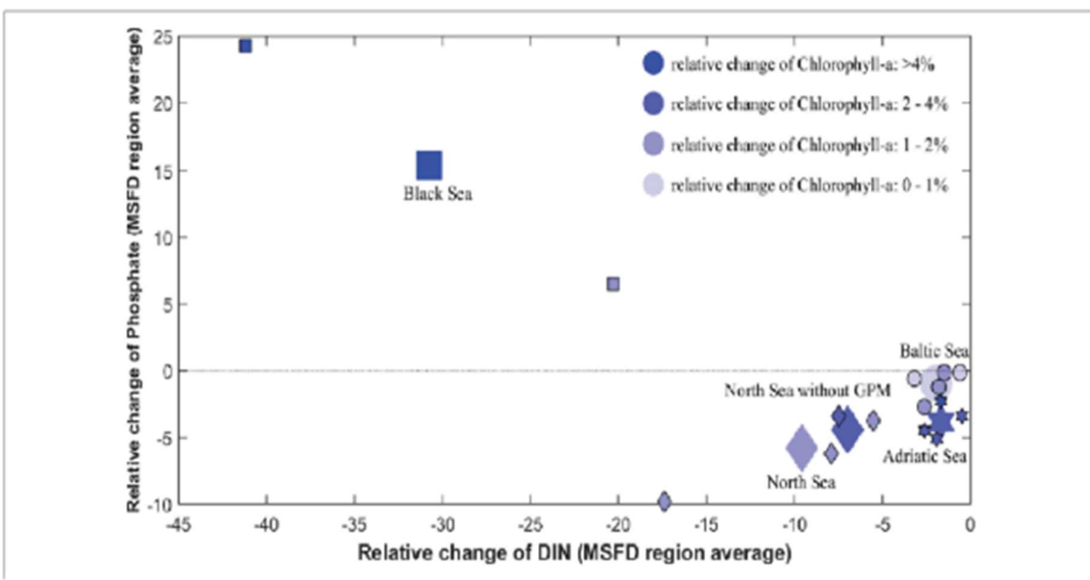


Fig. 4.22 Relative change in chlorophyll-a concentration by MSFD region (bluish colors refer to the intensity of chlorophyll-a change) as a function of relative changes in dissolved nutrients DIN and phosphate from all individual models (ensemble averages by region are highlighted by enlarged symbols). (Source R. Friedlan, et al., 2021).

As with the eutrophication indicators described above, no change was observed in most of the Mediterranean for bottom oxygen concentrations (D5C5).

An increase in bottom oxygen was detected only for the central and northern Adriatic, while the changes were zero for the other Italian seas. (Fig. 4.23A).

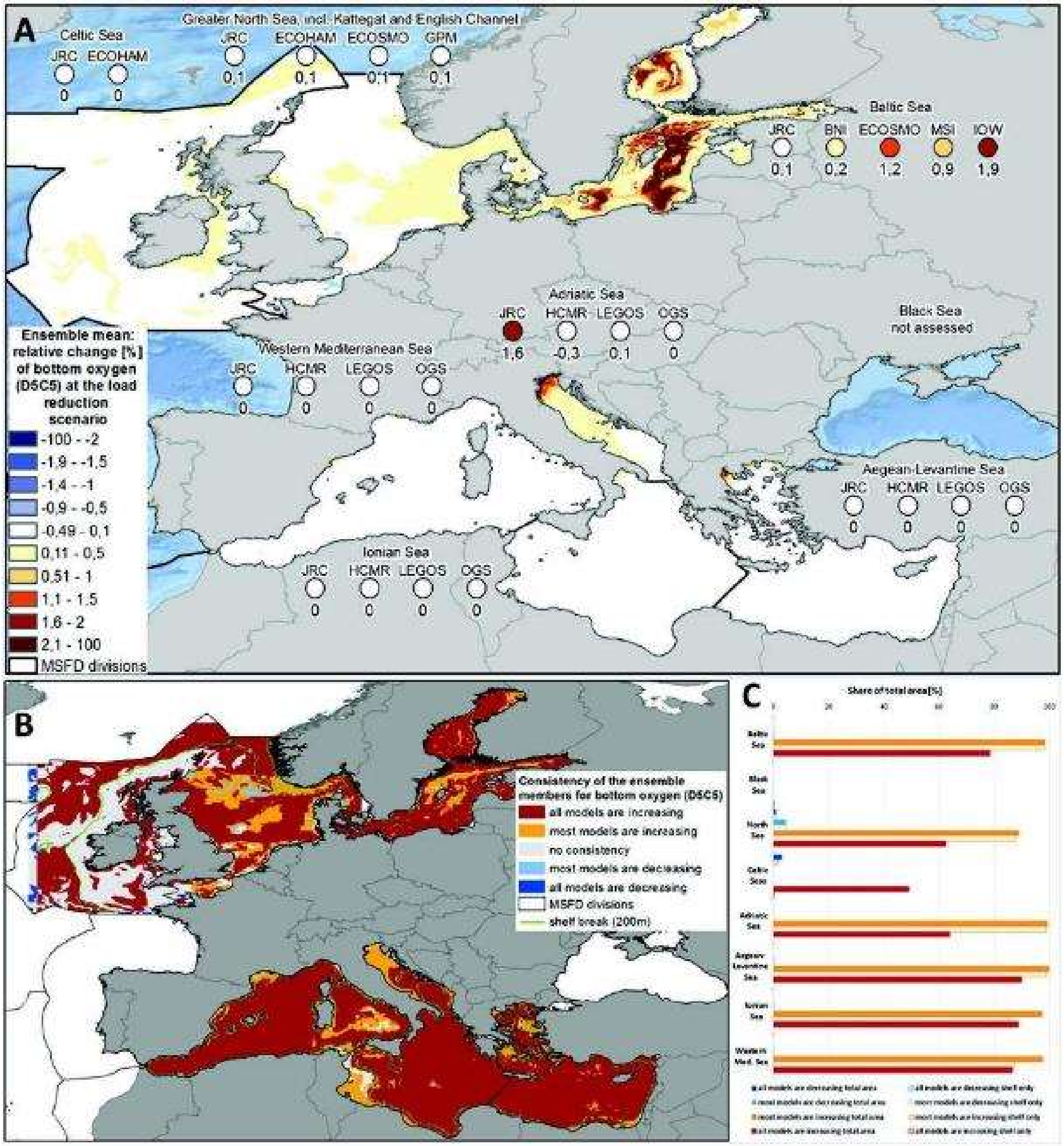


Fig. 4.23

(A) Ensemble mean and model-specific relative change in the load reduction scenario (compared to the reference scenario) for the MSFD regions of bottom oxygen (MSFD indicator D5C5) [please note that increased values of bottom oxygen indicate improved ecosystem status].

(B) Consistency map showing whether all or at least most of the models have the same trend of change regarding the load reduction scenario (compared to the reference scenario) with respect to bottom oxygen (MSFD indicator D5C5).

(C) Share of total area (bars in bold) and platform region (dashed bar), where all or most models show consistent changes relative to bottom oxygen (MSFD indicator D5C5).

(Source R. Friedlan, et al., 2021).

The trophic index TRIX is a composite of chlorophyll-a, DIN and phosphate in near-surface concentrations. Although not fully used as an indicator of eutrophication in the MSFD, in Italy TRIX is integrated into the monitoring program for the state of the marine environment (Fiori et al., 2016), because it allows for a consistent assessment of coastal and open sea water quality.

A marked reduction in TRIX of 0.7% was recorded only for the central and northern Adriatic, while changes were zero for the other Italian seas with a value below 0.2% (Figs. 4.24A and 4.25).

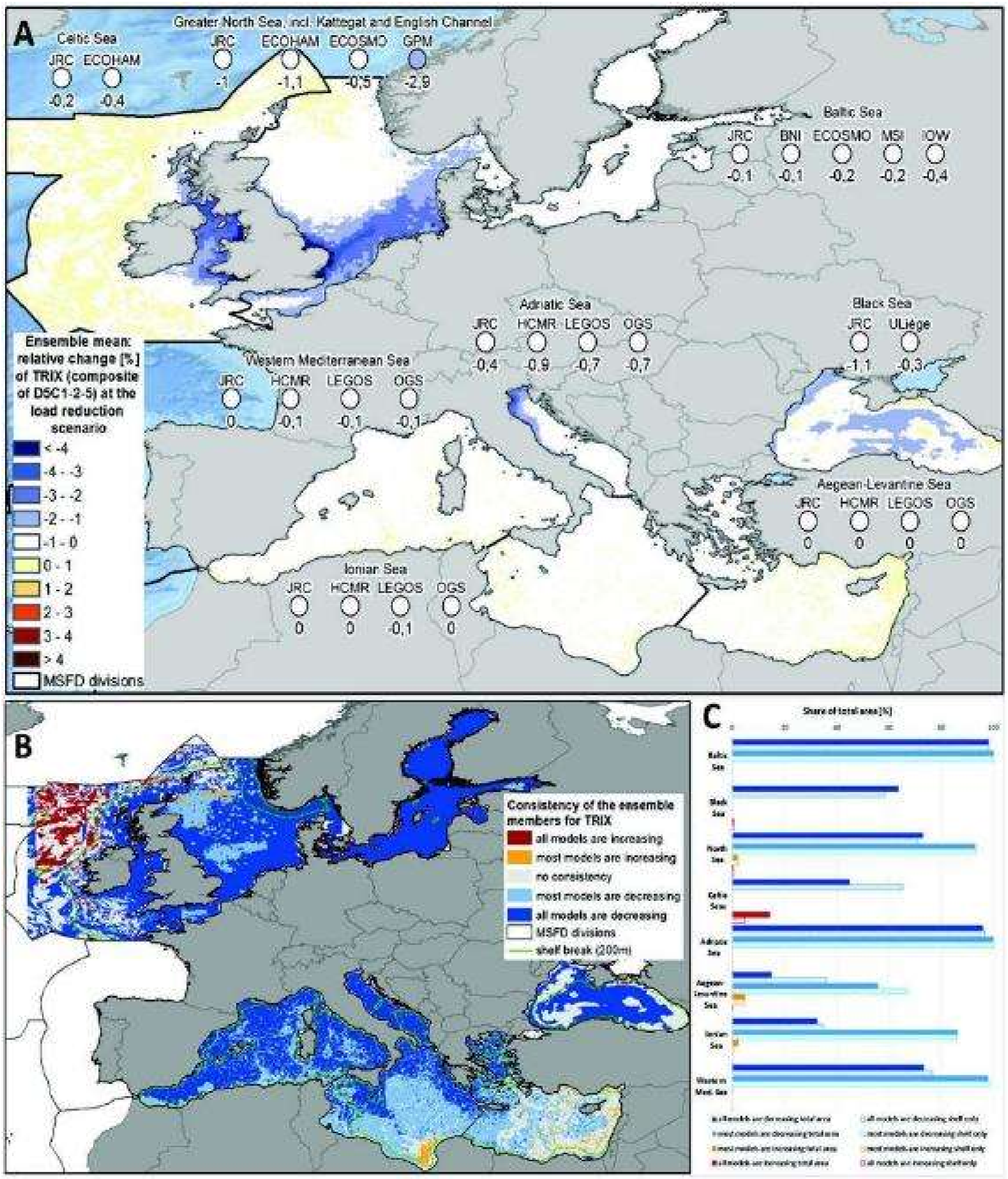


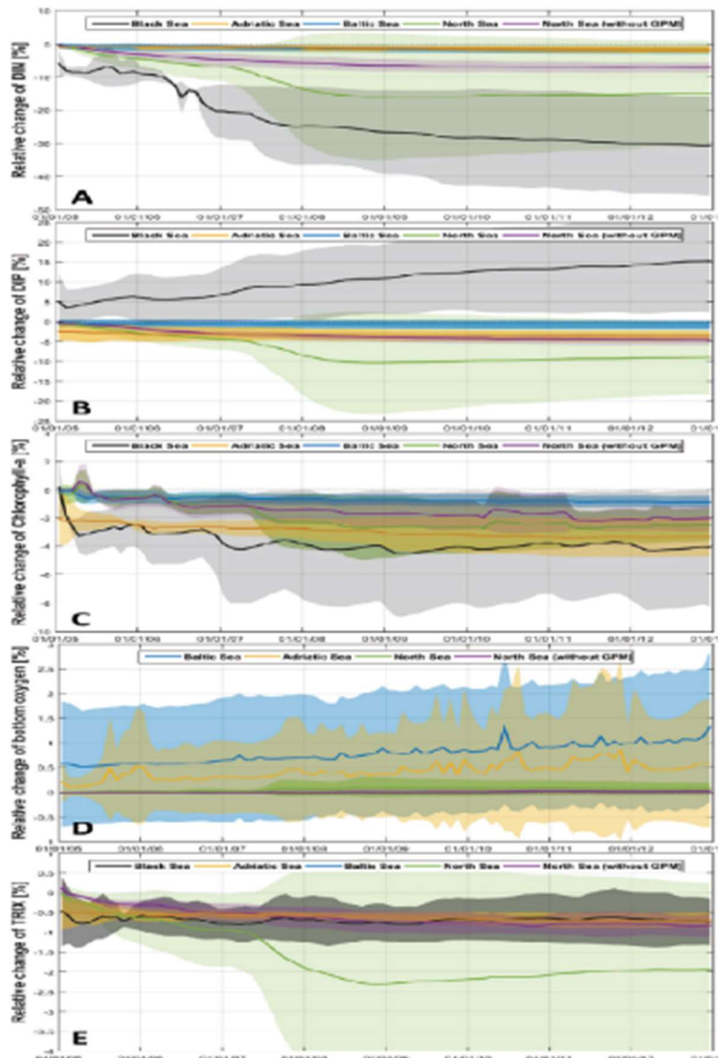
Fig. 4.24

(A) Ensemble mean and model-specific relative change to the load reduction scenario (compared to the reference scenario) for the MSFD regions for the TRIX trophic index.

(B) Consistency map showing whether all or at least most of the models have the same pattern of relative change to the load reduction scenario (compared to the reference scenario) as regards the TRIX trophic index.

(C) Share of total area (bars in bold) and platform region (dashed bar) where all or most models show consistent changes regarding the TRIX trophic index.

Fig. 4.25 Relative changes in DIN (A), phosphate (B), chlorophyll-a (C), bottom oxygen (D), and TRIX (E) calculated by ensemble members (ensemble mean ± standard deviation) from the Black Sea (black), Adriatic Sea (yellow), Baltic Sea (blue), and North Sea including GPM (green) and without GPM (purple) following Kearney's method (2020). (Source R. Friedlan, et al., 2021).



In almost all marine regions, reductions in river loads have led to reductions in nutrient concentrations in the marine environment. These improvements were greatest for dissolved inorganic nutrients, while changes were smaller and slower for chlorophyll-a and bottom oxygen concentrations. The consistency of changes within the ensemble was highest for regions that reacted more rapidly to the change in nutrient supply.

This positive effect of load reduction has not been strong enough to restore ecosystem resilience or achieve Good Environmental Status (GES) goals, however.

Results from all models indicate that dissolved inorganic nutrients (D5C1) responded most rapidly to changing nutrient loads. Although improvements occurred in all MSFD regions for almost all eutrophication indicators, the relative intensities and response times to changes showed strong variations among regions. This shows that the response times to nutrient management strategies depend on the characteristics of the seas. Therefore, the timescales used for simulations must be long enough to assess the full offshore impact of load reductions away from coastal and marginal areas such as the Adriatic Sea. Decades of excessive input of nutrients into the seas have resulted in huge accumulations in deep water or sediments, meaning that today pelagic nutrient pools are growing even as river inputs are declining. In the near future, any approach for assessing changes in eutrophication indicators will have to take into account changes related to atmospheric precipitation, warming and acidification of the seas, which will have an increasing impact on trophic processes and will most likely result in reduced amounts of dissolved oxygen in the marine environment (Wakelin et al., 2020). However, this cannot be overshadowed by the fact that spatial coverage in the Mediterranean Sea in terms of free access to information and data is still insufficient.

Assuming that the data should exist, (many are accessible or can be requested through EMODnet Chemistry), it seems to be a matter of coordination, storage in national or international databases, and accessibility of data rather than an actual lack of data. Not all national monitoring ends up in EMODnet Chemistry and not all data in EMODnet Chemistry are freely accessible. So, at Mediterranean level, data accessibility for D5 needs to be coordinated and implemented. In this regard, the Ministry of Ecological Transition has championed a database that is the heart of the InfoMAP system, which aims to support the flow of data resulting from the obligations of the Barcelona Convention (http://www.info-rac.org/en/infomap-system/data-centre) .

In conclusion, key steps towards a better assessment of eutrophication in the Mediterranean Sea should focus on the following elements:

- develop threshold values for D5 descriptor indicators for both coastal and offshore areas;
- develop a monitoring strategy and an assessment with a stratified sampling schedule, in which areas at risk are given higher priority than those unlikely to be affected by eutrophication;
- develop and test a eutrophication assessment tool based on multimetric indicators, apply it to all potential risk areas in the Mediterranean Sea, and make monitoring data accessible.

4.2.3.6 Qualitative descriptors: Sea-floor integrity (D6)

The Adriatic Sea is a semi-enclosed basin featuring increasing depths and geomorphological features that vary markedly along a north-south gradient. The complex climatic (low winter temperatures, strong summer vertical stratification) and oceanographic (surface and deep circulation, hydrology, prevailing winds regulating the movement of water masses) characteristics of the Adriatic play an essential role in determining its ecological and morphological configuration, influencing both ecological and sedimentological processes.

The northern portion of the Adriatic Sea, with a relatively scarcely indented coastline and a shallow seabed that reaches, with gentle slopes, an average depth of about 35 m, constitutes the largest continental shelf area in the entire Mediterranean Sea. The central Adriatic has an average depth of about 150 m and is characterized by the presence of the Pomo Pit, a complex depression that reaches a depth of about 270 m.

The Pomo Pit represents one of the most productive and relevant areas for the recruitment and initial accretion of commercially valuable fish species. Below the Gargano Promontory, the southern Adriatic shows a deep depression, as dep as -1225 m, enclosing platform areas of variable surface area and a relatively large bathyal zone. Descriptor 6 (Sea-floor integrity) requires, for the achievement of the GES, that sea-floor integrity be at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected. This descriptor is intended to ensure that pressures generated by anthropogenic activities on the sea-floor do not adversely affect marine ecosystem components, particularly benthic communities and their associated habitats.

From the initial assessment conducted as part of the first phase of the MSFD, with regard to Descriptor 6 (Physical Disturbance and Physical Loss) it was found that the pressure that most interacts on the sea-floor is Abrasion due to fishing activities that actively interact with the bottom (trawling, beam trawling and hydraulic dredges). With regard to Sealing pressure, in all three subregions, this was found to be concentrated mainly along the coast where, moreover, many protected and/or sensitive habitats are present.

For this reason, despite the fact that this pressure is always present in very low percentages, it was nevertheless taken into account for GES assessment, with exclusive reference to biogenic substrates as defined by the Marine Strategy. Due to their structure and the ecological role they play, these substrates and the communities associated with them, in fact, turn out to be very sensitive to anthropogenic pressures.

The data collected during the first round of assessment are an initial contribution to acquiring the information needed to identify the proper threshold value of intact seabeds and the extent of mobile bottom biogenic substrates. Indicators of seabed abrasion and sealing pressure, and an ecological index of the health of epimegabenthic communities of trawlable bottoms, defined in concert at the community level, are being defined. Biogenic substrates potentially subject to significant pressure (from abrasion and/or sealing) are predominantly *maërl* mobile bottoms and *Posidonia oceanica* seagrass beds, the latter habitat already protected by current regulations.

Posidonia oceanica meadows are not as widespread along the "Adriatic" marine area except along the Apulian coast of the southern Adriatic where, however, they are subject to regression. The nature and structure of the substrate, as well as the presence of urban, industrial and agricultural settlements, greatly influence the establishment and development of this habitat. In the Mediterranean Sea, the Gulf of Trieste and especially the Miramare Marine Protected Area represent the northern distributional boundary of *Posidonia oceanica*. The largest meadow is located near Koper on the Slovenian coast of the Gulf of Trieste. It is currently limited to a narrow area in front of the Grado lagoon, with isolated small patches and a seafloor cover of 1.2 percent.

Residual plants of *Posidonia oceanica (L.) Delile* are found at a depth of 3 to 4.5 m and grow only on the rocky substrate. The trend of habitat extension is stable, although along the coastal waters there are moderate signs of regression caused by physical, chemical and biological alterations, induced by pollutants in water and sediments, or by significant physical-morphological alterations of the coastal stretch due to urban, industrial and agricultural pressures. Moving southward, *Posidonia oceanica* meadows are also present on the seabed of the Tremiti Islands. The seaward part of the Tremiti Islands sees the presence of the marine protected area (MPA) and of the biological protection zone (ZTB).

On the seabed between Cala Matano (S. Domino) and Caprara there is a lush *Posidonia oceanica* meadow with specimens of *Pinna nobilis*. Studies and research carried out by the Interuniversity Consortium for the Sciences of the Sea (CoNISMa-2019) and subsequent assessments show that the *Posidonia oceanica* on the southern side of San Domino Island is at risk and will disappear within 5-6 years. Among the many factors that have caused a dramatic regression (especially in the last 4 years) are the moorings and anchorages of recreational boats. In the southernmost sector of the Adriatic, the Posidonia habitat is much more extensive than in the northern part of the Adriatic, and is present on small patches of rock from Otranto to Foggia with a seabed coverage of 11%, as shown in the following cartography.

However, along the Brindisi coastline, which stretches more than 60 km NW of Brindisi to Bari, *Posidonia oceanica* meadows show a generally healthy state, a good degree of conservation and do not extend beyond 25 m depth. This is probably also due to the presence of the "Torre Guaceto" MPA, extensive Natura2000 sites and the "Off the coast of Puglia" Biological Protection Zone. Of note is the massive presence of invasive algal species, particularly *Caulerpa cylindracea* within the habitat. Abrasion and sealing pressures on other biogenic substrate types, such as Coralligenous Biocenosis, Deep Corals and the Tegnùe, are mainly caused by trawling activities. The analysis of the data produced by the Monitoring Programs carried out did not allow the establishment of a value that represents a threshold above which significant impact is found and thus to assess the integrity of the sea-floor. In particular, data on the extent of mobile bottom biogenic substrates (*maërl* bottoms) are not available, so it is neither possible to determine whether these substrates are subjected to pressure due to abrasion (physical disturbance) and/or sealing (physical loss), nor is it possible to establish a significant pressure threshold. In addition, since areas of different fishing effort pressure have not been monitored, it is not possible to identify any alterations of the substrate subjected to abrasion in terms of changes in mobile bottom benthic and epimegabenthic communities. Finally, the processing of data regarding the distribution of fishing effort, years 2015-2016 (Figures 4.26 and 4.27), does not allow for comparisons with the related data prepared in the initial assessment because different processing methods were used and the data are expressed in units that are not comparable in absolute terms. Finally, as regards the necessary spatial resolution it would seem appropriate to use data sources (ISPRA, 2018).

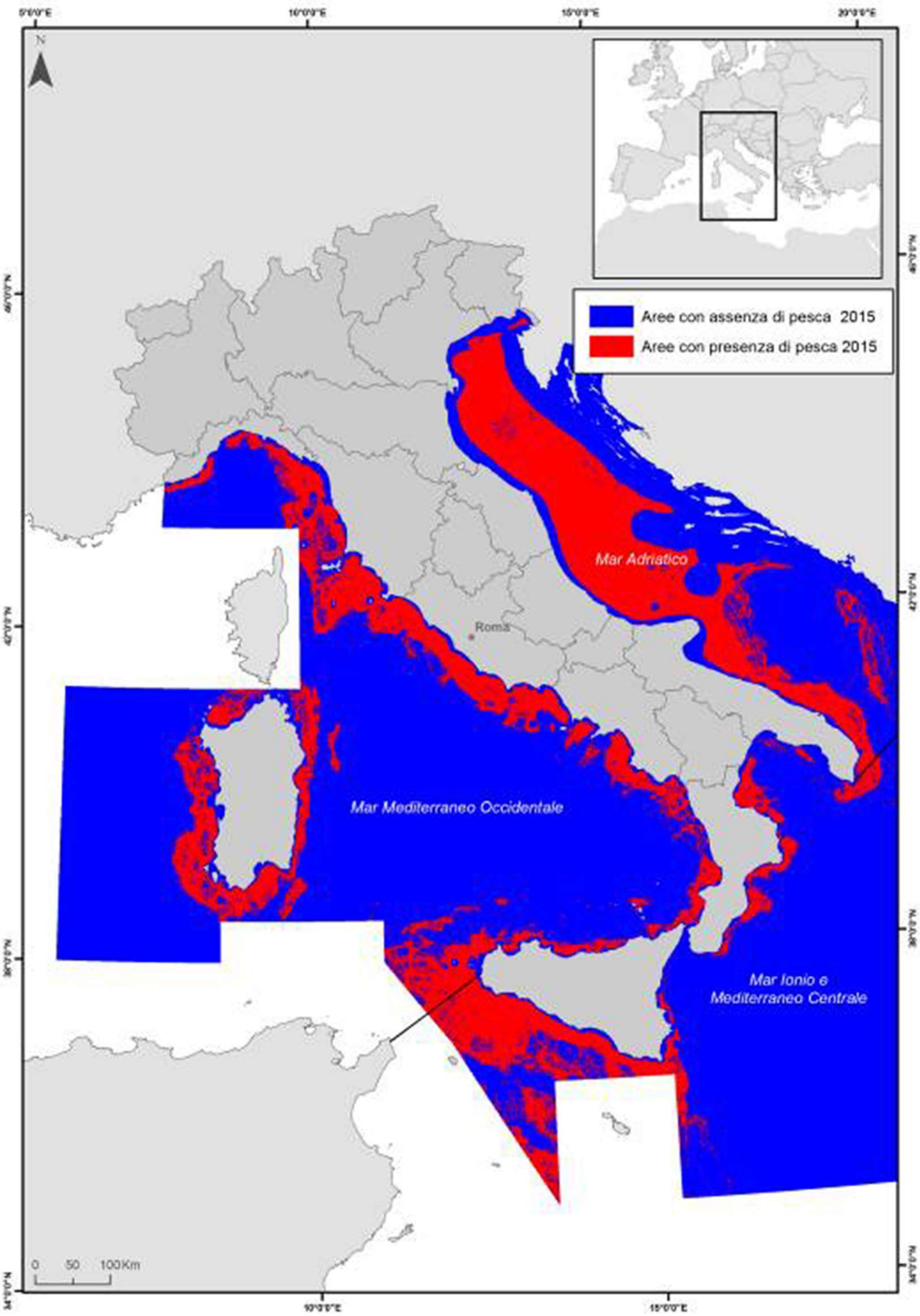


Fig. 4.26 Spatial distribution of the presence of fishing activities related to the presence of trawling vessels for the year 2015 (data coming from 'Report del S.pr. 2.5')

Source: ISPRA, Summary report MSFD 2018 – D6

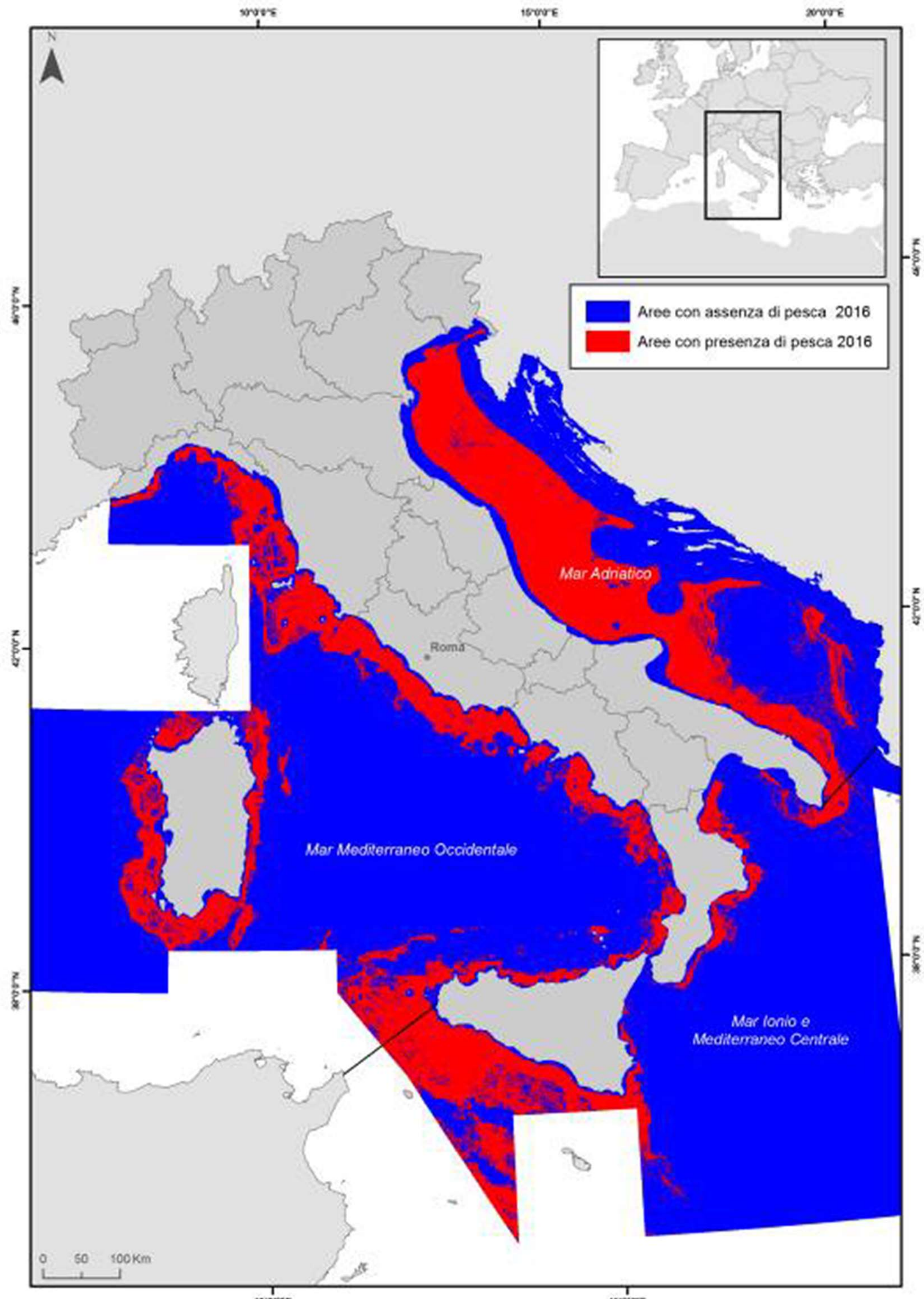


Fig. 4.27 Spatial distribution of the presence of fishing activities related to the presence of trawling vessels for the year 2016 (data coming from 'Report del S.pr. 2.5')
Source: ISPRA, Summary report MSFD 2018 – D6

4.2.3.7 Qualitative descriptors: Hydrographical conditions (D7)

Descriptor D7 envisages that, to achieve Good Environmental Status (GES), a "*permanent alteration of hydrographical conditions does not adversely affect marine ecosystems*".

Decision (EU) 2017/848 of 17 May 2017 sets two secondary criteria:

- D7C1 relating to the spatial extent of permanent alteration of hydrographical conditions;

- D7C2 relating to the spatial extent of each benthic habitat type adversely affected due to permanent alteration of hydrographical conditions.

Permanent alterations of hydrographic conditions due to coastal and marine infrastructure works under construction or planned as of 2012 were considered for this descriptor. To this end, Italy, through the EcAp-ICZM project, has identified two assessment areas affected by infrastructures subject to national Environmental Impact Assessments (EIAs) that have the potential to permanently alter hydrographic conditions, and such as to potentially produce significant impacts on benthic habitats: the new port of Fiumicino and the LNG Terminal in Monfalcone (Fig. 4.28).

Oceanographic data against which to assess permanent changes in hydrographic conditions due to infrastructure works were collected over the period 2012-2018. This project made it possible to conduct a census of coastal infrastructures subject to national EIA under construction or being planned as of 2012, to plan and implement specific monitoring for the port of Monfalcone, and to produce a methodological proposal for the estimation of descriptors D7C1 and D7C2.

Fig. 4.28 ISPRA-ARPA FVG-University of Trieste integrated monitoring LNG Terminal – Port of Monfalcone. (Source Summary report 2018)

The term 'hydrographical conditions' includes, in addition to the physiographic characteristics of the seabed in terms of morphology and nature of substrates, the scope of hydrological processes referable to the water column, such as currents, bottom energy, salt and thermal regime, described below for the Adriatic Sea.

The coastal areas of the Adriatic Sea host delicate environments that are under pressure from climate change and impacts of human activities. The latter can be amplified by local circulation characteristics, which can act as attractors of marine litter or dispersion of pollutants released on the coast, endangering local ecosystems, even in marine protected areas. The Adriatic Sea is a semi-enclosed basin about 800 km long and 150 km wide on average, oriented longitudinally from northwest to southeast.

It encompasses the area between the Balkan Peninsula and the Apennine Peninsula, at the geographic latitude of 39°45´ N and 45°45´ N, and the geographic longitude 12°15′ E and 19°45′ E, thus resulting in a very important and complicated border sea for issues such as security, transportation, tourism, environment, and fisheries. The southern boundary of the entire region represents the Strait of Otranto and passes through the line connecting Capo Santa Maria di Leuca - north coast of the island of Corfu (Greece) - mouth of the Butrinti River (Albania). The longitudinal axis measured from the mouth of the Butrinti River to the Porto di Lido is 475 nautical miles and the width axis, perpendicular to the longitudinal median, from Port Omiš (Croatia) to the Port of Vasto is 117 nautical miles. Three main water masses characterize the Adriatic Sea: the Adriatic surface water (AdSW), the Levantine intermediate water (LIW) and the Adriatic deep water (AdDW) (B. Gloginja et L. Mitrovìc 2021). From a strictly oceanographical point of view, the Adriatic Sea is of fundamental importance for the circulation of the entire Mediterranean Sea.

In the southern Adriatic, in fact, some of the dense water sinks and renews the deep waters of the Mediterranean. The circulation is mainly counter-clockwise or cyclonic, with a northwestward flow along the eastern side and a southeastward return flow along the western side. The cyclonic gyres vary in intensity depending on the season, and the southern Adriatic sub-gyre tends to persist throughout the year. Mixed tides with a relatively high percentage of salinity prevail in the Adriatic Sea. Over the years, various and numerous observational systems have been developed and used with the aim of monitoring and increasingly understanding the complicated dynamics of this sea. Based on its bathymetry, the Adriatic Sea is divided into the shallow Northern Adriatic (north of 100 m isobath), the Central Adriatic, and the Southern Adriatic characterized by a trench with depths greater than 1000 m (Artegiani et al. 1997) (Fig. 4.29).

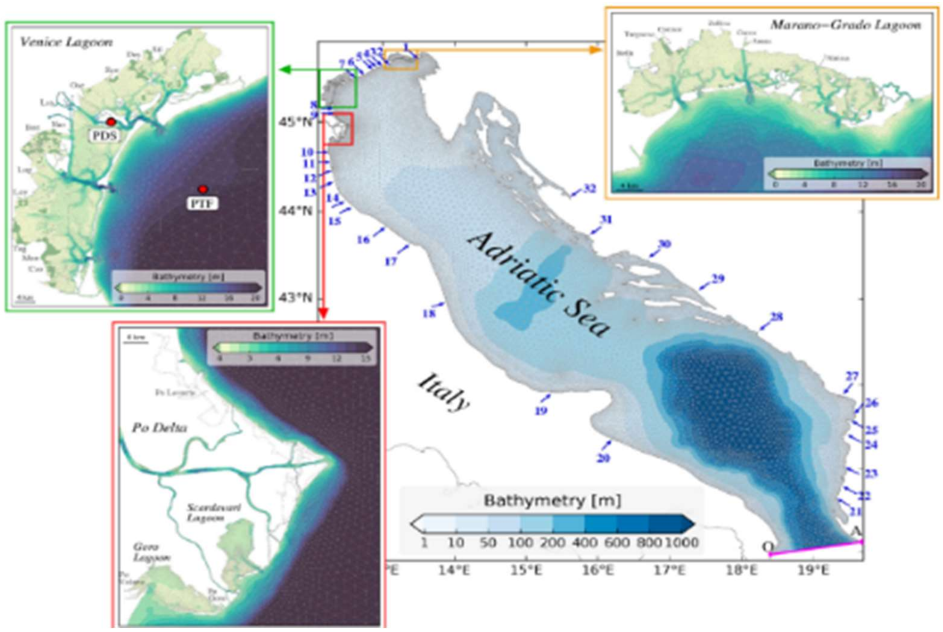


Fig.4.29 Bathymetry of the Adriatic Sea and the lagoons of Marano-Grado, Venice and the Po Delta interpolated on the triangular number grid (superimposed). Arrows mark the position of the main Adriatic rivers: (1) Isonzo, (2) Tagliamento, (3) Canale dei Lovi, (4) Lemene, (5) Livenza, (6) Piave, (7) Sile, (8) Brenta, (9) Adige, (10) Reno, (11) Lamone, (12) Fiumi Uniti, (13) Savio, (14) Uso, (15) Marecchia, (16) Metauro, (17) Esino, (18) Tronto, (19) Fortore, (20) Ofranto, (21) Vijuse, (22) Seman, (23) Shkumbi, (24) Erzen, (25) Ishm, (26) Mat, (27) Bojana, (28) Ombla, (29) Neretva, (30) Cetina, (31) Krka, (32) Zrmanja. Rivers flowing into the lagoons and Po Delta are labeled in the zoom panels. The purple OA line indicates the boundary of the Strait of Otranto. The red dots in the upper left panel indicate the tide gauges used for tidal validation. (Source B. Gloginja et al. 2021)

The complex hydrogeology of the Adriatic Sea is strongly characterized by the presence of areas of river deltas, lagoons and wetlands, which characterize the dominant landscape of the Italian Adriatic coastal area, especially in its northern belt. Such coastal environments have an average depth of 1.2 -1.5 m and are characterized by a complicated network of channels (up to 15 m deep), shallow plains (generally about 1 m deep), and marshes which are intermittently dry and wet. Local orography strongly influences the meteorology of the Adriatic Sea. Freshwater is discharged into the Adriatic Sea mainly from rivers along the north and northwestern coasts. Because of the abundant freshwater inputs, the Adriatic Sea is considered a dilution basin, moving water to the adjacent Ionian Sea (Ludwig et al. 2009; Verri et al. 2018). The Po River represents the main buoyancy input with an average discharge rate of 1500 m^3 s-1, accounting for about one-third of the total riverine freshwater in the Adriatic Sea. Such freshwater inputs make the basin one of the most productive in the Mediterranean, and determine with reduced salinity conditions and variable densities the movement of water masses with prevailing southward currents influencing the structure of the communities present.

The maximum level of subsurface salinity, with values below 39.0, was observed in the southern Adriatic at depths between 200 and 400 m, related to the entry of saltier and warmer waters from the eastern Mediterranean

(Levantine Intermediate Water - LIW) (H. Mihanovìc, I. Vilibìc et al., 2021). However, a strong seasonal influx of warm, high-salinity water (S > 38.8) has been observed much closer to the surface since spring 2015. At the same time, the main core of the LIW has been observed at a depth between 400 and 700 m. A new episode of very strong inflow of high salinity water from the northern Ionian Sea was observed in late winter and spring 2017, this time confined almost to the surface. As most of 2017 was characterized by extremely dry conditions, low river inflows and a warmer than usual summer over the Adriatic and northern Ionian, salinity values above the acute and shallow thermocline (15-4 m) increased significantly.

The maximum salinity level recorded was 39.26 in the southern Adriatic (Fig. 4.30).

Maximum surface salinity events have been documented in the past but with much lower intensity. Past events and the 2017 event were characterized by:

- concomitance with the general conditions of high salinity and the cyclonic or transitional phase of the Adriatic-Ionian Bimodal Oscillating System;
- very low river discharges that preconditioned events for a year or more;
- above-average heat fluxes during most summer and early fall periods, forming a stable warm layer above the thermocline;
- above-average E-P (evaporation minus precipitation) acting on this warm surface layer.

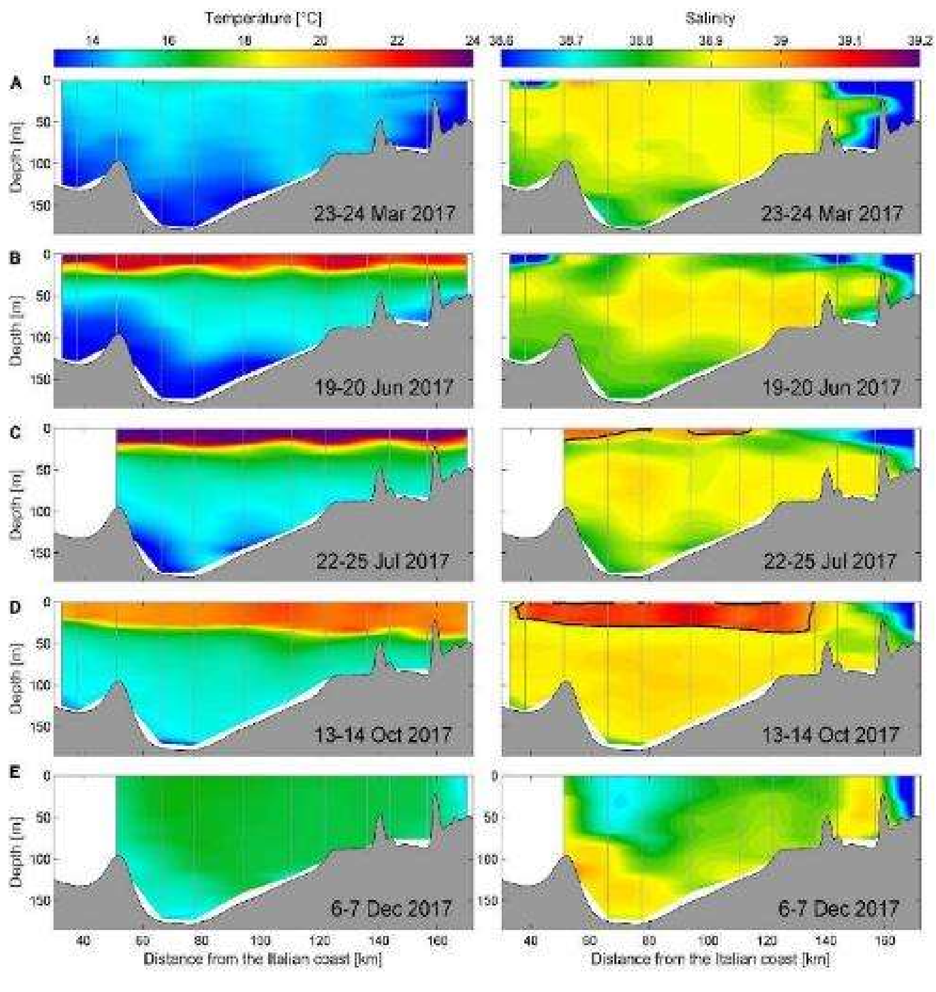


Fig. 4.30. Temperature and salinity measured at the Palagruža Sill transect: (A) March 23-24, 2017, (B) 19(C) July 22-25, 2017, (D) October 13-14, 2017, and (E) December 6-7, 2017. Salinity values above 39.0 are surrounded by a black line in the salinity graphs. The gray vertical lines denote the conductivity, temperature, depth (CTD) casts. (Source B. Gloginja et al. 2021)

As described, the Adriatic Sea is home to delicate coastal and marine ecosystems, and is characterized by rich and complex dynamics, determined both by the interaction of local forces with the complex morphology and bathymetry of the basin, and by exchanges with adjacent sub-basins occurring at all depths.

The proper management of socioeconomic activities insisting on coastal areas, and the planning of future activities aiming at the exploitation of marine resources, must take into account the marine circulation and its variability in order to understand, prevent and mitigate the risks associated with them.

All along the Adriatic coast north of the Gargano, numerous coastal defense works have resulted in both seabed modifications and in hydrodynamic alterations completely transforming coastal dynamics, as have ports.

The methodological approach of the above mentioned project, EcAp-ICZM, involved the analysis of significant and permanent changes with respect to the oceanographic background characteristics of hydrological processes and physiographic conditions produced by new infrastructure built (or being planned) since 2012 and subject to a national EIA. In assessing the level of significance of the alteration of the works, the analysis was restricted to only those infrastructures in the coastal and marine environment that are subject to a national EIA procedure. This allowed the exclusion of all those coastal defense works, construction of small ports or marinas, and extensions of existing port infrastructure that, not subject to a national EIA, are deemed not to produce significant impacts on both spatial and temporal scales of marine ecosystems as a specific consequence of altered hydrographic conditions.

In this case, the GESs and Targets also refer only to infrastructure subject to national EIA and constructed since 2012. Specifically, the assessment of the works did not address impacts on ecosystems but focused mainly on benthic habitats, with a regression to the limits of the Habitats Directive. This descriptor seems to overlook the impact of coastal defenses, in terms of both seafloor modification and hydrodynamic alteration. Changes in hydrographic conditions have produced corridors for alien species, changed sedimentation regimes and resulted in actual substrates for planktonic species with benthic stages, such as jellyfish.

Therefore, the impacts produced at the local scale by coastal defense works and small harbors should also be taken into account. These works, although small and extended only to the coastal strip, are widely present along all national coasts and interfere with hydrodynamics and sediment transport, greatly altering the natural balance of the beach system and the marine ecosystem. Maritime works such as protective dykes and groins, lagoon inlets, jetties and soft barriers, built between the emerged beach and the submerged beach, have entailed, and still entail, effects ranging from the total erasure of the beach body to the triggering of irreversible erosive processes. These processes can be traced back to changes in the main sediment transport processes, both longitudinally and transversely, as a result of the effect of the works on coastal hydrodynamics (reflection, refraction, diffraction and interference) and contribute in affecting the sediment balance.

In addition, infrastructure has created and continues to create fragmentation and often sharp separation between adjacent areas. The severity of damage perpetrated varies from area to area and is directly related to mitigation actions or increased urbanization works.

4.2.3.8 Qualitative descriptors: Contaminants (D8)

The concentration of contaminants in the marine environment and their effects are assessed taking into account the provisions of Directive 2008/56/EC, as required by Decision 2010/477/EU of September 2010 and the new Decision 2017/848 of May 2017, as well as the relevant provisions of Directive 2000/60/EC for territorial and/or coastal waters so as to ensure proper coordination of the implementation of the two legal frameworks. Substances or groups of substances were considered that: (1) are included in the list of priority substances in Annex X of Directive 2000/60/EC and further regulated in Directive 2013/39/EC; (2) are discharged into the affected marine region, subregion, or subdivision; (3) are contaminants and their release into the environment poses significant risks to the marine environment due to past and present pollution in the affected region, subregion, or subdivision. The data used for this new quality status assessment come both from specific monitoring conducted under the Marine Strategy Directive and from monitoring of marine coastal bodies conducted under the Water Framework Directive. The same GESs and Targets currently in place in the October 17, 2014 Decree are re-proposed. In general, the percentage of data coverage, although different for the various matrices and subregions, is not large enough to allow a judgment of environmental status as set forth in the definitions of GESs in the Decree of October 17, 2014.

As regards the targets, a comparison with the elaborations carried out in the previous assessment in 2012, although the assessment areas are different, shows the following:

- Biota

The investigated parameters were grouped into specific categories of contaminants (Metals, Polycyclic Aromatic Hydrocarbons (PAHs), Fluoranthene, Hexachlorobenzene (HCB), Hexachlorobutadiene (HCBD), pesticides/biocides and organochlorine compounds). It should be noted that due to the resident and physiological characteristics of bivalve mollusks, the assessment of concentration data for this species was defined over an area that covers the range of existence of these organisms, i.e., up to the 20 m bathymetry in the Adriatic Sea subregion. The available data, integrated and indexed, showed no exceedances of the threshold value of the different parameters, except for the parameter mercury. In detail, mercury exceedances recorded for shellfish are about 36 percent of the collected data, while for demersal species exceedances reach 100 percent for the Adriatic Sea area (Fig. 4.31).

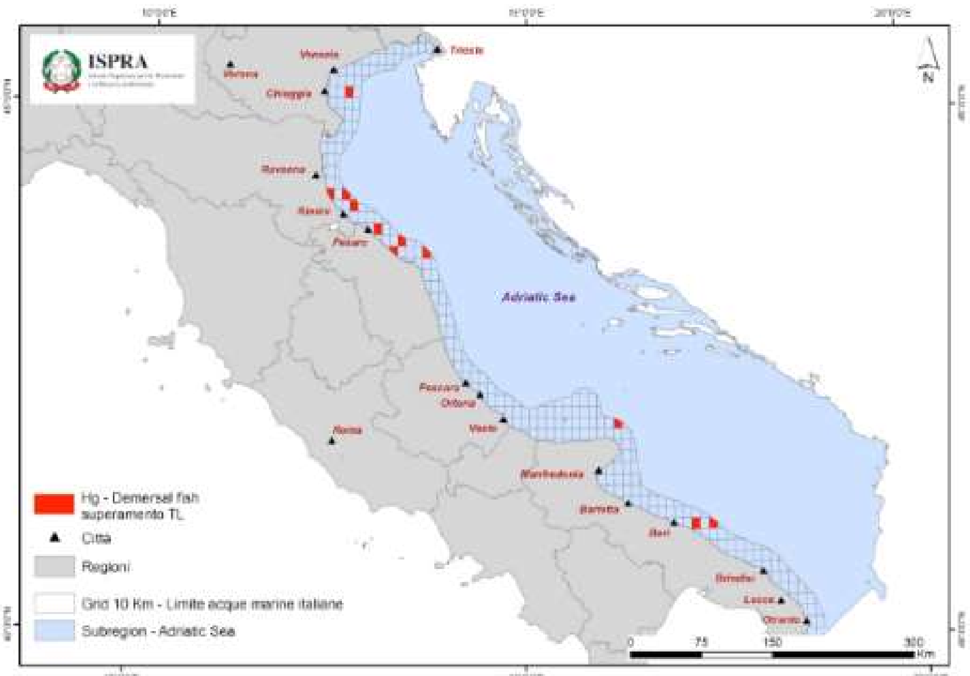


Figure 4.31 Distribution of Hg concentrations in demersal species in the Adriatic marine area (Source of data: Report 2018 MSFD)

- Sediments

The investigated parameters were grouped into specific contaminant categories (Metals, PAHs, organochlorine compounds, HCB and TBT). The evaluation of concentration data was carried out by distinguishing the coastal zone under the jurisdiction of the WFD from the offshore zone up to the limit of territorial waters for the maritime area in question.

In this area, the data provided show a qualitatively good status as the percentages of exceedances of threshold values for all contaminant categories are less than or equal to 20 percent. Specifically, metals and PAHs are the categories with the highest percentages of exceedances (Figures 4.32 and 4.33).

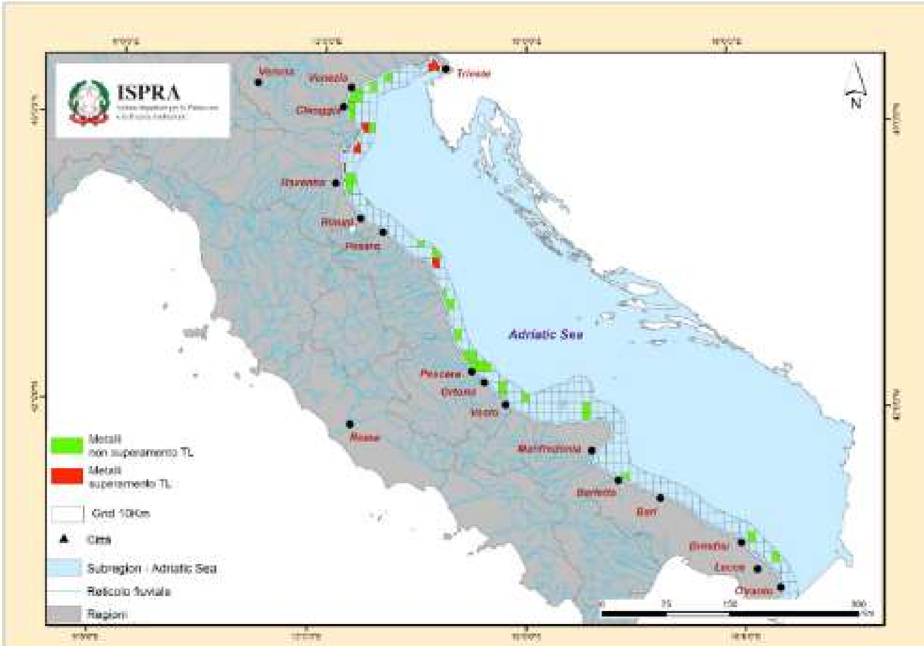


Fig. 4.32 Distribution of metal concentrations in the offshore areas of the "Adriatic" marine area (Source of data: Report 2018 MSFD)

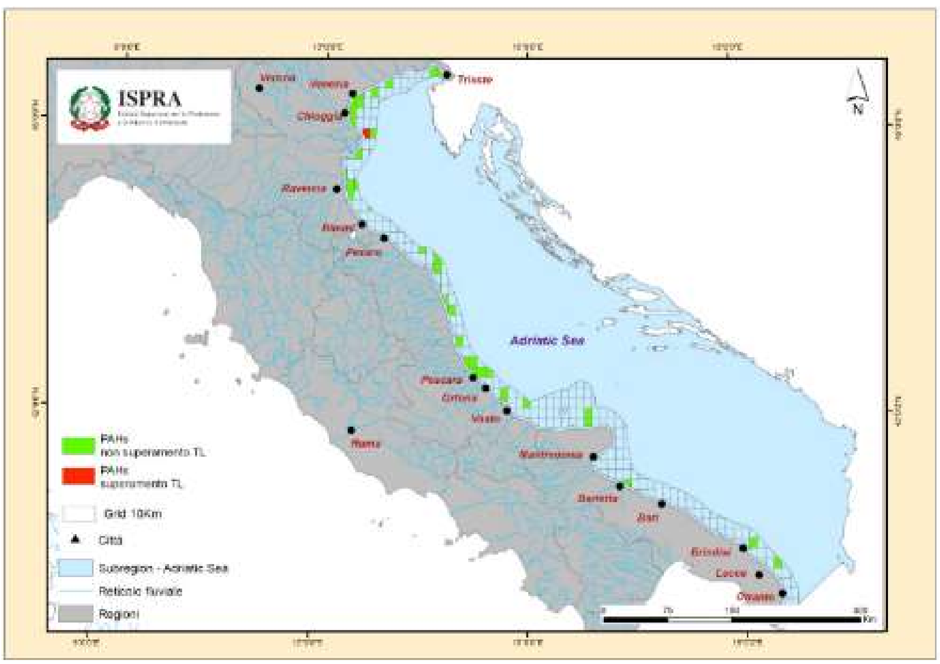


Fig. 4.33 Distribution of IPA concentrations in the offshore areas of the "Adriatic" marine area (Source of data: Report 2018 MSFD)

➢ Water

As with other matrices, the investigated parameters were grouped into specific contaminant categories (Metals, PAHs, organochlorine compounds, pesticides, BTEX, phenols, HCBDs, and organotin compounds). Concentration data were evaluated by distinguishing between the coastal WFD area and the offshore area up to the limit of territorial waters for the "Adriatic" marine area. In general, as regards the offshore area, the data provided allow for a qualitative assessment of the status, as the percentages of exceedances of threshold values are less than 8%. The exceedances found were recorded for several categories of contaminants, mainly in the WFD area. For the "Adriatic" marine area, the recorded exceedances concern metals (Fig. 4.34).

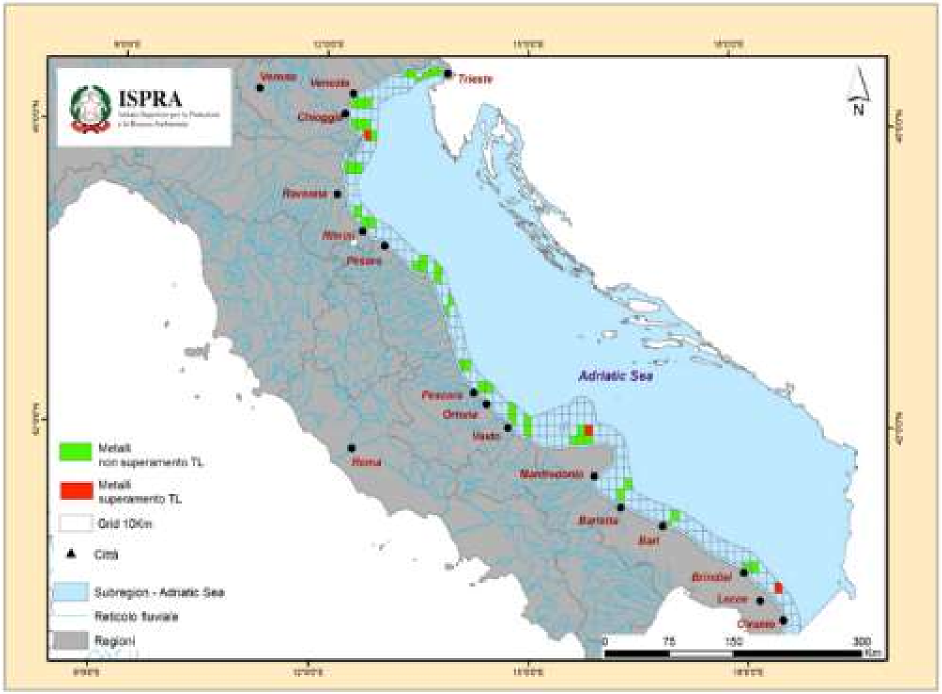


Fig. 4.34 Distribution of metal concentrations in the offshore areas of the "Adriatic" marine area (Source of data: MSFD Report 2018)

4.2.3.9 Qualitative descriptors: Contaminants in seafood (D9)

Nella Marine Strategy Framework Directive (EC/2008/56 – Cycle II 2018-2024) the contaminants in commercial fishing products are envisaged within the context of the qualitative Descriptor for the achievement of Good Environmental Status No. 9 that states "*Contaminants in fish or other seafood for human consumption do not exceed levels established by Union legislation or other relevant standards*". As regards Descriptor 9, in application of the Marine Strategy Directive (2018-2024), transposed by Leg. Decree 190/2010, Italy has determined the requirements for Good Environmental Status (GES) (Annex 1 of M.D. February 15, 2019, No. 36) with the following definition:

- G 9.1 Concentrations of contaminants detected in samples of fishery products from national waters are within legal limits for human consumption (Reg. 1881/2006 as amended).

Min. Decree (36/2019) also states, in Annex 2, defines the following environmental target:

- T 9.1 Aims at decreasing the concentration of contaminants in samples of fishery products from domestic waters that do not comply according to the limits set by current legislation (Reg. 1881/2006, as amended).

Criteria and methodological standards for good environmental status of marine waters as well as specifications and standardized methods for monitoring and assessment have been updated and defined by the new Commission Decision (EU) 2017/848 of May 17, 2017.

The primary criterion of the Decision (EU) for contaminant assessment in fishery products of commercial use is as follows:

- D9C1 — Primary: The level of contaminants in edible tissues (muscle, liver, roe, flesh or other soft parts, as appropriate) of seafood (including fish, crustaceans, molluscs, echino- derms, seaweed and other marine plants) caught or harvested in the wild (excluding fin-fish from mariculture) does not exceed: a) for contaminants listed in Regulation (EC) No 1881/2006, the maximum levels laid down in that Regulation, which are the threshold values for the purposes of this Decision; b) for additional contaminants, not listed in Regulation (EC) No 1881/2006, threshold values, which Member States shall establish through regional or subregional cooperation.

The parameters considered, listed in Regulation (EC) No. 1881/2006 and following are: Metals (Lead, Cadmium, and Mercury); Dioxins and PCBs; Polycyclic Aromatic Hydrocarbons (PAHs). The latest assessment of the GES under Art. 8 of the MSFD was carried out by ISPRA in the 2018 MSFD Report. The data used for the quality status assessment come from specific monitoring carried out for the Marine Strategy Directive according to WP 5.1 (Decree February 11, 2015). Figure 4.35 shows for the Adriatic marine area the spatial distribution of the MSFD monitoring carried out by the CNR (ISPRA 2018).

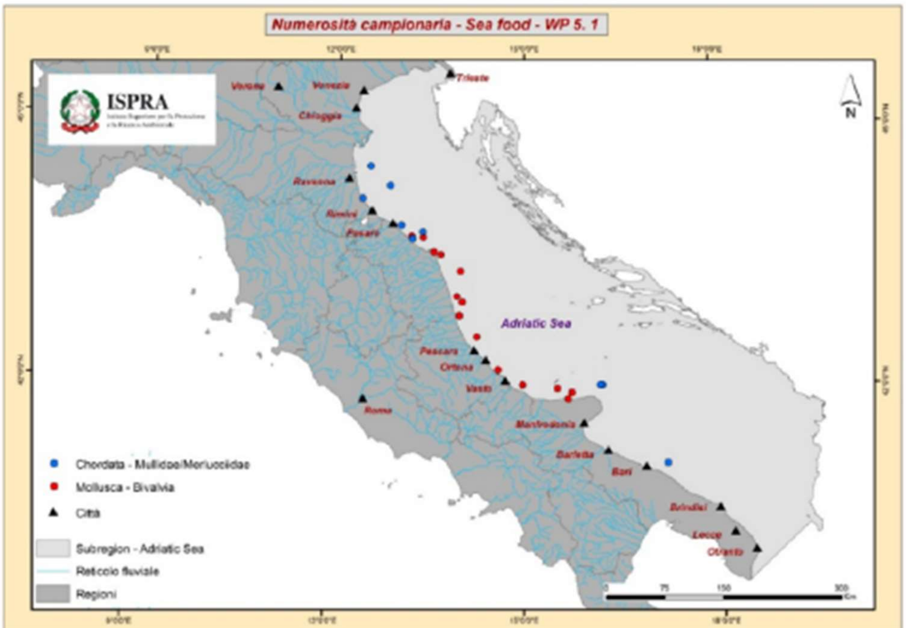


Fig. 4.35– Spatial distribution of the sampling stations of the AS sub-region

Source: ISPRA, Summary report MSFD 2018 – D9

An initial estimate of the spatial coverage of the data by Reg. 1881/06 categories and by subregion was made. As reported in Tables 4.9-4.10-4.11, the percentage of coverage is not large enough to allow a meaningful representation of the quality of the sub-region itself. The Adriatic Sea sub-region shows a higher percentage of coverage than the other two sub-regions.

Tab 4.9 Percentage of coverage for the Metals class.

Source: ISPRA, Summary report MSFD 2018 – D9

Reg 1881/06						
Sottoregione	Cd 3.2.5	Cd 3.2.9	Hg 3.3.1	Hg 3.3.2	Pb 3.1.5	Pb 3.1.7
AS (%copertura)	16,67	22,22	22,22	16,67	16,67	22,22
WMS (%copertura)	9,47	2,11	4,21	7,37	9,47	2,11
ISCMS (%copertura)	2,94	5,88	5,88	2,94	2,94	5,88

Tab 4.10 Percentage of coverage for the IPA class
Source: ISPRA, Summary report MSFD 2018 – D9

Reg 1881/06		
Sottoregione	Benzo(a)pirene 6.1.6	Sum IPA 6.1.6
AS (%copertura)	22,22	22,22
WMS (%copertura)	2,11	2,11
ISCMS (%copertura)	5,88	5,88

Tab 4.11 Percentage of coverage for the Organochlorines class.
Source: ISPRA, Summary report MSFD 2018 – D9

Reg 1881/06		
Sottoregione	Diossine - PCBdl 5.3	Diossine - 5.3
AS (%copertura)	16,67	16,67
WMS (%copertura)	9,47	9,47
ISCMS (%copertura)	2,94	2,94

In general, the percentage of data coverage is not large enough to make a judgment on environmental status as set out in the definitions of GESs in Ministerial Decree No. 36 of February 15, 2019.

However, it should be noted that the available data on contaminant concentrations detected in samples of fishery products do not show exceedances of threshold values for metals (Cd; Pb; Hg), nor for polycyclic aromatic hydrocarbons (PAHs: benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and chrysene), nor for organochlorines (Fig. 4.36, Fig. 4.37, Fig. 4.38, Fig. 4.39).

Thus, a qualitative improvement can be seen in general from a comparison with the data compiled in the past Initial Assessment (IA) in which exceedances were found for metals in all three subregions, although the coverage percentages are lower than in the past assessment (Ispra, 2018).

The codes shown in the figures correspond to the following food items:

3.1 Lead: 3.1.5 Fish muscle; 3.1.7 Bivalve mollusks

3.2 Cadmium: 3.2.5 Fish muscle; 3.2.9 Bivalve mollusks

3.3 Mercury: 3.3.2 Fish muscle; 3.3.1 Fishery products and fish muscle, excluding species listed in 3.3.2

5 Dioxins and PCBs: 5.3 Muscle meat of fish and fishery products and their derivatives, excluding eel

6.1 Polycyclic aromatic hydrocarbons (Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and chrysene): 6.1.6 Bivalve molluscs.

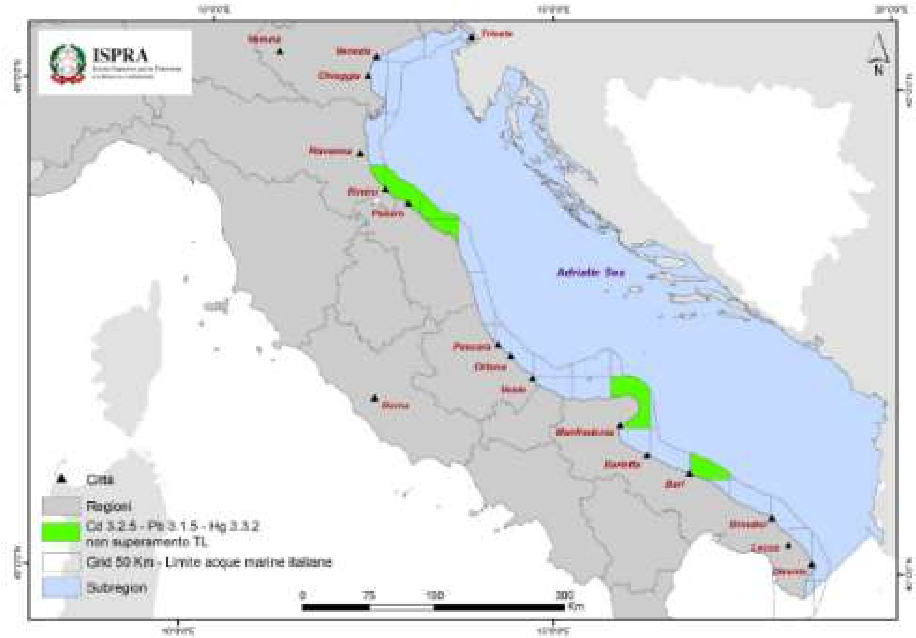


Fig. 4.36 Distribution of concentrations of Cd 3.2.5, Pb 3.1.5 and Hg 3.3.2 in the" Adriatic" marine area

Source: ISPRA, Summary report MSFD 2018 – D9

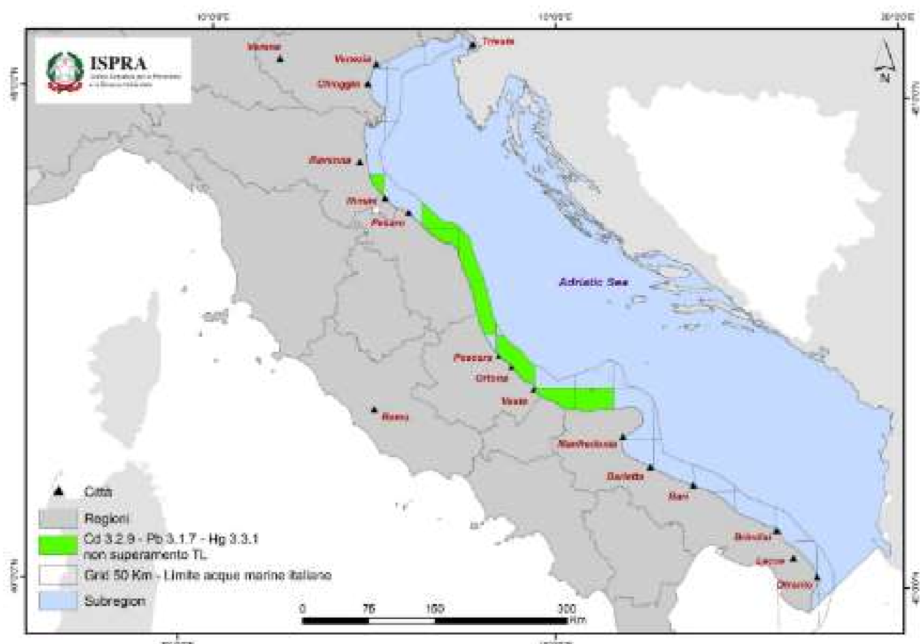


Fig. 4.37 Distribution of concentrations of Cd 3.2.9, Pb 3.1.7 and Hg 3.3.1 in the "Adriatic" marine area

Source: ISPRA, Summary report MSFD 2018 – D9

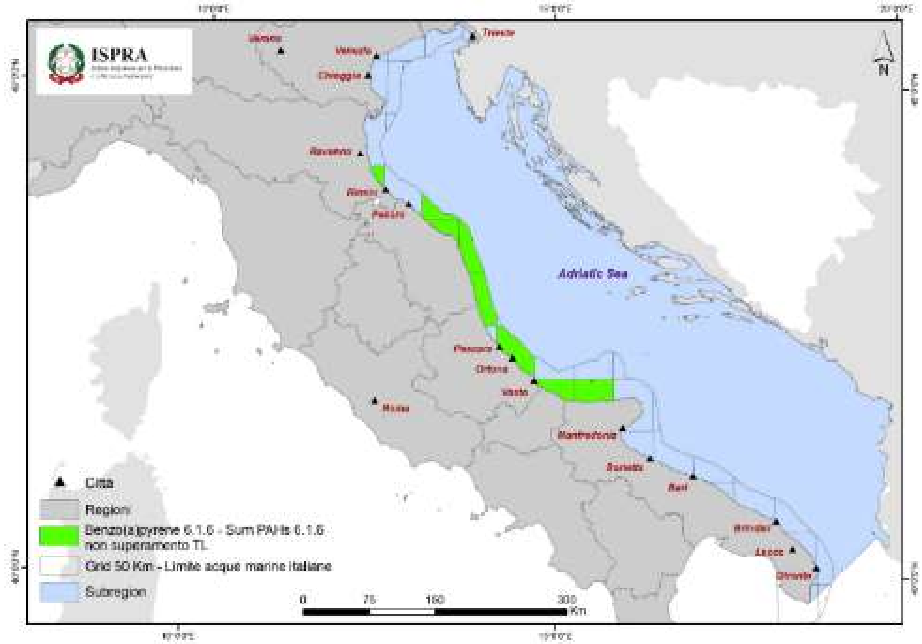


Fig. 4.38 Distribution of concentrations of Benzo(a)pyrene 6.1.6 and sum IPAs in the ”Adriatic” marine area

Source: ISPRA, Summary report MSFD 2018 – D9

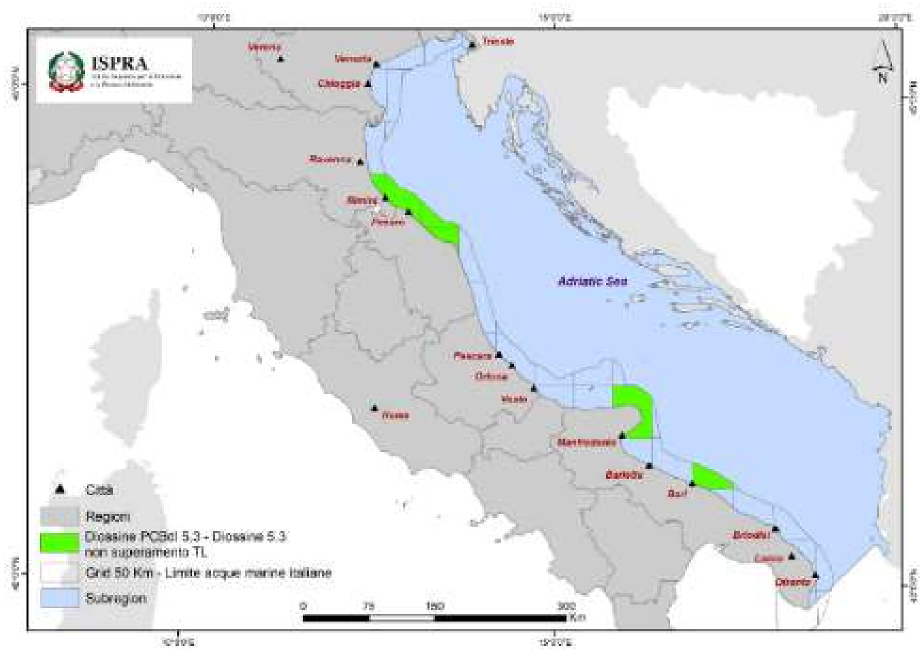


Fig. 4.39 Distribution of concentrations of Dioxins PCBdl 5.3 and Dioxins 5.3 in the “Adriatic” marine area
Source: ISPRA, Summary report MSFD 2018 – D9

4.2.3.10 Qualitative descriptors: Marine litter (D10)

Pollution from human waste is in most cases the effect of the industrial production of consumer goods and results in adverse effects on all environments, including the marine environment.

For many decades, consumer goods produced and used by humans have been made mainly of plastics, so after decades of releasing plastics into the environment they have become a major pollutant worldwide. Due to the durability of plastics, low recycling rates, poor urban waste management and their use in the maritime environment (fishing, aquaculture, etc.), a significant portion of plastic items have the sea as their final destination. Plastic materials have been found everywhere in the oceans, from beaches to the seabed. What is more, in the latter environmental settings, plastic degradation is hindered by decreasing mechanical (wave abrasion forces) and photolytic (UV radiation, temperature change) forces.

Waste enters marine ecosystems from terrestrial (land-based) and marine (sea-based) sources. The former category includes coastal infrastructure, tourism and recreation, industrial activities and agriculture; the latter category includes tourism and recreation near the coast, fishing, aquaculture, shipping, oil and gas refineries, military activities and submarine communication cables.

Once in the sea, plastic waste can travel immense distances, carried by currents and winds, it being incredibly durable especially in the aquatic environment. The result is that plastic waste constantly accumulates and only slowly degrades into smaller particles, called microplastics, which likewise continue to have a harmful effect on the surrounding environment. It is estimated that about five trillion pieces of plastic, weighing 250,000 tons, currently float in the seas, while estimates of the total amount of plastic waste in the oceans (floating and deposited on the sea floor) put the figure at about 150 million tons, with an increase each year of about 8 million tons. Data regarding beached marine litter are the result of monitoring campaigns conducted from October 2015 to March 2017 (one campaign per season for a total of eight campaigns).

As for the Adriatic, the sampling effort was 8 km and the results are shown in the following figure 4.41. In this area, a percentage close to 80 percent of this beach litter consists of plastics.

The data regarding floating litter are the result of the monitoring campaign conducted over three years, from October 2013 to September 2016 (Fig. 4.40). The values of floating litter density, again, are higher for the Adriatic Sea, with a value almost double that of the other monitored sea segments. Also in the Adriatic Sea, the share of litter of natural origin is very low, and equal to 8 percent, higher only than in the segment related to the channel between Sardinia and Sicily (SSCC) where, compared to a density value of 2.82, the portion of litter of natural origin is only 3 percent.

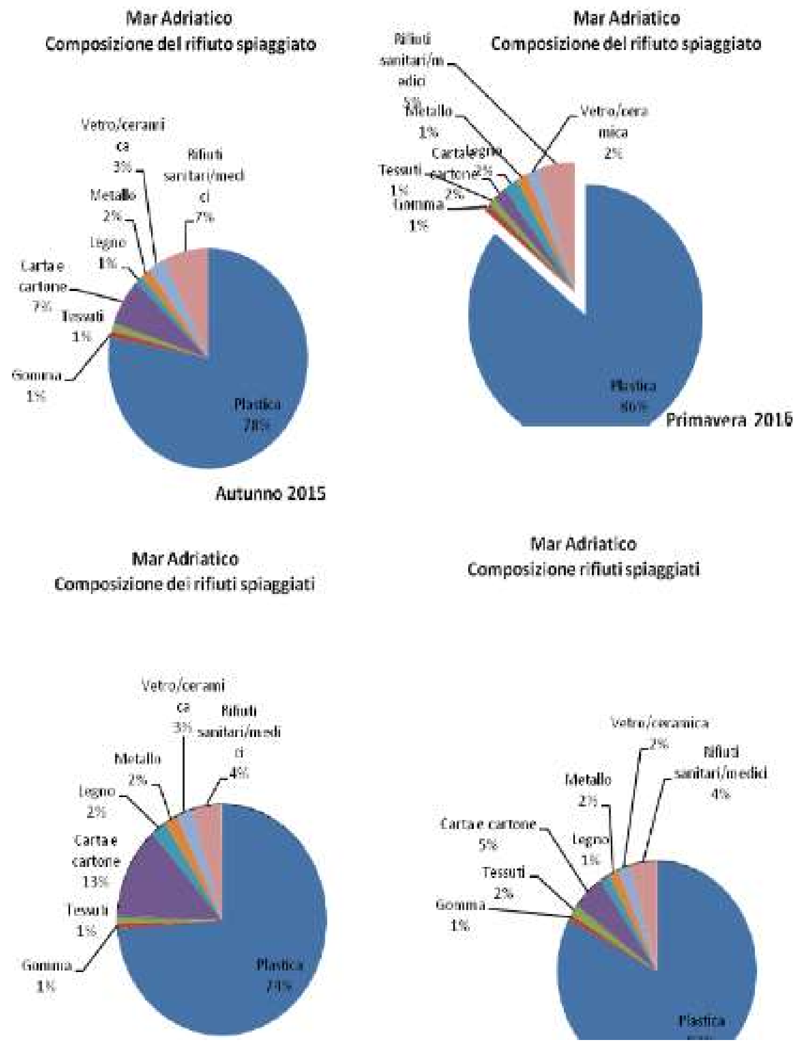


Fig. 4.40 Percent composition of beached waste broken down by macro-categories by season related to the "Adriatic" marine area (number of items/100 m of beach) (Source: Report 2018 MSFD)

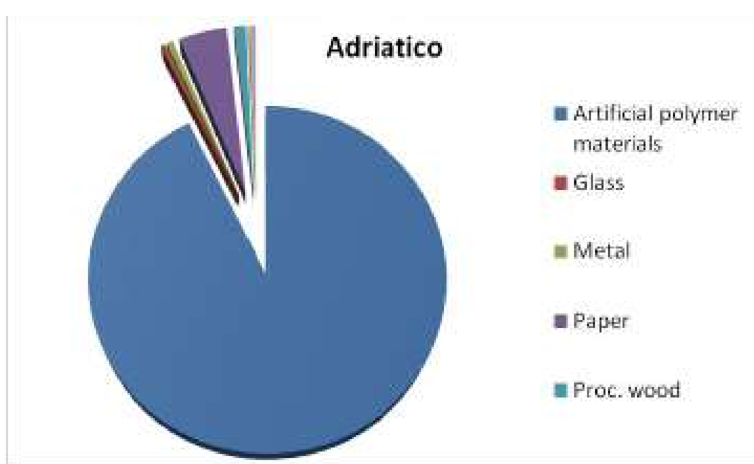


Fig. 4.41 Composition of floating waste in the "Adriatic" marine area (Source: Report 2018 MSFD)

As regards the litter found on the seabed, the most common types found, especially in the Mediterranean and Northeast Atlantic, are soft plastics (e.g., shoppers and bags), hard plastics (e.g., bottles, sundry containers), glass and metal (cans). Additional wastes accumulated on the sea-floor also include oil drums and radioactive waste containers that remain lying, stranded or silted, on underwater slopes and rocky outcrops. Data regarding the sea bottom litter component are derived from the MATTM-CNR Monitoring Program for the year 2016.

No sampling area under Italian jurisdiction was chosen for the "Adriatic" Marine Area. This means that it is reported that monitoring of litter on the sea bottom should also be carried out here. Nonetheless, at the local level in 2018 the project "In rete contro un mare di plastica - Fishing for Litter experimental project" was carried out by Legambiente together with other actors including the Port Authority of Porto Garibaldi and the Municipality of Comacchio in Emilia Romagna (Northern Adriatic Sea) with the aim of collecting waste accidentally recovered at sea by fishermen during trawling. In about 90 days, more than 3,300 kilograms of waste found on the seabed were collected. Of this litter, about 97 percent was plastic waste, followed by 1.4 percent metal waste and less than 1 percent textile or rubber waste (Fig. 4.42).

More than 80 percent of the waste came from fishing and aquaculture activities: among the plastic materials it was found that more than 80 percent were socks used for mussel farming (Fig. 4.43).

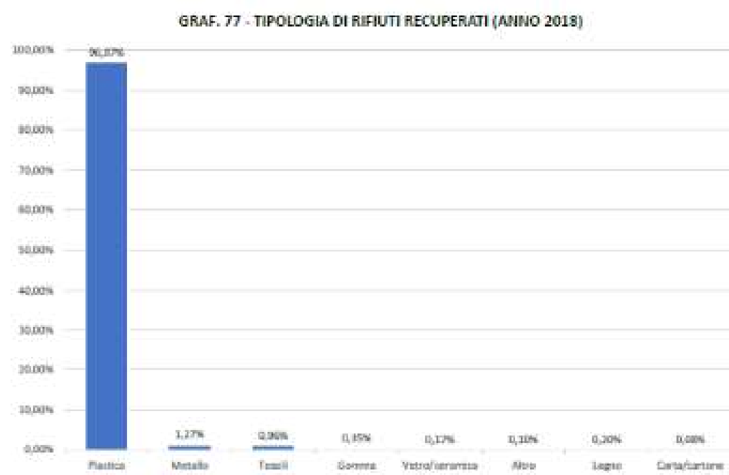


Fig. 4.42 Final results of the experimental project ‘Fishing for Litter’ (a) (Source: Experimental project “Fishing for Litter”, presentation of final results)

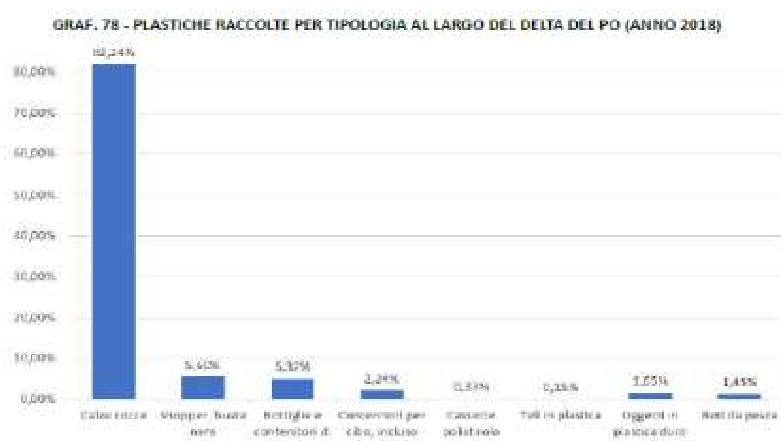


Fig. 4.43 Final results of the experimental project ‘Fishing for Litter’ (b) (Source: Experimental project “Fishing for Litter”, presentation of final results)

The project called "Life-Ghost - Techniques to Reduce Impacts of Ghost Nets and Increase Biodiversity in the Coastal Areas of the North Adriatic Sea" had among its participants the CNR - Institute of Marine Sciences and aimed to define a list of good practices to reduce the impact on marine ecosystems of fishing gear abandoned or lost on the seabed.

The preliminary analysis covered 20 km² of coastline off the Venetian coast and found the presence of 362 objects referable to ALDFGs (abandoned, lost or otherwise discarded fishing gear), with a total weight of more than 500 kg. One-third of these consisted of trawl nets and about one-quarter of trammel nets. The type of gear found is indicative of the type of local activity, e.g., the lower occurrence of mussel socks indicates that the area has little involvement in this activity (Fig. 4.44).

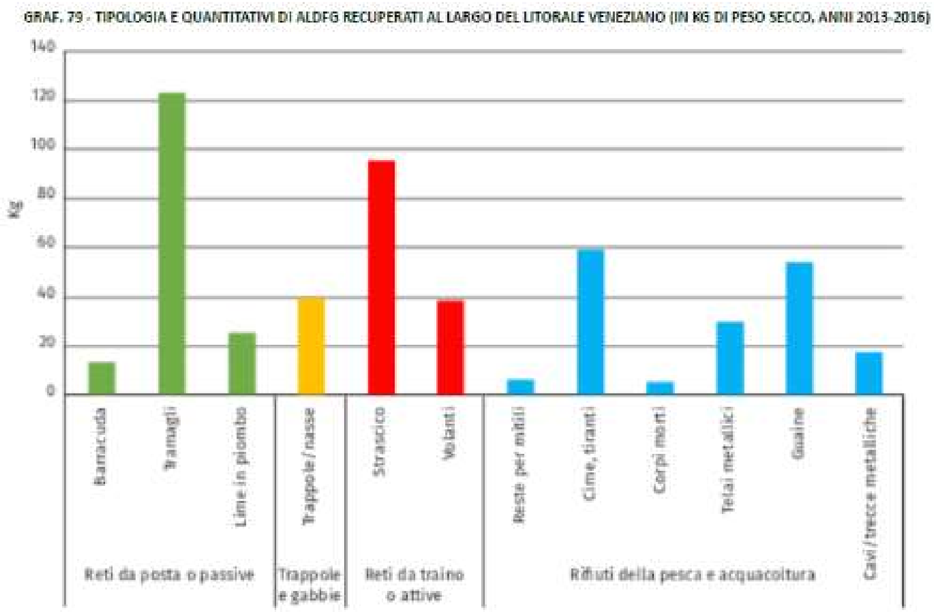


Fig. 4.44 Final results of the Life-Ghost project (Source: GHOST, Operation manual to prevent and mitigate the abandonment of fishing gear at sea)

Microplastics in the sea have a dual primary and secondary origin. Primary includes the production of microparticles such as pellets and microgranules used in cosmetics or abrasive cleaning products produced by industries. The secondary origin comes from fragmentation and degradation into small particles from macroplastics. Data analysis (Fig. 4.45) shows that the highest percentage for the Adriatic sea area is fragments, and the micro-waste identified is therefore mainly of secondary origin.

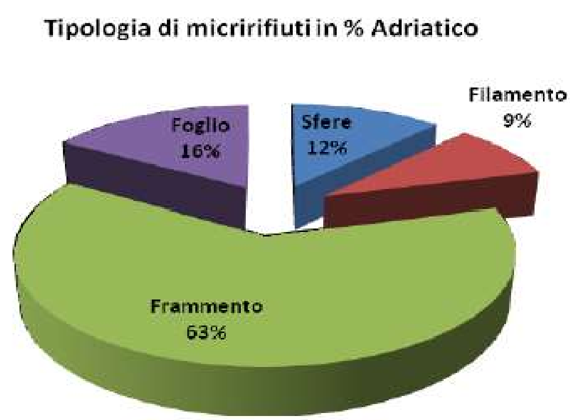


Fig. 4.45 Percent composition of micro-waste in the water column, broken down by category in the "Adriatic" marine area (Source: Report 2018 MSFD)

Waste pollution, including plastic waste, causes deep and lasting damage to the marine ecosystem. It is assumed that waste can change the structure and functioning of ecological communities, which in many cases show an increase in the mortality rate of the living organisms that comprise them. Seabirds, turtles, mammals and fish are known to ingest large amounts of plastic by mistaking it for food.

In most cases, ingestion of waste is not lethal, although it can result in harmful effects such as possible injury or adversely affects the overall health of organisms in the long run.

Litter promotes the worsening of invasions of non-indigenous species.

Litter movements have been related precisely to the spreading patterns of non-indigenous species, showing that microbial communities in marine litter are always different from those in surrounding environments, prompting scientists to name this habitat by the neologism 'plastisphere'.

4.2.3.11 Qualitative descriptors: Underwater noise (D11)

A significant portion of the Mediterranean Sea is mainly affected by continuous underwater noise caused by human activities, particularly by shipping. Some of the areas subjected to the most anthropogenic noise coincide with important habitats for cetaceans, which are among the marine organisms most disturbed by noise. Marine species show a wide range of negative responses to noise. Effects observed in marine mammals include changes in vocalization, stress, changes in respiration, increased swimming speed, loss of orientation, sudden and longer dives, changes in migration paths, strandings, changes in foraging and breeding behavior and auditory physiological damage. However, despite differences in impact, anthropogenic noise does not only affect certain species considered noise-sensitive. Indeed, chronic noise exposure also affects fish and invertebrates similarly to aquatic mammals by causing disturbances in growth and reproductive processes, stress, increased heart rate, increased motility, migration and hearing loss.

In the aquatic context, the main negative effects include:

- changes in seasonal distributions and movements;
- changes in spatial and social behavior;
- reduced detection of communication signals;
- increased stress hormones;
- temporary hearing loss and damage to auditory systems;
- reduced local abundance and capture rate.

The Marine Strategy Framework Directive (MSFD) moves in the same direction and distinguishes two main types of marine noise:

- impulsive sound, i.e., loud, intermittent or infrequent noise, such as that generated by piling, seismic surveys and military sonar;
- continuous sound, constant lower-level noise (e.g., generated by ships and wind turbines).

To improve the quality of the environmental status of EU marine waters, the MFSD aims to avoid or limit the negative influence of noise on marine life, which is particularly complex because sound travels rapidly through water, four times faster than through air. Thus underwater noise can be perceived by marine organisms even dozens of kilometers away. The Mediterranean Sea area is particularly exposed to continuous noise: an estimated 9 percent of Europe's marine area is exposed to very high-density ship traffic. Indeed, the largest area of such traffic is the Mediterranean Sea (27 percent). Impulsive sound, i.e., noise produced by pile driving for onshore and offshore construction, seismic surveys to inspect underwater oil and gas deposits, explosions and some sonar sources, affects the Mediterranean Sea to a lesser extent (18%).

With a view to initiating constant monitoring of marine noise and monitoring noise pollution in the sea, the Cetacea Foundation installed eight self-regulating buoys with hydrophones in the Adriatic Sea in 2020 as part of the Soundscape Project carried out with funding from Interreg Italy-Croatia.

4.2.4 Biodiversity and natural areas under protection

4.2.4.1 Marine Protected Areas: general information, description of habitats, ecosystem services

Marine Protected Areas[39] are a management tool for achieving sustainability goals in social-ecological systems. Together with the Natura2000 network and the OECMs (Other Effective Area-based Conservation Measures - CBD) they cover 19.1 percent of the national marine area (Sixth National CBD Report, presented in April 2019). They are, in addition, key tools for the conservation of coastal ecosystems.

The establishment of new MPAs involving the application of specific conservation measures makes it possible to contribute to the strengthening of the protection of Natural Capital stocks consisting, for example, of *Posidonia oceanica* seagrass beds and seabed characterized by the presence of coralligenous species and at the same time to encourage sustainable economic activities that are important for local communities. All species of marine spermatophytes in the Mediterranean are present along the Italian coasts: *Posidonia oceanica*, *Cymodocea nodosa*, *Zostera noltii*, and *Halophila stipulacea*. Of the four species, *Posidonia oceanica* is by far the most widespread and abundant, and is present along much of the Italian coastal perimeter.

Posidonia oceanica [40]meadows are not as widespread along the "Adriatic" marine area except along the Apulian coast of the southern Adriatic where, however, they are subject to regression as is the case in much of the Italian coast. In the Mediterranean Sea, the Gulf of Trieste represents the northern distributional boundary of *Posidonia oceanica*. The most extensive seagrass meadow is located near Koper, on the Slovenian coast of the Gulf of Trieste. It is currently limited to a narrow area in front of the Grado lagoon, with isolated small-sized patches. Residual plants of *Posidonia oceanica (L.) Delile* (total area covered: about 5 ha) occur at a depth of 3 to 4.5 m and grow only on the rocky substrate, while the surrounding incoherent seabed is colonized by dense seagrass beds of *Cymodocea nodosa*. The intrinsic biological value of *Posidonia oceanica* in the Upper Adriatic Sea is related to its genetic identity. The trend in habitat extent is stable, although moderate signs of regression are found along coastal waters characterized by urban, industrial and agricultural pressures. Much greater, however, is the total extent of habitat in the southern Adriatic, particularly along the Apulian coast. The nature and structure of the substrate, as well as the presence of urban, industrial and agricultural settlements, greatly influence the establishment and development of this habitat.

In the southernmost sector of the Adriatic, the habitat is present on small patches of rock south of Punta Faci (Otranto), and from Otranto to Bari. However, along the Brindisi coastline, which extends more than 60 km NW of Brindisi to the coastal town of Monopoli (Bari), *Posidonia oceanica* seagrass beds show a generally healthy state and a good degree of conservation.

This is probably also due to the presence of the "Torre Guaceto" MPA and extensive SCI/ZSC sites.

In recent decades, *Posidonia oceanica* meadows have been severely threatened by direct anthropogenic pressures, such as physical removal and eutrophication, and by climate change (Badalamenti et al., 2011). It has been estimated that these seagrass beds in the last 50 years have regressed by 34 percent in the Mediterranean and 25 percent along the Italian coast in particular (Telesca et al., 2015).

Posidonia oceanica is an essential component of beach morphodynamics also through the deposition of leaves that go to form plant mounds, known as banquettes (Simeone et al., 2013), with which it contributes to determine the geomorphological variability of beaches throughout the year. Thus it constitutes a significant component of the volume of coastal barriers, dunes and the material exchanged between the emerged and submerged beach during storm surges.

A survey of 144 Mediterranean coastal municipalities from Spain, France, Italy, Greece, and Cyprus (Med POSBEMED - 2017), in order to understand what practices and tools were used in beach management, revealed that removal of beached Posidonia is a common practice on many Mediterranean beaches, along with cleaning and flattening activities by beach lidos. About 83 percent of the municipalities surveyed remove Posidonia deposits on some or all of their beaches each year. Removal is practiced 3 or more times a year in more than half of the locations, while beach cleaning and beach leveling is practiced at all concession beach facilities.

[39] Carta delle Aree Marine Protette - MSP_ADR_AMBD001_AMP

[40] Carta della distribuzione della Posidonia oceanica -MSP_ADR_AMBD008_Posidonia

The study found that heavy machinery such as excavators are the number one choice in about 40 percent of cases. This is in spite of the significant impact this type of equipment could have on beaches and the associated coastal environment (shoreline retreat due to modification of the dynamic behavior of the beach, subtraction of sediment from beaches, subtraction of biomass and nutrients from the coastal ecosystem, soil pollution e.g., heavy metals). Regarding habitat 1170 "Reefs", the northern Adriatic is characterized by coralligenous formations, subject to specific protection measures, called "trezze" or "tegnùe". These unique hard-bottom bioconstructions in a predominantly sandy/muddy context are mainly concentrated between the Po Delta and the Gulf of Trieste, at a distance from the coast varying between 0.5 to 21 km and at depths between 7 to 25 m. Coralligenous formations extend almost uninterruptedly along the coasts of Marche, Abruzzo, and Molise. Along the north-south gradient, coralligenous formations thin out to the Gargano promontory. Past the Gulf of Manfredonia, coralligenous formations occur in the form of a few sparse patches. The bathymetric range of the southern Adriatic coralligenous habitat is between 10 and 140 m. This habitat shows a non-continuous distribution, i.e. while at shallow depths it is rather sparse, toward the sea bottom it forms extensive platforms of secondary biogenic substrate, with an extremely variable and complex three-dimensional conformation, reaching a height between 1 and 2.5 m on the lower surface. Rather interesting are the coralligenous formations along the coast of Polignano a Mare (BA) and those south of Otranto (LE). In general, little and uneven knowledge is recorded on the distribution of maërl and rhodolites. From Venice to Grado, the maërl and rhodolith habitat is characterized by a total of 12 taxa, found as both fossil and living thalli, with an uneven distribution between 9 and 24 m in depth.

In particular, these bioconstructions turn out to feature the rhodolith *Lithophyllum racemus*, while on pelitic-sand sediments the two characteristic species of the maërl association are *Lithothamnion corallioides* and *Phymatolithon calcareum*, together with *Lithothamnion minervae*.

Many of the ecosystem services generated by *Posidonia oceanica* and coralligenous habitats from a qualitative-quantitative perspective are not yet well known (IV REPORT of Natural Capital 2021).

Marine seagrasses constitute highly productive and complex ecosystems that generate important supply, regulatory and cultural ecosystem services, such as maintaining nursery habitats for commercially important fish species, preventing shoreline erosion and, most importantly, regulating climate through the sequestration and storage of significant amounts of carbon, known as "coastal blue carbon" (Howard et al., 2014). In fact, it has been estimated that, while affecting less than 0.2 percent of the global ocean surface, marine seagrasses sequester about 27 million tons of carbon (C) per year, or 10 percent of the carbon annually sequestered by the oceans on a global scale (Fourqurean et al., 2012). The nursery ecosystem service has been identified but not quantified (Dìaz-Gil et al., 2019), as has its role as a shelter (Vega Fernàndez et al., 2005; Zubak et al., 2017).

Conversely, the importance of *Posidonia oceanica* seagrass beds in determining high biodiversity values of associated fish populations is recognized (Guidetti, 2000). However, more data and insights are needed to quantify the role played by seagrass beds. The Natural Capital function of seagrass beds does not end with the ecosystem services mentioned above. For example, Posidonia seagrass meadows can be a very effective filter capable of abating up to 50 percent of the burden of bacteria that are pathogenic to humans and to other marine organisms (Lamb et al., 2017), and they can exert the function of trapping microplastics not only within matte but also in aegagropila, spherical structures composed of the fibers of dead leaves (Sanchez-Vidal et al., 2021). Additionally, marine seagrasses also play an important role in sedimentary processes in Mediterranean coastal environments (Coppa et al., 2019). The data available for coralligenous formations, white coral and maërl habitats from monitoring activities conducted by ARPA and the CNR do not allow for an assessment of any loss or maintenance of these habitats, but they have brought more knowledge about the distribution and condition of these habitats in the Italian seas, going to form a baseline for the current implementation cycle of

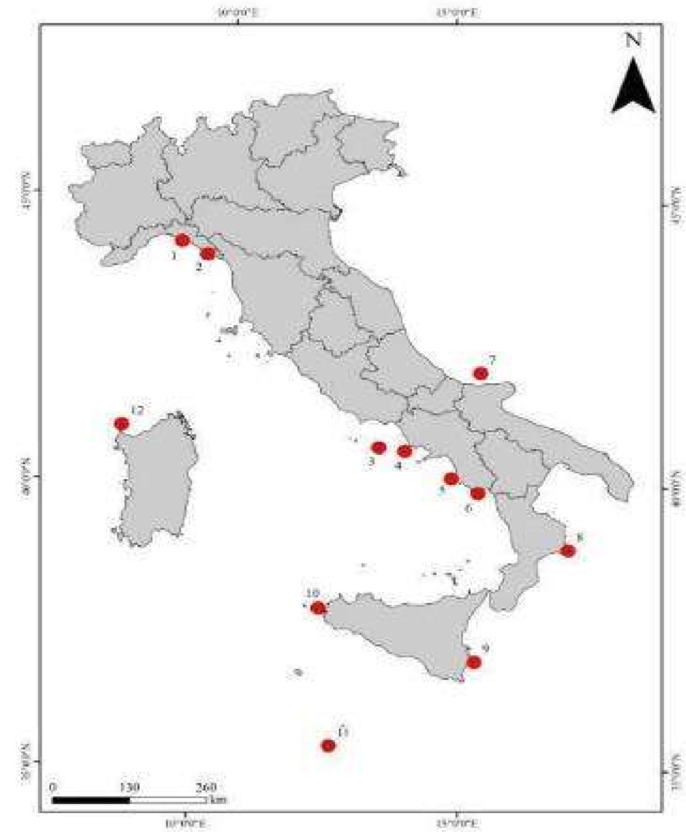


Fig. 4.46 Distribution of MPAs for which data on ecosystem services are reported.: 1) Portofino, 2) Cinque Terre, 3) Ventotene-S. Stefano, 4) Regno di Nettuno; 5) S. Maria di Castellabate; 6) Costa degli Infreschi e della Masseta; 7) Isole Tremiti; 8) Capo Rizzuto; 9) Plemmirio; 10) Isole Egadi; 11) Isole Pelagie; 12) Isola dell'Asinara. (Source: IV CNN 2021).

the Marine Strategy, for which improved and updated monitoring protocols have been prepared. Both coralligenous and maërl formations are being studied, and will be the subject of the CNN Report 2023. Specific technical and scientific methodologies are needed to assess the consistency and health of habitats and species, and to characterize the main economic activities present, so as to provide for their appropriate regulation to ensure the conservation and enhancement of the environmental values present. In this respect, marine protected areas represent concrete laboratories for the experimentation of good practices of integrated planning and management (consistent with the provisions of Objective 4 of the Marine Strategy Framework Directive (MSFD)), to be extended outside their perimeters to spread the application of measures, for the proper management and conservation of marine environmental resources. A step forward in aligning marine protected areas with the Environmental Economic Zones (EEZs), established in 2019 and coinciding with the territory of National Parks, was achieved through the September 2020 "Simplification and Digital Innovation" Law.

This intervention aligns the importance of marine protected areas with that already recognized for national parks in supporting the development of sustainability policies. There are two major consequences, first to move Italy forward toward building a comprehensive system of national protected areas, and second to strengthen and enhance the environmental, social and economic functions performed by national protected areas for the protection of Natural Capital. The total value of ecosystem services was calculated for 12 MPAs, distributed along the Italian coasts. The economic value of ecosystem services generated in each of the 12 MPAs investigated to date varies between 7 and 113 million euros per year, also depending on their extension. (Fig. 4.46). In the following tables (a, b, c, d), for each MPA, both flow indicators and benefit-relevant indicators expressed in economic terms are shown for each ecosystem service (Source IV CNN 2021).

Table a)						
ECOSYSTEM SERVICES	**MARINE PROTECTED AREAS**					
	PORTOFINO (ha 363)		**CINQUE TERRE (ha 4,865)**		**VENTOTENE-S. STEFANO (ha 2,850)**	
	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS
WILD FAUNA	Fish landings: 2,138 kg/year	37,174 €/year	Fish landings: 2,724 kg/year	24,169 €/year	Fish landings: 13,444 kg/year	94,788 €/year
CLIMATE REGULATION	CO2 fixation: 199 tCO_2/year	7,348 €/year	CO2 fixation: 141 tCO_2/year	5,201 €/year	CO2 fixation: 1,425 tCO_2/year	52,606 €/year
EXPLOITATION BY TOURISM	Tourists: 154,696/year	1,756,294 €/year	Tourists: 164,001/year	761.217 €/year	Tourists: 635,439/year	2.634.523 €/year
ECONOMIC BENEFITS FROM TERRITORY USE	Economic operators: 30/year	23,056,027 €/year	Economic operators: 15/year	20,873,126 €/year	Economic operators: 16.1/year	57,182,954 €/year
SCIENTIFIC ACTIVITY	Science projects: 5/year	188,264 €/year	Science projects: 2/year	220,505 €/year	Science projects: 1/year	N.A.
TEACHING-EDUCATIONAL ACTIVITY	Users: 1,683/year	81,904 €/year	Users: N.A.	14,740 €/year	Users: 10,222/year	37,000 €/year
TOTAL	**25,127,011 €/year**		**21,898,958 €/year**		**59,964,870 €/year**	

Table b)						
ECOSYSTEM SERVICES	**MARINE PROTECTED AREAS**					
	REGNO DI NETTUNO (ha 6,282)		**SANTA MARIA DI CASTELLABATE (ha 6,930)**		**COSTA DEGLI INFRESCHI E DELLA MASSETA (ha 2,360)**	
	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS
WILD FAUNA	Fish landings: 64,958 kg/year	1,036,908 €/year	Fish landings: 34,589 kg/year	269,925 €/year	Fish landings: 3,174 kg/year	37,083 €/year
CLIMATE REGULATION	CO2 fixation: 40 tCO2/year	1,472 €/year	CO2 fixation: 6,944 tCO2/year	256,375 €/year	CO2 fixation: 5,658 tCO2/year	208,904 €/year
EXPLOITATION BY TOURISM	Tourists: 2,306,940/year	6,054,514 €/year	Tourists: 653,705/year	474,781 €/year	Tourists: 158,06/year	122,758 €/year
ECONOMIC BENEFITS FROM TERRITORY USE	Economic operators: 128.5/year	98,571.78 €/year	Economic operators: 83.5/year	35,377,609 €/year	Economic operators: 30.5/year	8,381,052 €/year
SCIENTIFIC ACTIVITY	Science projects:	N.A.	Science projects:	N.A.	Projects: 1	N.A.

	5/year		1/year			
TEACHING-EDUCATIONAL ACTIVITY	Users: 186/year	152,000 €/year	Users: 847 /year	N.A.	N.A.	N.A.
TOTAL	**105,664,611 €/year**		**36,378,690 €/year**		**8,749,796 €/year**	

Table c)						
ECOSYSTEM SERVICES	**MARINE PROTECTED AREAS**					
	ISOLE TREMITI (ha 1,320)		**CAPO RIZZUTO (ha 15,000)**		**PLEMMIRIO (ha 1,998)**	
	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS
WILD FAUNA	Fish landings: 6,982 kg/year	147,375 €/year	Fish landings: 30,526 kg/year	182,030 €/year	Fish landings: 34,625 kg/year	264,106 €/year
CLIMATE REGULATION	CO2 fixation: 52 tCO2/year	1,917 €/year	CO2 fixation: 10,127 tCO2/year	373,902 €/year	CO2 fixation: 1,380 tCO2/year	50,931 €/year
EXPLOITATION BY TOURISM	Tourists: 238,965/year	606,145 €/year	Tourists: 444,860/year	979,559 €/year	Tourists: 101,011/year	233,632 €/year
ECONOMIC BENEFITS FROM TERRITORY USE	Economic operators: 16/year	25,113,796 €/year	Economic operators: 37/year	62,116,960 €/year	Economic operators: 7/year	6,695,672 €/year
SCIENTIFIC ACTIVITY	Science projects: 0.7/year	18,500 €/year	Science projects: 5/year	208,168 €/year	Science projects: 0/year	0 €/year
TEACHING-EDUCATIONAL ACTIVITY	Users: 4,878/year	26,333 €/year	Users: 8,377/year	Not measured	Users: 1,690/year	39,667 €/year
TOTAL	**25,914,066 €/year**		**63,860,619 €/year**		**7,284,008 €/year**	

Table d)						
ECOSYSTEM SERVICES	**MARINE PROTECTED AREAS**					
	ISOLE EGADI (ha 53,992)		**ISOLE PELAGIE (ha 3,849)**		**ISOLA DELL'ASINARA (ha 10,918)**	
	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS	FLOW INDICATORS	BENEFIT-RELEVANT INDICATORS
WILD FAUNA	Fish landings: 858,702 kg/year	12,974,872 €/year	Fish landings: 8,162 kg/year	85,350 €/year	Fish landings: 61,560 kg/year	409,251 €/year

CLIMATE REGULATION	CO2 fixation: 41,636 tCO2/year	1,537,218 €/year	CO2 fixation: 1,993 tCO2/year	73,575 €/year	CO2 fixation: 11,570 tCO2/year	427,166 €/year
EXPLOITATION BY TOURISM	Tourists: 1,061,015 /year	4,582,533 €/year	Tourists: 509,713/year	7,162,676 €/year	Tourists: 53,776/year	8,738,312 €/year
ECONOMIC BENEFITS FROM TERRITORY USE	Economic operators: 83.5 /year	94,320,900 €/year	Economic operators: 42.8/year	73,271,600 €/year	Economic operators: 25/year	11,490,683 €/year
SCIENTIFIC ACTIVITY	Science projects: 6/year	10,333€/year	Science projects: 2/year	N.A.	N.A.	245,084 €/year
TEACHING-EDUCATIONAL ACTIVITY	Users: 11,667/year	N.A.	Users:157/year	N.A.	Users: N.A.	64,661/year
TOTAL	**113,415,523 €/year**		**80,593,201 €/year**		**21,375,157 €/year**	

(Source CNN 2021)

The total value of ecosystem services calculated for the 12 MPAs investigated to date, constituting slightly more than 1/3 of Italy's 32 MPAs, is about 570 million euros per year. In the "Adriatic" marine area, the economic value of ecosystem services was calculated only for the Tremiti Islands MPA (IV CNN Report 2021). This value highlights the important role played by this MPA in the conservation of marine resources and, at the same time, in the generation of important human benefit flows. The recent increase in their establishment around the world, fostered by international policies, highlights the need for comprehensive and integrated assessment frameworks that can address the evaluation of their socio-ecological effectiveness and management performance, which is of paramount importance for their adaptive management and for various decision-making processes. Marine protected areas (MPAs) are critical to the conservation of marine ecosystems at local and global levels. Aichi Target 11 of the Strategic Plan for Biodiversity 2011-2020 called for increasing protection measures to achieve the goal of protecting at least 10 percent of the global coastal and marine environment. This target was set at 30 percent by the EU Biodiversity Strategy 2030.

Within this context, the extent and number of the planet's MPAs has grown significantly in recent decades, reaching a global coverage of 7.65 percent and protecting a total area of 27,724,036 km^2 (www.protectedplanet.it). A recent study published by National Geographic (2022) assessed the protection levels of the Mediterranean's 1,062 MPAs. While 6.01 percent of the Mediterranean is covered by some form of protection, 95 percent of this area shows no difference between the regulations imposed within MPAs versus outside MPAs. Comprehensive and high levels of protection, the most effective for biodiversity conservation, represent only 0.23% of the basin and are unevenly distributed across political boundaries and eco-regions. With this in mind, marine protected areas (MPAs) are an important deterrent to such phenomena as illegal fishing, for example, as well as a particularly effective tool for restoring marine biodiversity and ecosystem services, but currently only 2.7 percent of the ocean is adequately protected. This low level of ocean protection is also due to conflicts with fishing and other extractive uses, as well as, in some cases, resistance to their establishment by local governments.

The European Green Deal approved by the European Commission and the European Parliament aims to lead the entire continent to the protection and restoration of ecosystems and biodiversity and to the decarbonization of its economies. The integrated Next Generation EU 11 program was created as a result of this approach and within the context of the consequences due to the CoV-2 pandemic. This program includes an unprecedented concerted spending commitment for Europe (750 billion in total and 209 billion for Italy, which is the largest beneficiary among the Member States) for the implementation of specific National Recovery and Resilience Plans, of which 37 percent must be allocated to actions for climate change mitigation and adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems. Based on the urgency of immediate and concrete actions for the next 10 years, the vision that is proposed for our country is to rapidly activate all the transitions defined by the GBO-gbo5 that are deemed essential to safeguard biodiversity and restore the ecosystems on which our lives depend, by giving ourselves the goal of achieving, by 2030, the halting of biodiversity loss, the reversal of its degradation processes, and the first results of a great "public work" of restoring our terrestrial and marine environments, which constitute the fundamental basis of the well-being and health of us all (CN Report-2021). The protection of ecosystems and biodiversity plays a key role in the implementation of the European sustainable growth policy in the context of the Green Deal.

Studies and scientific research show that it is crucial to conserve and restore, where necessary, the ecosystem services of our natural systems to a healthy state, and to increase the number and quality of protection programs and measures targeting the most vulnerable terrestrial and aquatic ecosystems, the establishment of biological corridors, the implementation of native species protection and conservation programs, the study and countering of the spread of invasive alien species, the fight against illegal trade and poaching, and public awareness. To realize and concretize the above vision, it is crucial to implement actions to restore our ecosystems through projects related to the creation of Green Infrastructures and Nature Based Solutions, which also respond to the commitment outlined in the *UN Decade of Ecosystem Restoration 2021-2030* and concrete solutions to address the issues of adaptation to ongoing climate change, coping as best we can with the risks that tend to make our socio-ecological systems increasingly vulnerable.

A recent United Nations report on the state of the environment in the Mediterranean (*State of the Environment and Development in the Mediterranea*n, 2020) identifies the following priorities for action:

- the adoption by countries of monitoring programs and the identification and mapping of coastal and marine species and habitats within their territories;
- the promotion, development and implementation of management plans for Marine Protected Areas (MPAs) and other conservation measures, particularly by increasing the operational and financial capacity of MPAs;
- integration between biodiversity protection aspects and sector policies and planning at all levels;
- the integrated management of coastal areas and their associated river basins in the Mediterranean;
- connectivity between habitats and the land-sea interface, given the impaired functioning of wetlands, coastal aquifers and other coastal ecosystems;
- the characterization, assessment and prioritization of ecosystem services (including climate change mitigation and adaptation) as an essential part of coastal and marine ecosystem management, integrated into policies/plans for sustainable development;
- the development and implementation of sustainable operational and financial mechanisms to prioritize marine ecosystem conservation and restoration efforts at national and local levels.

It should be remembered, in this regard, that 2021-2031 is the United Nations' *Decade of Ecosystem Restoration*, aimed at "*preventing, halting and reversing the degradation of ecosystems worldwide*".

Italy will play a key role in this thanks to the project just launched via the NRRP called 'Restoration of Marine Ecosystems'. Governance of the Project is entrusted to the Ministry for Ecological Transition and ISPRA. The project will end in 2026 and consists of 3 investments:

1. The implementation of marine and marine-coastal ecosystem observation systems through non-stationary observation systems and in situ observation systems.
2. The mapping of marine, coastal and deep-sea habitats of conservation interest.
3. Ecological restoration activities of the seabed and marine habitats through ecological protection measures, active restoration actions and implementation of protection measures.

In order to achieve one of the EU goals of the Biodiversity Strategy 2030, i.e. that of "*ensuring that at least 30 percent of species and habitats whose current conservation status is unsatisfactory become satisfactory or show a clear positive trend*", it may be of some use to conduct a scenario analysis that simulates the extension or definition of new areas for protection.

4.2.4.2 Marine Protected Areas potentially interested by the Adriatic MSP

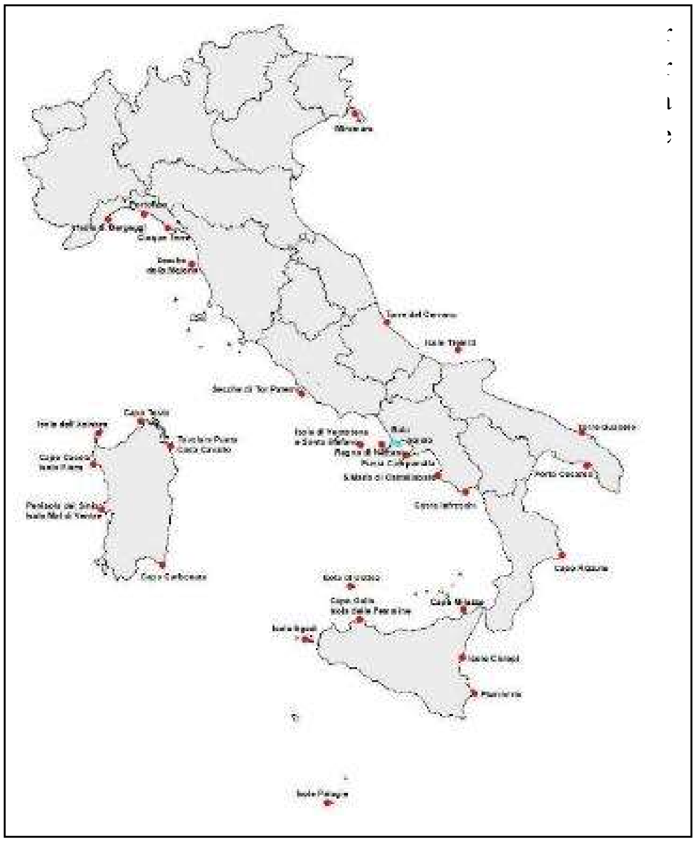


Fig. 4.47 Established Marine Protected Areas. (Source MITE)

The 2016 Tangier Declaration established goals to complete the network of Marine Protected Areas (MPAs) in the Mediterranean, with a specific focus on better protection of the marine-coastal and deep-sea ecosystems that are represented in the network. MPAs have specificities that have led to the provision for them by SNB 2020 of a specific objective, No. 5. This goal has been effectively pursued although it is not yet fully achieved.

Currently designated MPAs cover 9.68 percent of the Mediterranean Sea, but those effectively managed are only 1.27 percent. To date, 29 MPAs have been established covering an area of about 222 thousand hectares (Tab. 4.13), and to these one needs to add two underwater archaeological parks and the International Marine Mammal Sanctuary, adding another 2.5 million hectares protected, for a total of 32 MPAs (data from the 6th update of the Ufficiale List of Protected Areas). (Fig. 4.47-Tab. 4.12).

Capo Caccia Isola Piana MPA	Isole Egadi MPA	Penisola del Sinis- Isola Mal di Ventre MPA	Santa Maria di Castellabate MPA
Capo Carbonara MPA	Isola dell'Asinara MPA	Miramare MPA	Secche della Meloria MPA
Capo Gallo-Isola Femmine MPA	Isola di Bergeggi MPA	Porto Cesareo MPA	Secche di Tor Paterno MPA
Capo Milazzo MPA	Isola di Ustica Island MPA	Portofino MPA	Tavolara - Punta Coda Cavallo MPA
Capo Rizzuto MPA	Isole di Ventotene e Santo Stefano MPA	Punta Campanella MPA	Torre del Cerrano MPA
Capo Testa - Punta Falcone MPA	Isole Ciclopi Islands MPA	Regno di Nettuno MPA	Torre Guaceto MPA
Cinque Terre MPA	Isole Pelagie MPA	Isole Tremiti MPA	
Costa degli Infreschi e della Masseta MPA			SUBMERGED PARKS
Plemmirio MPA			Parco archeologico sommerso di Baia
			Parco archeologico sommerso di Gaiola
			Santuario Internazionale dei Mammiferi Marini.

Tab. 4.12 Percentage distribution of MPAs. (Source: Official List ANP - MITE*)*

Type of EUAP Protected Area – L. 394/91	Quantity	Land surface area (ha)	Sea surface area (ha)
National Parks	24	1,472,321	71,812
Marine Protected Areas [41]	29	0	222,442.53
State-Owned Nature Reserves	148	125,849	0
Other State-Owned Natural Areas	3	0	2,557,477
Regional parks	134	1,294,656	0

[41] To which one must add the two Underwater Archeological Parks of Baia and Gaiola and the International Sanctuary of Marine Mammals.

Regional Nature Reserves	365	230,240	1,284
Other Regional protected Areas	171	50,238	18
Total	**877**	**3,173,304**	**2,864,872**

Sicily with 79.895 ha and Sardinia with 89.983 ha including the marine area of the Maddalena Archipelago NP, are the regions with the most MPAs, both in terms of number (7 in Sicily and 6 in Sardinia) and of marine protected areas (Source Ispra 2021). Campania has 4 MPAs, plus the underwater archaeological parks of Baia and Gaiola, covering a total area of 22,441 ha. Liguria has 3 established MPAs but a much smaller total protected area of about 5,100 ha compared to the situations described above. (Table 4.13).

Tab. 4.13 Surface area of MPAs by Regions (Source: Ispra 2021)

Region	Protected area type	Name	Province	Municipality/ies involved	Sea surface area	Sea surface area	Sea surface area	Sea surface area	Total per Region
					2003	2010	2012	2019	2019
					ha	ha	ha	ha	ha
Friuli-Venezia-Giulia	MPA	Golfo di Trieste-Miramare	Trieste	Trieste	30	30	30	30	**1,314**
	RNR	Falesie di Duino	Trieste	Duino Aurisina	63	63	63	63	
	RNR	Valle Cavanata	Udine	Grado, Go	67	67	67	67	
	RNR	Foce dell'Isonzo	Gorizia	Fiumicello, Grado, San Canzian d'Isonzo, Staranzano	1,154	1,154	1,154	1,154	
Liguria	MPA	Golfo di Portofino	Genova	Portofino, Camogli, S.Margherita Ligure	346	346	346	346	**5,140**
	MPA	Cinque Terre	La Spezia	Riomaggiore, Levanto, Vernazza, Monterosso	2,726	4,591	4,591	4,591	
	MPA	Isola di Bergeggi	Savona	Bergeggi		902	203	203	
Tuscany	MPA	Secche della Meloria	Livorno	Livorno		9,372	9,372	9,372	**66,138**
	NP	Arcipelago Toscano	Livorno and Grosseto	Capraia, Campo nell'Elba, Capoliveri, Isola del Giglio, Marciana Marina,	56,766	56,766	56,766	56,766	

				Marciana, Portoferraio, Pianosa, Rio Marina, Rio nell'Elba					
Lazio	MPA	Isole di Ventotene and S. Stefano (Isole Pontine)	Latina	Ventotene	2,799	2,799	2,799	2,799	**4,204**
	MPA	Secche di Tor Paterno	Roma	Roma	1,387	1,387	1,387	1,387	
	ONRPA	Gianola	Latina	Formia and Minturno	5	5	5	5	
	ONRPA	Villa di Tiberio	Latina	Sperlonga	10	10	10	10	
	ONRPA	Monte Orlando	Latina	Gaeta	3	3	3	3	
Campania	MPA	Punta Campanella	Napoli, Salerno	Massa Lubrense, Piano di Sorrento, Positano, Sant'Agnello, Sorrento, Vico Equense	1,539	1,539	1,539	1,539	**22,441**
	MPA	Regno di Nettuno	Napoli	Barano d'Ischia, Casamicciola Terme, Forio, Ischia, Lacco Ameno, Serrara Fontana and Procida		11,256	11,256	11,256	
	AANPN	Parco sommerso di Baia	Napoli	Bacoli, Pozzuoli	177	177	177	177	
	AANPN	Parco sommerso di Gaiola	Napoli	Napoli	42	42	42	42	
	MPA	Costa degli Infreschi e della Masseta	Salerno	Camerota, San Giovanni a Piro		2,332	2,332	2,332	
	MPA	Santa Maria di Castellabate	Salerno	Castellabate		7,095	7,095	7,095	
Puglia	MPA	Porto Cesareo	Lecce	Porto Cesareo, Nardò	16,654	16,654	16,654	16,654	**20,347**
	MPA	Torre Guaceto	Brindisi	Brindisi, Carovigno	2,227	2,227	2,227	2,227	

	MPA	Isole Tremiti (Caprara, Pianosa, S. Nicola, S. Domino, Cretaccio)	Foggia	Isole Tremiti	1,466	1,466	1,466	1,466	
Calabria	MPA	Isola Capo Rizzuto	Crotone	Crotone, Isola Capo Rizzuto	14,721	14,721	14,721	14,721	**14,721**
Abruzzo	MPA	Torre del Cerrano	Teramo	Pineto, Silvi		3,431	3,431	3,431	**3,431**
Sicily	MPA	Isole Ciclopi	Catania	Aci Castello	623	623	623	623	**79,895**
	MPA	Isole Egadi	Trapani	Favignana	53,992	53,992	53,992	53,992	
	MPA	Isola di Ustica	Palermo	Ustica	15,951	15,951	15,951	15,951	
	MPA	Capo Gallo - Isola delle Femmine	Palermo	Palermo, Isola delle Femmine	2,173	2,173	2,173	2,173	
	MPA	Isole Pelagie	Agrigento	Lampedusa e Linosa	3,230	4,136	4,136	4,136	
	MPA	Plemmirio	Siracusa	Siracusa		2,429	2,429	2,429	
	MPA	Capo Milazzo	Messina	Milazzo				591	
Sardinia	MPA	Capo Carbonara	Cagliari	Villasimius	8,598	8,598	14,361	14,361	**89,983**
	MPA	Penisola del Sinis - Isola Mal di Ventre	Oristano	Cabras	32,900	25,673	26,703	26,703	
	MPA	Tavolara, Punta Coda Cavallo	Olbia-Tempio	Loiri Porto San Paolo, Olbia and San Teodoro	15,357	15,357	15,357	15,357	
	MPA	Capo Caccia-Isola Piana	Sassari	Alghero	2,631	2,631	2,631	2,631	
	MPA	Isola dell'Asinara	Sassari	Porto Torres	10,732	10,732	10,732	10,732	
	NP	Arcipelago della Maddalena	Sassari	La Maddalena	15,046	15,046	15,046	15,046	
	MPA	Capo Testa - Punta Falcone	Sassari	Santa Teresa di Gallura				5,153	
TOTAL					**263,415**	**295,776**	**301,870**	**307,614**	

Figure 4.48, below, shows that only 2.8% of the total area is under full protection restrictions (Zone A), while in the remaining area human activities are regulated consistently with protection objectives (Zones B, C and D). Protection level D, in which restrictive measures are minimal, is present only in the MPAs "Isole Egadi",

"Regno di Nettuno," and "Torre del Cerrano", affecting 17.7 percent of the area protected by the MPAs. The surface area figure alone, however, does not allow us to trace the actual degree of protection, which is closely related to the distribution in the different zoning levels:

- **Zone A,** with Total Protection, interdicted to all activities that may cause damage or disturbance to the marine environment. Only scientific research and service activities are generally allowed in this zone.
- **Zone B,** with General Protection: where a range of activities are permitted, often regulated and authorized by the management body, while granting sustainable enjoyment and use of the environment, resulting in minimal impact.
- **Zone C,** with Partial Protection, which represents the buffer strip between the areas of greatest naturalistic value and the sectors outside the marine protected area, where activities of sustainable enjoyment and use of the sea of modest environmental impact are allowed and regulated by the management body, in addition to what is already allowed in the other zones.
- **Zona D**, present only in rare cases, provides for less restrictive regulation than the other zoning levels. For special territorial characteristics in some marine protected areas, special subzones Bs of total reserve are established, forbidden to all activities that may cause damage or disturbance to the environment and marine species. In such a zone, access is allowed but all forms of harvesting are prohibited.

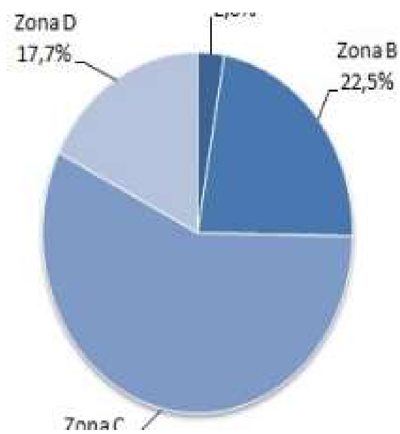


Fig. 4.48 Levels of protection of Marine Protected Areas (Source Ispra 2019)

As shown in Figure 4.49, the number of MPAs established only grew modestly until the mid-1990s, gaining momentum thereafter. Since 2009 there has been a stabilization, up until the establishment in 2018 of two new MPAs.

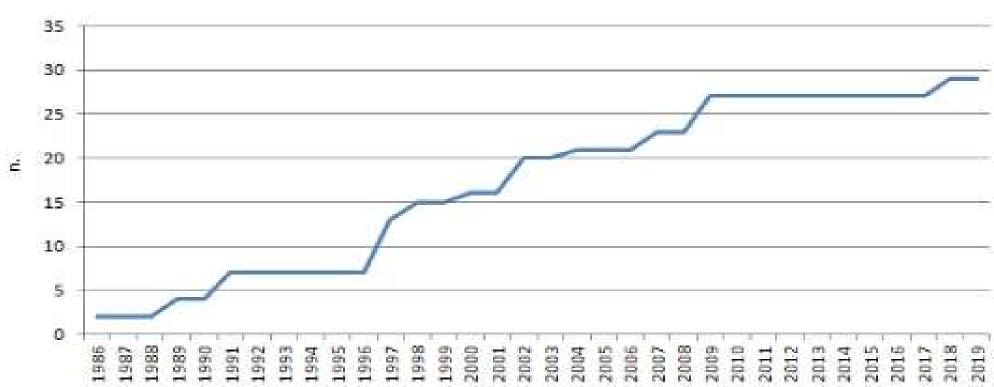


Fig. 4.49 Trend in Marine Protected Areas in the years 1986-2019 (Source Ispra 20221)

Designated marine areas

The 52 designated marine areas in the Adriatic Sea have been identified according to the provisions of Laws 979/82 art. 31, 394/91 art. 36, as amended. Of these, 29 have already been established, as well as 2 underwater parks in Baia and Gaiola (Fig.4.50). The marine protected areas that are soon to be established are the designated areas for which the preliminary process is underway. This process is provided for the areas included in the list of 46 Designated Areas indicated by Laws 979/82 Art. 31 and 394/91 Art. 36. (Fig. 4.51).

At present, in addition to the Capo Spartivento MPA, which is in the process of being established, there are ongoing preliminary investigations for the establishment of twelve new marine protected areas (designated marine areas Laws 394/91, Art. 36, and 979/82, Art. 31, as amended), whose administrative procedures can be considered to be in the final or very advanced stage:

1. Isola di Capri,
2. Capo d'Otranto-Grotte Zinzulusa and Romanelli-Capo di Leuca,
3. Costa di Maratea,
4. Costa del Monte Conero,
5. Isole Eolie,
6. Banchi Graham-Terribile- Pantelleria-Avventura,
7. Isola Gallinara,
8. Golfo di Orosei – Capo Monte, Santu
9. Isola di San Pietro
10. Isole Cheradi.
11. Arcipelago toscano
12. Monti dell'Uccellina - Formiche di Grosseto - Foce dell'Ombrane - Talamo

Fig. 4.50 – The 23 "designated marine areas"

Fig. 4.51 - The 17 soon-to-be established marine protected areas, whatever the status of the planned administrative process. (Source MiTE)

The environmental characteristics and spatial framing of the marine protected areas established in the "Adriatic"[42] marine area are described below. Information and data from MITE, ISPRA and MPA management bodies were used to describe the environmental and territorial layout of the MPAs.

In general, with regard to the MPAs' Provisional Regulations and Specifications, it should be noted that they refer to those published in their current state on the websites of the MPAs' Managing Entities.

- **"MIRAMARE" Marine Protected Area**

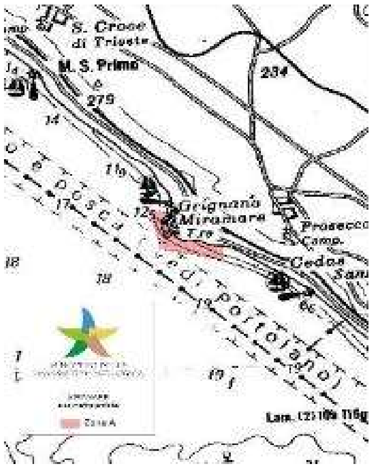
The "Miramare" Marine Protected Area has been identified as a Specially Protected Area of Mediterranean Importance (SPAMI) and is a UNESCO Biosphere Reserve. It protects 30 hectares of marine and coastal biodiversity subject to full protection, and 90 hectares of buffer zone established in 1995 by an ordinance of the Harbour Master's Office to defend the core area from lampara net fishing, which is widely practiced in the Gulf of Trieste and was threatening the integrity of the reserve.

The area was further protected by the Port Authority in 2014. The iconic species is the Peacock blenny (*Salaria pavo*), but there are also barnacles, mussels, crabs, sea tomatoes and clingfish. Prominent among the algae is brown seaweed (*Fucus virsoides*). *Posidonia oceanica* meadows, which are a priority habitat under the Habitats Directive (92/43/EEC), are not as widespread and are limited to a narrow area in front of the Grado Lagoon, with small isolated patches at a depth of 3 to 4.5 meters that grow only on the rocky substrate, while the surrounding seabed is colonized by dense meadows of *Cymodocea nodosa*. The Biological Protection Zone "Miramare" covers a coastal strip about 1 mile wide and several miles long with real natural "reefs" whose building organisms are not corals but calcareous red algae called "Corallinaceae": *Peyssonnelia, Lithothamnium* and *Lithophyllum*. Building organisms also include bryozoa, encrusting cnidarians, including the Mediterranean 'coral', *Cladocora caespitosa*, and *Polychaete serpulidae*.

Their overlapping determines the growth of tegnùe in length, width, and height, growing at different speeds and in different directions, thereby giving rise to the strangest shapes, rich in porosity and ravines.

"MIRAMARE" Marine protected Area	
REGION	FRIULI VENEZIA GIULIA
PROVINCE	TRIESTE
MUNICIPALITY	TRIESTE
IMPLEMENTING DECREE	D.I. 12/11/86
SEA SURFACE AREA	Extension 30.00 ha Length of coast 8,405 m
MANAGED BY	WWF for Nature ONLUS Main office: Viale Miramare 349, 34014 Grignano (TS)
BOUNDARIES AND ZONING	(art. 2 I.D. 12/11/86) Reg. M.D. 26/05/09

[42] Map of Marine Protected Areas MSP_ADR_AMBD001_AMP



The MPA includes the Special Area of Conservation (ZSC) IT3340007 Area marina di Miramare.

The MPA is internally divided into:

ZBT "Land Buffer" zone (Historical Park Museum and Miramare Castle)

ZCM "core" zone (Miramare MPA)

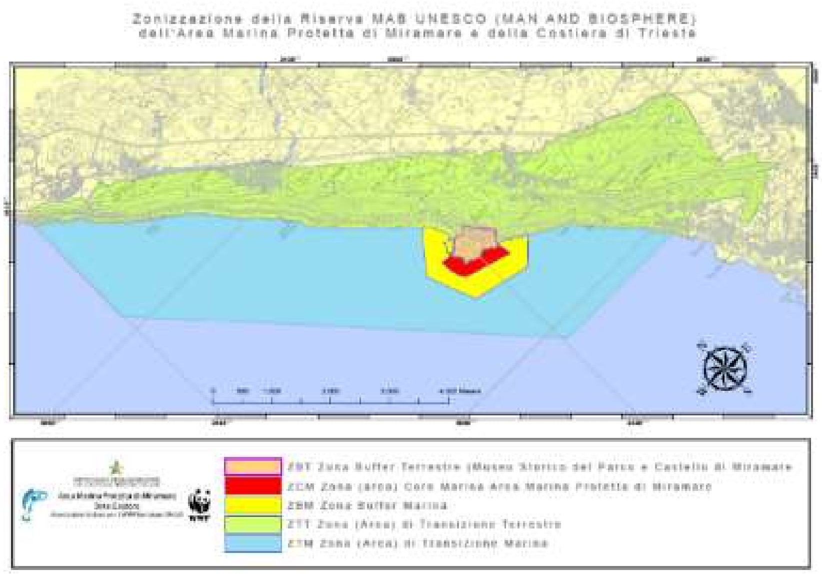
ZBM Sea buffer zone

ZTT Land transition zone

ZTM Sea transition zone

Bordered by 16 yellow buoys, the Miramare MPA is divided into:

- **ZONE A** with Total Protection encompassing 30 hectares that extend into the strip of sea in front of Miramare Park, from the Grignano marina to the Sticco establishment, and up to 200 m from the coastline. A total protection regime is in force in this area. This means that no activities are allowed here, except for guided tours and educational and research and monitoring activities conducted by the managing body.
- **ZONE B** is a 90-hectare, partially protected belt of sea buffer zone known as "buffer" surrounding Zone A. This area constitutes an additional protected belt 400 meters wide, where only professional fishing and anchoring are prohibited. In Zone B, it is possible to participate in activities organized by the managing entity, such as: educational and awareness raising activities, *snorkeling* and scuba diving, beach and seabed cleaning. In addition, it is possible to freely practice transit and anchoring, including of motor vehicles, bathing, diving and fishing from land.

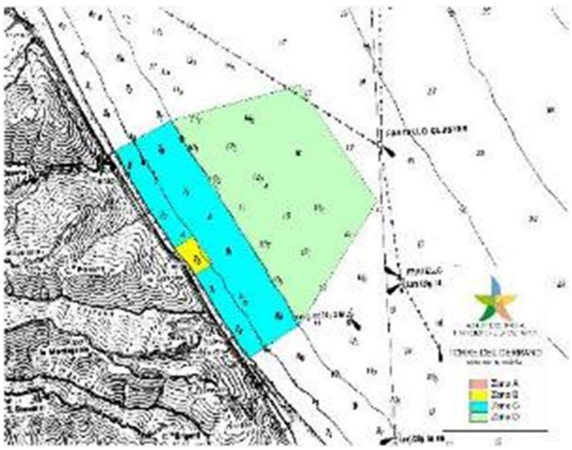


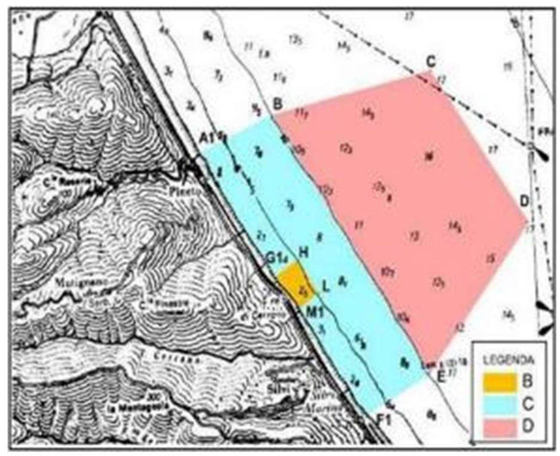
➢ "Torre del Cerrano" Marine Protected Area

The marine protected area "Torre del Cerrano" includes the Teramo stretch of coastline about 7 km long between the municipalities of Pineto and Silvi. It is characterized by low and sandy coastal environments, typical of the Adriatic Sea, in which it is possible to observe the presence of psammophilous dune vegetation with specimens of sea lily (*Pancratium maritimum*), Gargano mullein (*Verbascum niveum subsp. garganicum*), Beach morning (*Calystegia soldanella*) and *Euphorbia terracina*. On the dunes, in addition to the observation of many species of insects such as *Scarabaeus semipunctatus*, it is possible to observe the presence of unusual and peculiar species of avifauna. The marine environment is characterized by priority habitat 1110 "Sandbanks which are slightly covered by sea water all the time" under Directive 92/43 EEC. Reports of findings in the area of *Cymodocea nodosa* and *Posidonia oceanica*, moreover, lead one to consider the possibility that residual patches of seagrass meadows are still present in the area. As for fauna, the area contains a good number of marine animal species, both pelagic and benthic, and a small contingent of plant species. In addition to the presence of the rare gastropod endemic to the Adriatic Sea such as the Adriatic *Trivia*, and the impressive bioconstructs of the *Sabellaria halcocki*, the underwater environment of the area contains species of fish and mollusks, including conger eels, sea bass, sole and bream that live in contact with the sandy seabed characterized by extensive and important shoals of *Chamelea gallina* (common clam).

The area is home to the nesting of the Kentish plover (*Charadrius alexandrinus*), a rare migratory bird that frequents the beach from April to late September and returns each spring to lay its eggs. In addition, it is not uncommon to come across the passage of migratory or otherwise extremely mobile species. The avifauna is characterized by species that take advantage of the wetlands at the mouth of the Vomano River, including pelagic birds such as shearwaters, which nest in the Tremiti Islands. In the marine area, the most interesting passage species include dolphins and sea turtles (*Caretta caretta*).

"Torre del Cerrano" Marine Protected Area	
REGION	ABRUZZO
PROVINCE	TERAMO
MUNICIPALITIES	PINETO AND SILVI
IMPLEMENTING DECREE	D.I. 21/10/09
SEA SURFACE AREA	Extension 3,431.00 ha, length of coast 0.01 km²
MANAGED BY	Consorzio Gestione Area Marina Protetta Torre del Cerrano. Sede Operativa: Dep. Villa Filiani, via D'Annunzio 90 Pineto (Te)





BOUNDARIES AND ZONING art. 4 I.D. 21/10/09 Reg. M.D. 12/01/17

The delimitation of the 'Torre del Cerrano' MPA coincides with the perimeter of SCI IT7120215 "Torre del Cerrano". Therefore, the Marine Protected Area Management Entity is entrusted with the management of the SCI.

The MPA is internally divided into:

Zone B with **General Protection** is the stretch of sea along the coast between the towns of Pineto and Salvi in front of Torre del Cerrano.

Zone C with **Partial Protection** is in turn divided into three sub-zones:

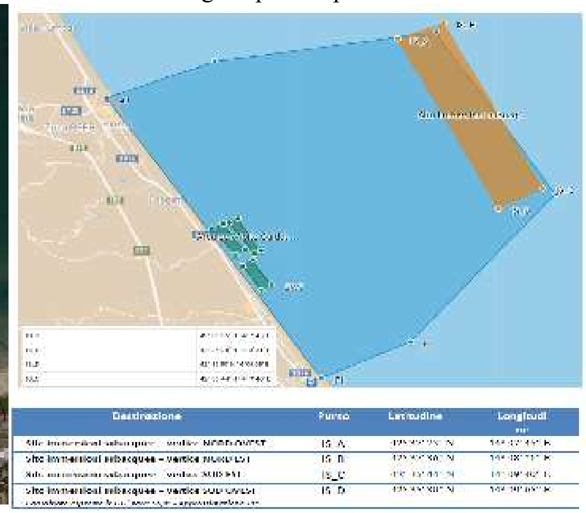
- C1 north of Pineto.
- C2 south of Pineto.
- C3 includes one section north and one south of Pineto.

Zone D included between the remaining stretch of coastline within the MPA and the Marine Oasis for the protection and development of aquatic resources. Guided tour activities can be conducted not only in Zone B but also in the present archaeological area of the MPA, between the buoy line of the "Half Blue Mile" free swimming field to the limit of the mooring field, which is located on the outer boundary of Zone B. Diving guides or diving instructors must register in the appropriate List of "Cerrano Guides," or be part of a diving center authorized by the managing entity for this purpose. As regards the Seawatching activity, the maximum number of visitors per day is 72, and no more than 10 permits may be issued annually. The activity must be conducted in the presence of at least one guide with an instructor's license or diving guide, ensuring that minors are accompanied, or authorized by their parents if older than 8 years of age, and with the use of self-inflating emergency vests. The sites, where to carry out the Seawatching activity, are described and shown in the map below:

a) In Zone B, from land up to 300 meters from shore, referred to as "Ancient Underwater Port";

b) in Zone C1, again from land up to 300 meters from shore, called "Bassano Reefs."

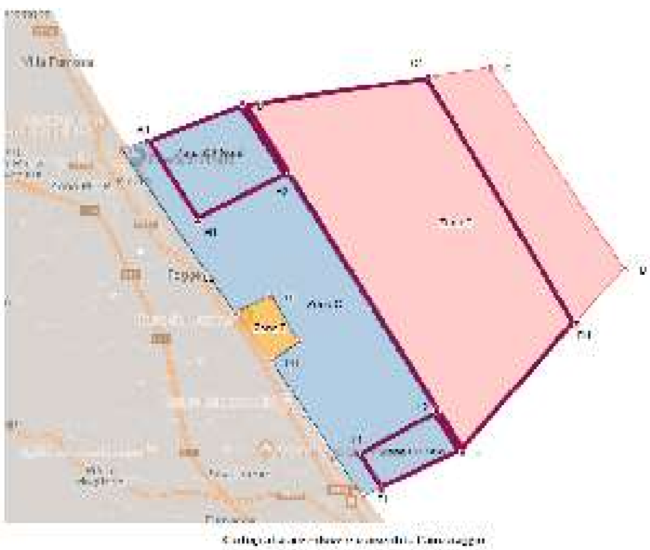
Within the MPA, authorization for access for reaching anchorage points, for landing or for haulage of unregistered pleasure craft must be issued by the Managing Body, while for registered craft, authorization may be submitted by each individual Association/Body. Anchoring is allowed outside the areas designated for bathing at a depth of 300 meters from the coast. The mooring field is delimited by the junction of the points identified with buoy ‘H’ and buoy ‘L’, respectively, of external delimitation of Zone B of the MPA, with the mooring buoys, shown in the following map excerpt. For a distance of 50



metres from the buoy field to the coastline, no kind of fishing is allowed, and the transit of nautical vessels not headed to the mooring buoys is prohibited. Mooring at the yellow buoys ‘H’ and ‘L’ marking the outer boundary of Zone B of the MPA is prohibited.

It is also prohibited to moor at the buoys marking swimming corridor called "*Blue Half Mile*", shown in the following map excerpt. For safety purposes, the navigation of nautical units is prohibited along a distance of 50 meters from the corridor buoy line. In order to allow recreational units to approach the shore, a launch and landing corridor bounded by orange buoys is established. For units serving bathing establishments, such as pedal boats or other rowing or pedal or sailing units, the managers of the establishments may apply for a single permit providing the total number of units to be authorized. Small-scale artisanal fishing and "small-scale coastal fishing" is carried out exclusively by units with an overall length of less than 12 meters, and licensed for local coastal fishing (within 12 miles from the coast), with the following gears: set (anchored) gillnets GNS, trammel nets GTR, set - combined GTN, pots, hand and pole lines LHP, fixed longline LLS.

The access and transit to nautical units used for fishing bivalve molluscs (turbo blowers), for the time strictly necessary for crossing Zone D of the marine protected area only, is allowed with the authorization of the Managing Body. Passenger transport and guided tours are allowed, subject to the authorization of the Managing Body. Anchoring is allowed outside the areas designated for bathing at a depth of 300 meters from the coastline, located in correspondence with Zone D, the two zones C3 north and south, and sections of zone C1 and C2 in correspondence with the hauling areas. The map excerpt is shown below.



The access and mooring of recreational units of small-scale artisanal fishing and fishing tourism, sport and recreational fishing, the transit in Zone D of bivalve fishing boats and the navigation of nautical units for hire and the rental of recreational units used for passenger transport and guided tours, must be authorized by the Managing Body. The same applies to activities of scientific research, film, photographic and television shooting, marine observation.

➢ **"Isole Tremiti" Marine Protected Area**

The Tremiti Islands are a veritable "rocky oasis" for marine organisms in the endless sandy plains that characterize the Adriatic basin. The marine area sees the presence of the Marine Protected Area (MPA) and the Biological Protection Zone (ZTB). The Tremiti Islands are located along the migratory route of the European avifauna and represent an important stopover point for these birds, some species of which stop for a short time to rest, while others stop longer, even to reproduce.

Among small passerines, the most common species are the common sparrow and the Sardinian warbler, while the solitary sparrow and the pallid swift are rarer. In 2020, the Special Protection Areas (ZPSs) were expanded to protect the foraging areas of several bird species: *Calonectris diomedea* (Scopoli's shearwater), *Puffinus yelkouan* (Yelkouan shearwater) in poor conservation status, and *Larus audouinii* (Audouin's gull). The storm petrel (*Hydrobates pelagicus*) is in a poor state of conservation.

Scopoli's shearwater is found on the island of St. Domino and is known in Tremiti as the 'diomedea' which reaches the islands in spring to nest along the cliffs. During courtship rituals, this petrel emits moan-like sounds, the so-called "weeping of the diomedea." Other seabirds present on the island include the petrel, which for centuries has been reaching the Tremiti Islands in spring to nest on the cliffs, the herring gull, with the only nesting colony in Puglia here, and the peregrine falcon. The element of extreme naturalistic importance, whose presence in the past at the Island of St. Domino is certain and documented, is the monk seal (*Monachus monachus*) called "sea ox" by local fishermen, hence the name of the cave with the same name present along the western side of the island where this species used to take refuge. A few swifts can be seen on the island of St. Nicholas and which usually nest along the east-facing cliffs.

Another visitor to the cliffs of St. Nicholas is the kestrel, a small hawk with pointed wings and a narrow tail. It can be easily spotted as it soars over garrigue and lentisk scrub clearings in search of prey. The marine environment is rich in biodiversity. To the east, near the Segato rock, it is possible to spot bream, sea bream and groupers sheltering among the large boulders. Pianosa Island enjoys the presence of a large colony of nesting herring gulls. Of particular interest is the presence of a limited population of pallid swift that nests in an open karst cave on the north side of the island. The numerous puddles that originate from the breaking waves on the exposed shores of the island feature the presence of shrimps belonging to the genus Palaemon, of the marbled crab, of chitons and, near the mean sea level, of sea anemones and various species of algae. On the rocks continually washed by the spray from the waves, the presence of the gastropod *Littorina neritoides* and barnacle crustaceans is also noted, which along the northern slope form almost continuous bands until they completely cover the rock below. Large stretches of the northern coast, at mean sea level, are characterized by the horizontal development of calcareous structures, produced by the growth of coralline algae of the genus *Lithophyllum*, called trottoirs. On all slopes near the surface it is easy to find agglomerates of mussels.

The seabed of Pianosa is characterized by variable macrobenthic species populations, as different edaphic conditions (hydrodynamics, illumination, sedimentation, substrate slope, etc.) are present. The northern slope and the east-facing section have walls that, at a short distance from the coast, reach a depth of 50 m.

The calcareous nature of the rock determines the presence of special environments, crevices and caves that allow the development in the infralittoral section of typical circalittoral organisms, such as species belonging to the Coralligenous. Particularly relevant appears the development of encrusting sponges. On the southern side, the rocky seabed slopes gently down to the sands, pre-eminently from a depth of about 30 m to about 300 m offshore. Ecological associations are, mostly, those typical of areas subject to intense illumination and moderate hydrodynamics. The seabed is particularly characterized by the presence of algae belonging to the genus *Cystoseira*. The intense grazing by sea urchins results in the complete denudation of large areas of rocky seabed. On the western side of the island, the presence of an interesting, almost continuous association of the cnidarian *Paramuricea cl*avata and of the bryozoan *Pentapora fascialis* can be found at depths between 40 and 60 m, with the presence also of the false black coral (*Gerardia savaglia*) and the bivalve mollusk *Pinna nobilis*, found mainly in coastal areas, between 0.5 and 60 m in depth, mainly on soft sediments colonized by seagrass beds but also on bare sand, mud, mäerl, pebbly bottoms or among boulders. They generally have an irregular distribution, with depth appearing to be one of the most significant factors in explaining the distribution of population density. *Pinna nobilis* is included in Annex IV of the Habitats Directive (92/43/EEC).

It requires strict protection and its collection is prohibited except for scientific purposes. Despite the presence of protection measures, mainly aimed at stopping any voluntary harvesting and other anthropogenic pressures, even the Adriatic populations are now in serious danger of extinction due to the Mediterranean-scale epidemic that, since 2018, has been causing many cases of deaths due to the protozoan parasite *Haplosporidium pinnae*, which, where present, has exterminated about 95 percent of the pre-existing populations, thus increasing their risk of extinction. Among the fish, several specimens of bonito, amberjack, mackerel, bream, redfish and conger eel have been observed.

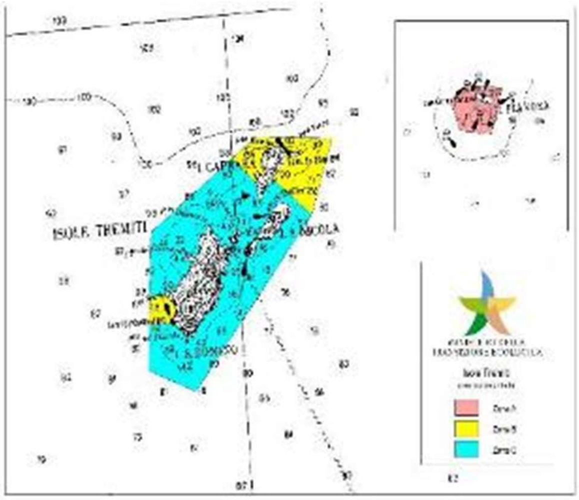
“Isole Tremiti” Marine Protected Area	
REGION	PUGLIA
PROVINCE	FOGGIA
MUNICIPALITY	COMUNE ISOLE TREMITI

IMPLEMENTING DECREE	D.I. 14/07/89
SEA SURFACE AREA	Extension 1,466 ha 20,410 m of coastline surrounding the St. Domino, St. Nicola, Caprara and Pianosa islands for the entire section of sea included, more or less, up to the 70 m isobath
MANAGING BODY	Ente Parco Nazionale del Gargano Sede Operativa: Via Sant'Antonio Abate n. 121 71037 Monte Sant'Angelo (FG)

BOUNDARIES AND ZONING art. 4 I.D. 14/07/89 – Interim Specifications

This MPA includes the Special Area of Conservation (ZSC):

- IT9110011"Tremiti Islands".



L' Area Marina Protetta è suddivisa al suo interno in:

- **Zone A with Total Protection** (red). Includes the stretch of sea surrounding (up to the 70-meter isobath) the island of Pianosa located 12 miles northeast of the other islands of the archipelago. Access and any activity is prohibited here without possible exemptions due to the presence on the seabed of unexploded ordnance.
- **Zona B with General Protection (yellow).** Includes two stretches of coastline: the first on the west coast of the island of St. Domino, from the lighthouse of Punta Provvidenza to Punta Secca always up to the 70-meter isobath; the second, the entire coast from west to east of Capraia, Island from Cala Sorrentino to Caciocavallo rock. In these two sites any kind of sport fishing is prohibited unless authorized by the municipality (application to the municipality on stamped paper with 20 thousand stamp), which may also authorize scuba diving, as long as it is not for the purpose of fishing, and sailing but at a speed not exceeding 6 knots.
- **Zona C with Partial Protection (light blue)**. Includes the remaining stretch of sea surrounding the islands of St. Domino and St. Nicola, where the aforementioned constraints remain for professional and underwater fishing, while for sport fishing no limits except a maximum of 5 kg of daily catch; navigation does not require any authorization, but the speed limit of 6 knots remains.

"Torre Guaceto" Marine Protected Area

The Torre Guaceto Marine Protected Area covers about 2,200 ha up to the 50 m bathymetric line, covering an 8 km stretch of coastline between Punta Penna Grossa and the Apani rocks.

The diversity of the underwater environments and their numerous species have determined the inclusion of the 'Torre Guaceto' Marine Protected Area within the List of Specially Protected Areas of the Mediterranean (SPAMI) for the Conservation of Biodiversity. In addition, the Marine Protected Area has received the prestigious Blue Park Award offered by the Marine Conservation Institute in the Oslo conference.

The MPA includes the Special Area of Conservation (ZSC) IT9140005 "Torre Guaceto and Macchia S. Giovanni." Closely related to the marine protected area is the State Nature Reserve, which covers about 1,200 hectares and is characterized by various ecosystems, such as Mediterranean scrub, the dune system and the wetlands, which give the area a high naturalistic value.

The Wetland is composed of Mediterranean maquis, marsh environments and beaches.

Along the submerged rocky coast, it is possible to come across numerous fish belonging to the Sparidae family, including bream and seabream, common Serraninae such as painted comber and grouper, or Labridae such as the rainbow wrasse and ornate wrasse. In the shallower section of the seabed there are Anthozoa, including the sea tomato and the madreporian *Cladocora caespitosa*, which represents the largest of the Mediterranean Madreporaria. Descending in depth one comes across *Posidonia oceanica* and coralligenous meadows.

Posidonia meadows are rich in species, including the noble pen shell (*Pinna nobilis*), the largest bivalve mollusk in the Mediterranean, and Anthozoa such as the golden anemone. Posidonia meadows are one of the most important and fragile environments in the Mediterranean, so much so that they are included in the list of priority habitats protected at EU level by the Habitats Directive 92/43/EC.

Bordering the meadows is another habitat of great importance: coralligenous formations, characterized by the presence of Gorgonia such as *Eunicella cavolinii* and *Eunicella singularis*. Also noteworthy is the presence of the slender branching structure of Bryozoa such as false coral and the fragile Neptune's lace, Anthozoa such as *Parazoanthus axinellae*, sponges such as the common *Petrosia ficiformis*, and large Axinellae.

The 'Torre Guaceto' area is visited by many birds and is home to many amphibians and various invertebrates.

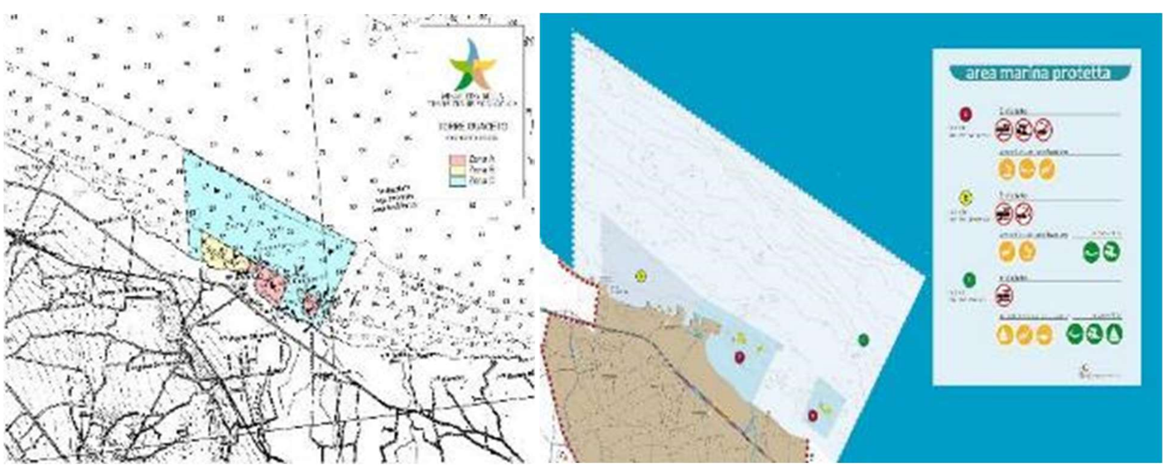
A few pairs of Western marsh harrier nest here. Many waterfowl can be spotted during migration passages, including water rails, coots, mallards, greater spotted eagles, cormorants and spoonbills.

"Torre Guaceto" Marine Protected Area	
REGION	PUGLIA
PROVINCE	BRINDISI
MUNICIPALITIES	CAROVIGNO and BRINDISI
IMPLEMENTING DECREE	D.I. 4/12/91
SEA SURFACE AREA	Extension 2,227 ha – length of coast 8,405 m
MANAGING BODY	Joint management association of Municipalities involved and WWF for Nature ONLUS, Main office: Via Sant'Anna 6, 72012 Carovigno (BR)

BOUNDARIES AND ZONING (art. 2 I.D. 4/12/91) - Reg. M.D. 26/01/09

The MPA includes the Special Area of Conservation (ZSC):

- IT9140005 "Torre Guaceto e Macchia S. Giovanni".



The MPA is internally divided into:

- **ZONE A** with Total Protection, which represents the "core area" of the MPA, in which any anthropogenic activity that may cause damage or disturbance to the marine environment is prohibited, except for that duly authorized by the Managing Body for service reasons as well as for any scientific research activities and guided tours.
- **ZONE B** with General Protection, where a range of activities that allow for the sustainable enjoyment and use of the environment is allowed, often regulated and authorized by the Managing Body, in addition to the activities provided for Zone A. In Zone B, bathing is permitted.
- **ZONE C** with Partial Protection, is the buffer strip between the areas of greatest naturalistic value and the areas outside the MPA; most of the MPA's extension falls into it. In addition to the activities possible in Zones A and B, fishing and boating activities can be carried out in this zone. The presence of a buffer zone allows this transition area to act as a filter and mitigator of disturbance processes.

In Zone A, photographic activities must be carried out either with MPA staff or with the authorization of the Managing Body. In Zones B and C, sailing, rowing, pedal-powered or electric propulsion is not allowed, unless otherwise authorized by the Managing Body. Guided underwater tours and sailing school activities may be conducted throughout Zone C of the MPA. Local professional inshore fishing is allowed in Zone C, according to current regulations, with fixed gillnets of the "trammel dragnet" type, with a maximum length of 1,000 m, a maximum height of 1.5 meters and mesh size, each side, from knot to knot, equal to or greater than 30 mm. Applications for permits for sport fishing activities must be submitted to the Managing Body. Parking and transit on the coastal maritime domain is prohibited, unless otherwise authorized by the Managing Body.

4.2.5 Land and Soil

4.2.5.1 Land Use

Use of the land results from anthropic activities and coverage of the land itself, which provides a description of how the land is used by man. Thus, coverage of the land is a concept that is related to but distinct from land use and, in fact, relates to bio-physical coverage of the land's surface. One definition can be taken from Directive 2007/2/EC, which includes artificial surfaces, agricultural areas, bush and forests, semi-natural areas, wetlands, and bodies of water in land coverage. The term land is used to refer to the upper layer of the earth's crust, made up of minerals, humus, water, air, and living organisms. Like water and the air, land is a limited resource, and is one of the essential pre-requisites for life. Generally it forms over a very long time, but can be destroyed physically within a very short period of time, or altered chemically and biologically, despite its resilience, to the point of losing its functions. The land is a key component of the basic resources for agricultural development and ecological sustainability, and is the basis for producing food, forage, fuel, and fibres. Waterproofing is one of the main causes of degradation of the land in Europe, as it leads to a heightened risk of flooding, contributes to climate change, threatens biodiversity, results in the loss of fertile farmland as well as natural and semi-natural areas, and, along with urban spread, contributes to the progressive, systematic destruction of the countryside, especially the rural landscape.

Covering the land with waterproof materials is probably the practice that has the greatest impact on the land as a resource, because it brings about total loss or compromising of its functionality, to the point of limiting / inhibiting its irreplaceable role in the nutritive element cycle. The land's productive functions are therefore inevitably lost, as is their capacity to absorb CO2, to support and sustain the biotic factors of the ecosystem, guarantee biodiversity and, often, its social use.

One important tool for studying and monitoring land as a resource is the European Corine Land Cover Programme (Copernicus) that was launched in 1990 and implemented to provide the European Union, the associated countries, and countries adjacent to the Mediterranean and Baltic Seas with homogeneous territorial information within the countries involved, facilitating contact between the operators. The most recent data available (https://land.copernicus.eu/pan-european/corine-land-cover) relate to acquisitions by the Sentinel-2 and Landsat-8 in 2017-2018. For the coastal environment, the Copernicus Programme has a specific section of studies and in-depth analysis of a coastal belt about 10 km wide, making all the geographical data available in vectorial form, to support activities connected with the MSFD.

Using GUS techniques, this geographical data is used to characterise the land component of the coastal belts included in the Adriatic MSP Sub-areas using, given the aims, scale of survey and representation of this RA, the first resolution level (Level 1), broken down into 8 classes. The table below (Tab. 4.14) shows the percentage area for each class / type of land cover of the extent of the entire sector, for each coastal belt sector that corresponds to the specific sub-area.

Coastal belt in the sub-area	Type of land cover - Level 1	Percentage of the area of the entire sector
A/1	Croplands	47.0%
A/1	Bush, forest	20.3%
A/1	Anthropised	15.0%
A/1	Sea, river, lake	13.1%
A/1	Grasslands	2.0%
A/1	Wetlands, transition water	1.4%
A/1	Plains, scrubland	0.7%
A/1	Areas with little or no vegetation	0.5%
A/2	Croplands	53.1%
A/2	Sea, river, lake	22.6%
A/2	Anthropised	12.4%
A/2	Wetlands, transition water	6.0%
A/2	Grasslands	3.3%
A/2	Bush, forest	2.2%
A/2	Areas with little or no vegetation	0.3%
A/3	Croplands	62.9%
A/3	Anthropised	16.1%
A/3	Sea, river, lake	12.1%
A/3	Bush, forest	4.7%
A/3	Wetlands, transition water	1.8%
A/3	Grasslands	1.8%
A/3	Areas with little or no vegetation	0.5%
A/3	Plains, scrubland	0.1%
A/4	Croplands	64.1%
A/4	Anthropised	19.6%
A/4	Bush, forest	10.8%
A/4	Grasslands	4.4%
A/4	Areas with little or no vegetation	0.7%
A/4	Sea, river, lake	0.5%
A/4	Plains, scrubland	0.1%
A/4	Wetlands, transition water	0.0%
A/5	Croplands	71.1%
A/5	Anthropised	15.2%
A/5	Bush, forest	8.8%
A/5	Grasslands	2.6%
A/5	Areas with little or no vegetation	0.9%
A/5	Plains, scrubland	0.8%
A/5	Sea, river, lake	0.5%

Coastal belt in the sub-area	Type of land cover - Level 1	Percentage of the area of the entire sector
A/5	Wetlands, transition water	0.0%
A/6	Croplands	65.0%
A/6	Anthropised	10.9%
A/6	Bush, forest	9.3%
A/6	Grasslands	6.5%
A/6	Plains, scrubland	3.4%
A/6	Sea, river, lake	2.6%
A/6	Wetlands, transition water	1.7%
A/6	Areas with little or no vegetation	0.6%

Table 4.14 – Areas (in percentages) of classes of land cover. Corine Land Cover 2018. SOGESID 2022 processing of Corine Land Cover 2018 data - European Copernicus Geoportal.

A lot of the coastal belt area in sub-area A/1 is cultivated land (47%, while about 20% is covered by bush. The anthropised areas account for 15%, which is the same percentage as the Marano Lagoon, along with the transition waters. The percentage the Venetian Lagoon occupies of the coastal belt that corresponds to sub-area A/2 is almost 23%, added to by the 6% of wetlands and transition waters. The anthropised area is about 12% whereas more than half the entire area is allocated for agricultural use. This latter cover class also prevails in the coastal belt in sub-area A/3, in which croplands account for almost 63% of the total area calculated.

The Comacchio Valleys in the Po Delta Park, along with the other lagoons, rivers, and transition waters, amount to about 14% of the cover, while the zones changed by man account for 16%. Almost all the land cover in the coastal belt in sub-area A/4 can be broken down as being in four classes: croplands at 64%, anthropised areas at almost 20%, bush and forests at 11% and 4% grasslands.

For the coastal sector in sub-area A/5, administered therefore by the regions of Abruzzo and Molise, one finds a large expanse of croplands at more than 71% of the entire area analysed. The anthropised areas make up about 15% and about 11% is occupied by bush and grasslands. Then poorly vegetated areas, transition waters, and lakes and rivers each account for less than 1%.

In the entire "Adriatic" M.A. [maritime area] the lowest anthropised zone percentage within the entire extent of the coastal belt is that measured on the coast of Puglia, which is in sub-area A/6 and reaches almost 11%. Croplands account for 65% of the total area, along with 9% of bush / forests, 6% of grasslands, and the remaining part made up of plains with more or less vegetation, and coastal and transition waters.

4.2.5.2 Subsidence

Subsidence is a well-known, slow process of the land getting lower. It mainly affects coastal areas and plains (e.g. Venice, Ravenna). Subsidence is generally caused by geological factors (compacting of sediments, tectonics, isostasis), but in recent decades it has been aggravated by the actions of man, reaching a greater scale (in terms of both area extent and speed) that those that would have been attained naturally. Generally, natural subsidence is at a rate of a few millimetres per year, and so its consequences are relatively minor and mainly manifest themselves over a very long time. The case of subsidence induced and/or accelerated by anthropic causes (extracting fluids from the sub-soil or water remediation) is different. It reaches values from ten to more than a hundred times greater, and its effects manifest themselves within a shorter time, in some cases resulting in compromising human works and activities.

Especially drawing fluids from the sub-soil results in the reduction in the volume of sediment it contains (especially if clays or limes are involved) which, as a result, compacts, and its topographical surface is lowered significantly. Therefore, subsidence is an important environmental risk factor, especially in areas that are highly urbanised or recently urbanised, and in coastal areas, especially when these are below sea level, also as regards climate fluctuations in the Mediterranean context (Annuario dei Dati Ambientali, ISPRA Ed. 2019).

Fig. 4.52 ISPRA 2019-modified - Italian municipalities with subsidence phenomena and Sub-Areas of the Adriatic Sea.

This interaction of natural and anthropic processes makes studying the subsidence phenomenon complex, and so also its mitigation. In some zones, such as in Emilia-Romagna or the Venetian Lagoon, for example, where drawing fluids from the sub-soil is significant, the legislative actions taken to protect the territory have slowed down or even stopped subsidence locally.

This phenomenon involves about 14% of Italian municipalities (1,093 towns/cities). This mainly involves towns and cities in the regions in the North, especially in the Po Valley Plains. In central and southern Italy, this phenomenon affects mainly the coastal plains. The regions most exposed are Veneto and Emilia-Romagna, in which about 50% of municipalities are affected (307 and 179 municipalities respectively), followed by Tuscany (28%, 79 municipalities), Campania (19%, 103 municipalities), Lombardy (17%, 257 municipalities), and Friuli-Venezia-Giulia (11%, 24 municipalities) (Annuario dei Dati Ambientali, ISPRA. Ed. 2019). The data quoted above shows that, for the Maritime Area of the Adriatic Sea, the Sub-areas can only be classified in relation to the number of municipalities affected by subsidence in each region (or part of a region) with an Adriatic coastline, as indicated in table 4.15.

The Sub-Areas for the regions most affected by the subsidence phenomena are A/2 and A/3, which correspond to the regions of Veneto and Emilia-Romagna. As shown in Fig. 4.53 besides the zones in the Po Valley Plains and Venetian Lagoon, mainly the coastal municipalities are affected by this phenomenon and, especially, those characterised by low and sandy coastlines.

Sub-area	Municipalities with subsidence phenomena that fall within the regions in the Adriatic Sea sub-areas
A/1	24
A/2	307
A/3	179
A/4	5
A/5	5
A/6	11

Table 4.15 – Number of municipalities with subsidence for each sub-area of the "Adriatic" Maritime Area. SOGESID 2022 processing of ISPRA data.

A monitoring system is only in place in some areas or Regions, which provides information on progress of this phenomenon over time. In 2018 Emilia Romagna published a Chart of vertical movement speeds of the land for the period 2011-2016, along with all information related to the studies carried out to survey this subsidence. The survey shows that most of the territory (79%) did not show changes in trends in the 2011-16 period compared to the 2006-2011 period, while 18% of the area showed a reduction in subsidence. For decades, due to the extent of the phenomenon resulting from the lithostratigraphic, hydrogeological, and tectonic characteristics and drawing of fluids from the sub-soil, subsidence has been monitored in the Region by means of geometric surveying and GNSS with, in recent years, the addition of satellite interferometric data (InSAR). Other Regions have also developed satellite territory monitoring systems, such as, for example, Tuscany, Veneto, and Valle d'Aosta, and, thanks to the *Copernicus European Ground Motion Service* (https://land.copernicus.eu/pan-european/european-ground-motion-service) that will provide European Countries with satellite Interferometric Data (taken from Sentinel-1 radar images) from 2022 and updated annually, one presumes that subsidence monitoring will be done more regularly countrywide.

4.2.5.3 Coastal situation

The Italian coastline along the Adriatic Sea is about 1,400 km long and about 86% of that is natural coastline (Table 4.16). The longest stretch of coastline is in area A/6 and is about 680 km long, whereas the shortest is in sub-area A/1 at about 100 km long (Figure 4.54) ISPRA 2022 Data - processed by SOGESID.

SUB-AREA	Overall length (km)	Natural coastline (km - % of total sub-area)		Anthropised coastline (km - % of total sub-area)	
A/1	104	68	66%	36	34%
A/2	149	128	86%	21	14%
A/3	123	106	86%	17	14%
A/4	181	147	82%	33	18%
A/5	166	139	84%	27	16%
A/6	681	623	91%	58	9%

Table 4.16 - Coastline length of the "Adriatic" Maritime Area, broken down into natural and anthropised coastline (ISPRA 2022 data - processed by SOGESID).

An initial indication of the coastline set-up can be obtained by computing the sections of natural coastline in relation to those subjected to coastal works by man for various purposes (ports, piers, tight-fitting barriers, etc.), which replace the coastline stiffening it almost completely.

Excepting for sub-area A/1 where, of the entire coastline for the sub-area 34% is anthropised, all the other sub-areas of the coast are mostly natural, especially in sub-area A/6 where it has been calculated that 91% of the coastline has not been subjected to anthropic works. Another indication of the coastal set-up, also processed, presented, and commented on to a functional extent for the purposes of this ER is the data that, albeit speditiously, distinguishes high from low coastline. The latter is the most common morphology at about 87%, whereas the high coastline is found mainly on the Puglia coast (sub-area A/6) and marginally on sub-areas A/1, A/4, and A/5. As is known, the Veneto and Emilia-Romagna coasts (sub-areas A/2 and A/3) are exclusively in the form of beaches, as indicated in Table 4.17. Other indications on the coastal situation can be gleaned from the ISPRA information on the coastline, referred to before, and referring to the lithology of the coastal section, the type of anthropic works, and the evolutionary trend. Another aspect to be considered in characterising the coasts in the Adriatic Maritime Area is the occurrence of pocket beaches.

These particular beaches nestle in high coastlines, and are not fed by fluvial debris and, as they are limited in extent, they often constitute zones of great interest and environmental value, as well as being highly attractive from a tourism point of view. The data and knowledge provided and commented on below were taken from the book "Le Pocket Beach" written by Simeoni, Corbau, Pranzini, and Ginesu in 2012 (ISBN 978-88-204-0156-6).

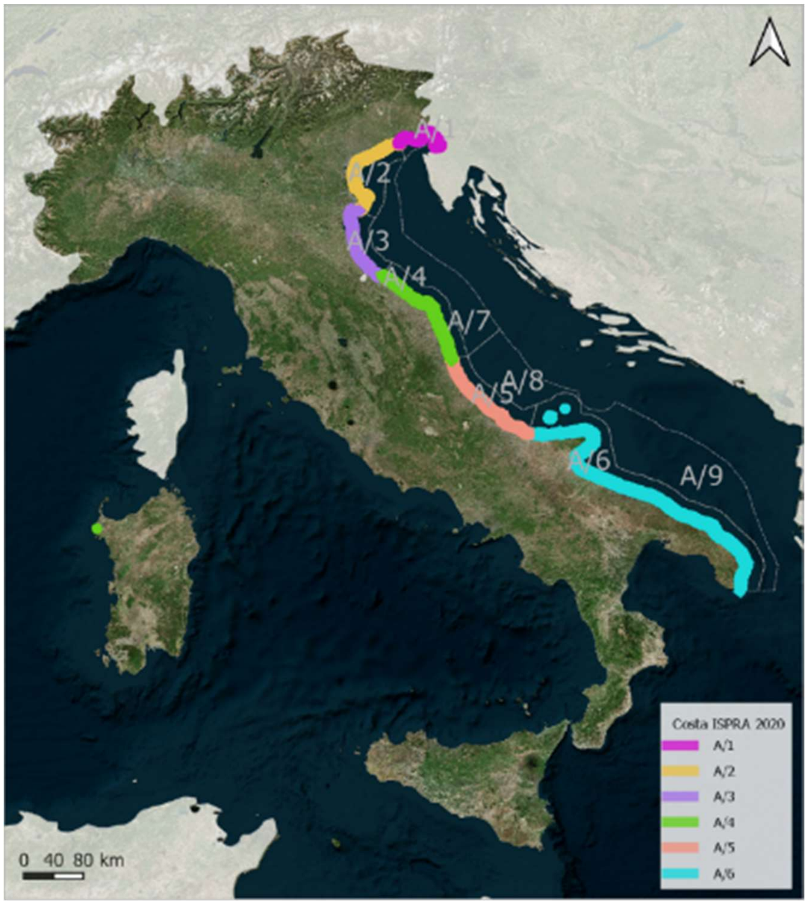


Figure 4.53 – The Adriatic Coast broken down by maritime sub-areas

SUB-AREA	Overall length (km)	Low coast (km - % of total sub-area)		High coast (km - % of total sub-area)	
A/1	104	99	96%	4	4%
A/2	149	149	100%	0	0%
A/3	123	123	100%	0	0%
A/4	181	171	94%	10	6%
A/5	166	164	99%	2	1%
A/6	681	513	75%	169	25%

Table 4.17 - Morphological characterisation of the "Adriatic" Maritime Area coastlines (ISPRA 2022 Data - processed by SOGESID).

About 80 pocket beaches have been recorded in the "Adriatic" Maritime Area, most of which are in sub-area A/6 which, as described previously, presents the natural morphological setting for the appearance of this type of beach (high coasts and rocky promontories). Of these there are those on the Tremiti Islands, those in Vieste, and the one in Torre Canne. The Aurisina Cave pocket beach (Friuli-Venezia Giulia - A/1), Numana Alta (Marche - A/4), and Ripari di Giobbe (Abruzzo - A/5) are other well-known examples of these particular beaches along the Adriatic coast.

4.2.5.4 Coastal erosion

The extent of the Italian coastline is about 6% of the total for Europe, and the coastal belt is historically distinguished by a high degree of urbanisation, to the extent that phenomena of coastal erosion represent a risk factor for many towns and cities, as well as roads and railways. In fact, urbanised coastal sections exposed to a risk of erosion extend for 669 km and affect 90% of the towns and cities. To contain erosion phenomena artificial replenishment works are carried out, using mainly sand from the seabed. The retraction of the coastlines is perhaps the most monitored coastal risk factor, especially due to its impact on the tourism economy. In fact, erosion of the coastlines results in a reduction in spaces used for swimming and recreation activities which, is some areas like the Romagna coastline, are an important part of the Region's GDP. This criticality affects both sections of active crags (or high coasts), where the phenomenon is often associated with collapses and/or undercutting at the base due to wave motion, and especially sandy and gravel beaches, where the loss of sediment due to the effect of coastline dynamics, results in lowering the level and the beach and retraction of the coastline. A recent piece of data on the evolutionary trend of the Adriatic coastline is found in the ISPRA 2020 processing for the Coastline, which provides information on retraction - stability - advancement of each segment of the coastline.

Table 4.18 highlights the fact that the coastline subject to erosion is that in sub-areas A/2, A/3, A/5 with percentage portions of retracting coastlines of between 20 and 28%. The most "stable" coasts appear to be those in sub-areas A/1 and A/6 with percentages of stable coastline sections exceeding 80%. When it comes to the coasts in sub-area A/1 (Friuli-Venezia Giulia) the stability is ascribed to the geomorphological component combined with the significant addition of debris by the rivers, whereas for sub-area A/6 it is only the geomorphological component, often marked by high, rocky coasts, that ensures stability.

SUB-AREA	Retracting coastline (km - % of total sub-area)		Stable coastline (km - % of total sub-area)		Advancing coastline (km - % of total sub-area)	
A/1	8	7%	85	82%	11	11%
A/2	36	24%	48	32%	65	44%
A/3	34	28%	51	41%	38	31%
A/4	22	12%	98	54%	61	34%
A/5	33	20%	77	47%	56	33%
A/6	70	10%	549	81%	62	9%

Table 4.18 - Evolutionary trends of the Ionian and Central Mediterranean Maritime Area coastlines (ISPRA 2022 Data - processed by SOGESID).

The most frequent sections for which advancing coastlines are found are in sub-area A/2, where 44% of the coast is advancing, followed by those in sub-areas A/4 and A/5. The overview that emerges from this study therefore clearly differentiates sections of coastline characterised by a high degree of dynamism of the coastline (sub-areas A/2 and A/3 for example), with alternating erosion and prograding phenomena and sections of coastline with limited evolutionary phenomena (sub-areas A/1 and A/6), where the coast appears to be stable over the years.

REGIONE	Numero di dighe	Volume invasabile (milioni di m^3)
Friuli-Venezia Giulia	12	189,86
Veneto	18	237,96
Emilia-Romagna	25	158,96
Marche	17	119,07
Abruzzo	14	370,38
Molise	7	202,91
Puglia	9	541,42

Table 4.19 - TNFC Guideline Data and obtained from the Italian Dams Register (2015).

In general, the phenomenon of coastal erosion can mainly be ascribed to the great reduction in the transportation of solids by rivers over the last century, associated with natural causes, such as the end of the 'Little Ice age', which had produced a sharp increase in fluvial peaks up to the end of the 19th and start of the 20th centuries, with consequent redistribution of sediments in the inter-peak zones, and a growth of beaches. Man's actions have had a dominating effect on the natural phenomena, with the construction of barrages, cementing river beds, and removing small stones used for building. A significant piece of data in this sense is that on sediments trapped in the dams in various regions.

The service for downloading WFS data from the MITE National Geoportal was used to acquire and process the changes in beach areas plotted from the orthophoto for the years 1994-2012. Essentially, the data obtained and shown in Table 4.20, below, confirms the evolutionary trend of the Adriatic coastlines, taken from the ISPRA 2020 Coastline Study, despite relating to a different monitoring period, and the differences between linear and aerial data measurements. Therefore, the coastline sections that are most stable are confirmed to be in sub-areas A/6 and A/1 for the reasons laid out before. Those that are most dynamic are in sub-areas A/2 and A/5, marked by changes in the areas of beaches of the order of millions of square metres. Especially for sub-area A/2 an overall growth from 1994 to 2012 of almost 3 million square metres calculated, and erosion of about 2 million square metres of beach area.

SUB-AREA	Erosion in sq.m.	Growth in sq.m.
A/1	394,723	1,286,625
A/2	1,926,402	2,932,461
A/3	882,289	1,134,455
A/4	570,131	682,390
A/5	1,014,268	1,044,051
A/6	710,572	853,845

Table 4.20 - Change in the beach areas for the "Adriatic" Maritime Area from 1994 to 2012 (MITE National Geoportal Data - processed by SOGESID)

Other information can be obtained from a work by MATTM 2017 that provides an analysis of the coastal sector most at risk, due to the presence of exposed assets along the coast (towns(cities, roads, railways) that are within 20 m of the coastline found to be retracting. Of the Adriatic regions, those with the largest percentage length of coastal sections exposed to a potential risk in 2012, were: Abruzzo, Emilia -Romagna and Marche, that had undergone particularly intense urbanisation over the last 50 years that had resulted in occupying more than half the territory within 300 metres of the coastline (Abruzzo: 62%, Marche: 59%, Emilia-Romagna: 55%). However, on analysing the data provided by the regions at the national meeting on coastal erosion (TNEC - MATTM-Regions, 2018) related to monitoring phenomena by individual bodies in different periods and using different methods, the situation appears to be even more alarming. In fact, the Adriatic Regions that provided the data are all affected by erosion phenomena covering more than 30% of the length of their coastlines. Another factor that contributes to the erosion of beaches is connected with interruption of coastal transport adjacent to ports, reinforced river mouths, and sea defence works (transverse dykes, breakwaters) that, in an attempt to safeguard some sections of the coast, transfer the erosion phenomena downstream on the flow. This problem has gradually become more relevant after the 1960s-1970s, due to the massive amount of this type of work done, and indiscriminate anthropic use of beaches and dunes.

The most impactful effects of erosion phenomena are seen after storm surges that often result in a significant transfer of sediments away from the beach system, which is not counteracted by subsequent additions. In all of this, the artificial contribution of replenishing beaches becomes fundamental, especially taking advantage of stockpiles of sand under the sea, which are an important source of sand with characteristics that are compatible with those of the current beaches. This type of work has been done in Italy from the 1990, albeit not yet to a sufficient extent. According to what is shown in the MATTM 2017 work, the overall balance in the area of beaches in 2012 is still strongly negative, despite more than 20 million cubic metres of sand, coming mainly from the seabed, being added from 1997 to 2011 (Source TNEC, MATTM-Regions 2018). By applying some equations that include the quantity of eroded sediment, that added to the system naturally, and the replenishing done, in order to reinstate the beach areas lost countrywide since 1960, about 350 million cubic metres of sand would be required. This calculation is based in the assumption that, to reconstruct 1 cu.m. of beach, 10 cu.m of sand would be required.

For a precise description of the genesis and knowledge about these sand deposits under the sea, see the TNEC Guidelines (MATTM-Regions 2018), in which Research Bodies (CNR) and Universities have produced specific chapters on the discovery, origin, and use of these deposits. What is important to recall in this document is that, for the Adriatic, the Marine Science Institute CNR-ISMAR, in collaboration with some coastal Regions and transferring technological experience with private entities, has identified a series of sand deposits under the sea (DSMR), part of which have already been studied in detail, with geophysical surveys and sampling and, some of which have yet to be defined in terms of characteristics and cubic metres. The most recent research on the Adriatic looks at deposits near the Puglia coastlines.

By specific collaboration with the Emilia-Romagna Region, capitalised on with the Veneto Region, informative tools and protocols were also produced to make exploitation and management of these deposits more effective and environmentally sustainable (Correggiari et al. 2016).

Figure 4.54 – Coastal defence works along the Adriatic coast. ISPRA 2022 Data - processed by SOGESID.

Regione	Note	Profondità depositi	TOTALE - Potenzialità Mm3			
		min-max	teorica	accessibile	presunta	verificata
Friuli-Venezia Giulia	Non risultano effettuate ricerche	-	-	-	-	-
Veneto	sabbia da media a fine	16-30 m	140,48	129,01	57,76	7,6*
Emilia-Romagna	sabbia fine	34-50 m	392,94	392,94	221,98	221,98
Marche	sabbia fine (phi=2,8 - sorting<1)	85-92 m	100	100	100	100
Abruzzo	sabbia fine e interc. pelitiche-copertura pelitica >> 2m	25-135 m	3404	-	-	-
Molise	Non risultano effettuate ricerche	-	-	-	-	-
Puglia	Sabbie da medio-fini a grossolane	10-150 m	8057	1693,5	213,7	0
TOTALE	-	-	12094,42	2315,45	593,44	379,74

Table 4.21 - Volumes of sand identified in the Adriatic off the regional coastlines (Source: TNEC-MATTM-Regions 2018).
***Already authorised for dredging, by Decree of the Director of Land Defence for the Veneto Region n° 505 of 28.12.2017.**

The analysis of the availability of sediment already quantified by surveys in the Adriatic, highlights a rather favourable situation for this basin, if one thinks that only the sediments accessible using technologies known so far and available, come to more than 2300 Mm^3 of sediment (TNEC Data-MATTM-Regions, 2018). These deposits are all on a platform with a seabed depth that varies greatly, as indicated in the table below, and require correct management and regulation, which must be considered when planning the marine space. To counteract phenomena of marine flooding and erosion, extensive defence works have been erected, almost exclusively concentrated at low coast sections.

The most common classes of works include:

− Tight-fitting defences

− Emerging and submerged detached defences (reefs)

- Transverse defences (piers)
- Mixed defences (in terms of type and materials)

Many of these defence systems ensure survival of large portions of territory and, especially in a context of climate changes like that currently in progress, they require constant maintenance and reinforcement.

Regione	fonte dati più recenti	lunghezza costa in km	Costa alta	Costa bassa in km	% costa bassa	costa protetta lunghezza in km	% costa protetta al 2019
				(inclusa protetta)			
Friuli-Venezia Giulia	dati regione	111	11,5	99,5	89,6	40	24,3
Veneto	TNEC 2018 /ISPRA-annuario 2015	138,9	0	138,9	100	51,3	37
Emilia-Romagna	RER/ARPAe 2012	130	0	130	100	74	32,2
Marche	Piano GIZC (2019	176	32	144	81,8	129	73,3
Abruzzo	Piano Difesa Costa Regionale (2008-2017)	130	32	98	79,3	69	55
Molise	Regione/Università Molise al 2008 /ISPRA-annuario 2015	35,8	13,2	22,6	61,4	23,6	66
Puglia	Piano Costa PRC2012 (dato rif. costa totale)	603	340,8	262,09	39,1	-	12

Table 4.22 - Length of protected coastline by Region.

In fact, many works date back to the early decades of the 1900s and others, even more recent, may no longer be effective in their original configuration. In the table below the percentage of coastline protected in the Marche Region stands out.

The works involve moving boulders, making the seabed safe, as this has often been altered by the presence of the works themselves.

One problem connected with the presence of rigid works in the sea is the deepening of the seabed at openings in or the edges of the structure that, in addition to altering the environmental conditions, can pose risks for swimming in the sea. Of the environmental aspects connected with detached works one must stress degradation of the quality of the waters behind the reef, as well as a loss of habitats, resulting in non-insignificant effects on the composition of the benthic communities present in terms of diversity, abundance, and biomass. On the other hand, submerged detached defences, similar to rocky sub-strata, facilitate the presence of epibiotic communities.

In relation to the matters and criticalities described above, one must point out the importance of careful evaluation of the criticalities induced by anthropic activities in the sea, on the dynamics of the coastal belt, while also taking into account the evolving scenarios associated with current climate changes. In fact, it was found that, especially in the North Adriatic Regions, already greatly afflicted with problems of marine flooding, the degree of vulnerability will increase in the coming decades, and they will have to come up with "adaptation plans" for climate changes that involve new ways of managing and using the coastline.
These plans could include non structural measures, which tend to increase the resilience while reducing the vulnerability of the coastal system, also by applying a set-back band in which better implementation of ideas and concepts must be provided for, as also expressed in the TNEC Guidelines (MATTM - Regions 2018 http://www.erosionecostiera.isprambiente.it), such as:

- "Renaturalisation" (e.g. acknowledging and conserving dune apparatus).
- Incentivising "seasonality" (any removable work in place for the summer and removed outside of that period).
- "Minimisation of interference with the coastal hydrodynamic balance" (e.g. construction on "pilotis").
- Limitation of "land consumption".
- Providing for "delocalising" elements at risk.

To combat the coastal erosion phenomena that affect the entire Adriatic coast, the techniques and strategies in place will have to be improved, especially making use of off-shore sand resources, which calls for "regulation" as part of the Adriatic MSP.

The main priorities to be considered in the plan, can therefore be summarised in the following points:

Land Side:

- ✓ Plans to reinstate sedimentary flow by rivers, even if long-term (art 117 of D.Lgs. 152/06).
- ✓ Work on nature and reinstatement of dune systems.
- ✓ Constant maintenance of coastal defence works, and increase in sea side replenishment works.
- ✓ Reduction in drawing off of fluids and gases in the coastal zone, which causes accelerated subsidence and increase in the areas at risk of flooding.
- ✓ Containment of maritime works that affect the coastal dynamics, interrupting the transportation of coastal solids.
- ✓ Searching for and exploitation of sand deposits for replenishing beaches.
- ✓ Maintaining weather and marine monitoring networks.
- ✓ Development of environmental monitoring networks, called for in Regional plans.

4.2.5.5 Seismic dangerousness

Italy is largely a country that is tectonically and seismically active, which brings about seismic dangerousness that is particularly relevant along the entire Chain of the Appenines, Western Alps, Southern Sicily, and the Gargano Promontory in Puglia. The seismic dangerousness is determined by two elements; seismic shaking, which generally causes most of the damage, and surface faults.

The presence of numerous active, capable faults in the country, that is, faults that can break or deform topographical surfaces if they move during strong earthquakes, brings about a dangerousness due to "surface faults" that is able to cause damage to anthropic structures and infrastructures. One representation of the dangerousness connected with seismic shaking is given in the "*Mappa di Pericolosità sismica a scala nazionale*",[Map of seismic dangerousness at a National Scale] by the INGV.

Sub-area	Mean of the seismic classifications for coastal towns and cities in each sub-area
A/1	2.96
A/2	3.00
A/3	2.28
A/4	2.19
A/5	2.74
A/6	3.31

Table 4.23 - Mean of the seismic classifications for the coastal towns and cities affected by the "Adriatic" Maritime Area SOGESID 2022 processing of Civil Defence data.

This map[43] is annexed to OPCM 3519 of 28 April 2006 that updated the national criteria for seismic classification. Based on these criteria, Italy is divided into four zones characterised by different classes of maximum acceleration on rigid land (ag), expressed as a fraction of the acceleration due to gravity g, with a probability of exceeding 10% in 50 years: ag>0,25 for Seismic Zone 1; 0.15<ag≤0.25 for Seismic Zone 2; 0.05<ag≤0.15 for Seismic Zone 3 and ag≤0.05 for Seismic Zone 4.

[43] See http://zonesismiche.mi.ingv.it

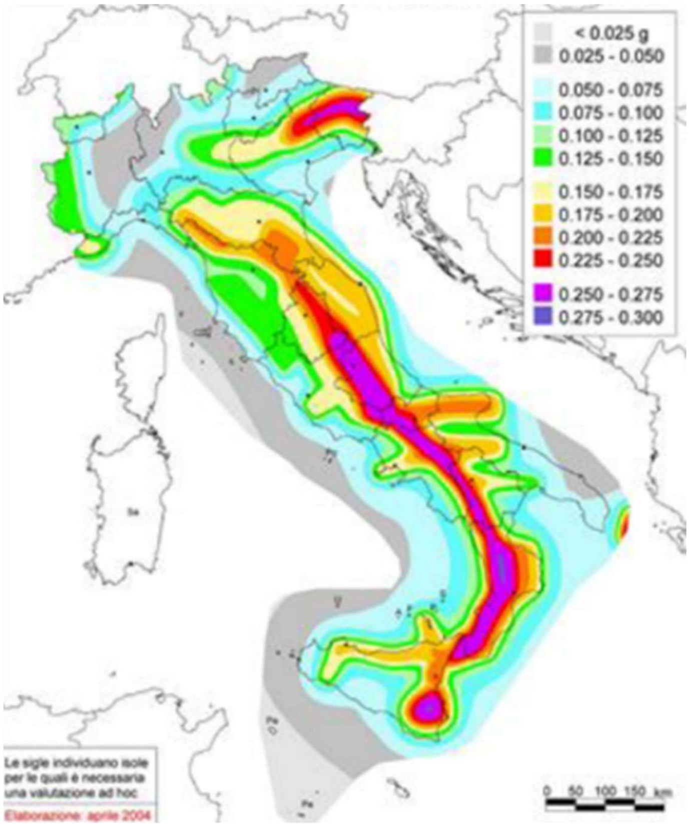


Figure 4.55 Seismic dangerousness map (approved by means of OPCM 3519/2006), drawn up by the National Institute of Geology and Vulcanology, used as a reference to identify the ag values (ag is the acceleration of the land expressed as a fraction of acceleration due to gravity g) and the seismic zones. The maximum ag values are provided for the points on a reference grid, the node points is which are not more than 10 km apart (0.05° grid) and for various probabilities of exceeding in 50 years. There are various maps for different return periods.

Using this classification for the coastal municipalities affected by the Adriatic Sea sub-areas, and consulting the seismic classification updated on 31 March 2022, by the Civil Defence, and averaging the values for each of them using geostatic GIS techniques, table 4.24 was drawn up that, albeit speditiously, gives each sub-area a value that expresses its seismic characterisation. The coastal belt with the highest mean seismicity value (3,31), is that located off sub-area A/6 administered territorially by the Puglia Region. Values below 3 are obtained for coastal belts for Sub-areas A/5 (Abruzzo and Molise), A/4 (Marche), and A/3 (Emilia-Romagna). Finally, for coastal municipalities in sub-area A/2 the mean seismic classification value was equal to 3.

Another dangerous aspect of seismic activity that Italy is subject to, is that of surface faulting. This is due to the presence in the country of Capable Faults, that is, breakage planes in the earth’s crust that are potentially able to reactivate in the near future (along with seismic events) or that creep continuously (aseismic creep), displacing or at least deforming the land surface (giving rise to surface faulting). Displacement along capable faults is able to produce even significant damage to the anthropic structures and infrastructures that pass through.

Nuclear plants or dams must be located at an adequate distance from capable faults. Other infrastructures, such as those that are linear (gas, oil, and water pipelines) that, by their nature, cannot avoid crossing them, must be designed applying suitable technical features. Data on the characteristics of Active and Capable Faults in Italy, such as location, geometry, kinematics, associated earthquakes, and mean degree of deformation, etc. are gathered and described by ISPRA in the ITHACA (ITaly HAzard from CApable faults) Catalogue.

This Catalogue, which contains cartography managed in a GIS environment, is a useful application tool for representing the dangerousness of a surface fault in Italy, and therefore as a support for territorial planning studies. The Catalogue contains both Capable Faults (activated in the last 125,000 years) and Potentially Capable (active in the last 2 million years approximately) for which further studies are required, especially in the case of the presence or designing of works for which damage may give rise to a significant risk for the population or an extensive environmental impact.

By overlaying the geographical information from the Catalogue of Active and Capable Faults, and the zones affected by the “Adriatic” Maritime Area, as shown in Figure 4.56, one sees that the direct faults (shown by a continuous line) affect the coastal belts off sub-areas A/1, A/2 and A/6, while inverse and oblique (shown by a broken line) are found for sub-areas A/3, A/4 and A/5. By correlating this information with the seismic classification of the coastal municipalities in question, one can highlight the relationship between the presence and/or nearness of direct faults in a zone, with a higher seismic dangerousness level (e.g. the promontory of Gargano in sub.area A/6), compared to a zone in which oblique or inverse faults were found (Sub-areas A/3 and A/4).

Figure 4.56 -Adriatic Maritime Sub-Areas and Catalogue of Capable Faults in Italy ITHACA (ITaly HAzard from CApable faults. http://sgi2.isprambiente.it/ithacaweb/viewer/), Catalogue of active and capable faults in Italy: capable faults (activated in the last 125,000 years) and potentially capable (active in the last 2 million years), known in Italian literature (Processed by SOGESID 2022).

The seismicity of Gargano is associated with an articulated system of faults, some of which are still active. These faults have moved in various ways during their existence, some of which date back to the Mesizoic era on both the horizontal and the vertical plane. Of these, the faults that run East to West are of significant importance in the structural context of Gargano (https://www.ingv.it/).

4.2.5.6 Volcanism

Like seismic phenomena, in Italy volcanic phenomena are connected with the particularly intense geodynamics of the entire Mediterranean area, characterised and determined by the presence / cohabitation of three tectonic plates: the Tyrrhenian, Adriatic, and African. The collision of the Tyrrhenian with the Adriatic plate formed (and is still forming) the Appenines, and both these plates, which in turn constitute the Euro-Asian plate, collide with the African plate. It is specifically this collision that, over million years, has formed most of the Italian volcanoes, and especially those in Southern Italy.

The paroxysmal manifestations of the volcanic phenomena are eruptions, which occur when magma from inside the Earth rises to the crust due to the lower density than the surrounding rocks, passes through the crust and comes out on the surface in the form of lava, releasing the gases trapped while it is rising to the surface. Volcanic eruptions can last for anything from a few hours to years (https://rischi.protezionecivile.gov.it/it/vulcanico/eruzione-vulcanica).

Literature deals with various types of eruption, closely related to the magma's chemism, the presence of gas (mainly water vapour), and the geological conditions of the area. The two extremes of eruption types are effusive eruptions, characterised by (basalt) fluid magma with very little gas and able to cover long distances, and explosive eruptions due to acid magma with a high gas content, which are particularly dangerous in the immediate vicinity of the crater. Finally, the type of eruption normally shapes the volcanic structure: flat and extensive for effusive eruptions (such as in Hawaii), and high and cone shaped, with strata for explosive eruptions (Vesuvian eruptions).

Volcanic eruptions pose a great risk for densely populated areas near to active volcanoes. The volcanic risk components are the vulnerability of people and buildings, which is always high, and so the risk is only minimal when the dangerousness or exposure value are also minimal. This is the case with extinct volcanoes, volcanoes that pose limited dangerousness, or volcanoes that are in areas that are not inhabited. The greater the probability of eruption, the greater the risk. For the same degree of dangerousness, the risk increases as urbanisation of the area around the volcano increases. Volcanic eruptions under the sea, earthquakes under the sea, and landslides that spill into the sea can give rise to tsunamis.

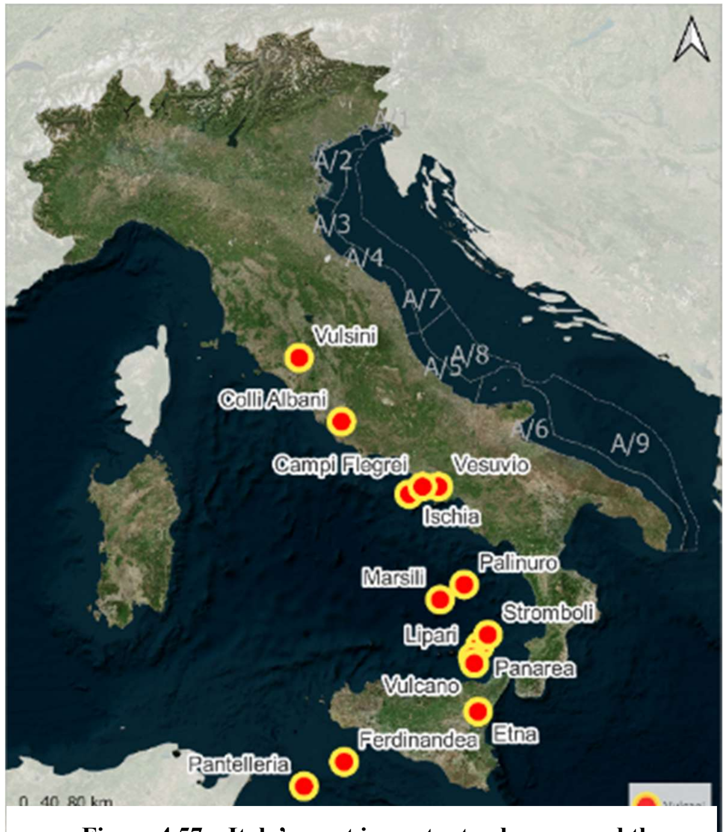


Figure 4.57 – Italy's most important volcanoes and the "Adriatic" Maritime Area.

The energy propagated by this series of waves is constant and varies in relation to the height and speed. So, when the wave approaches land, its height increases, while its speed decreases (https://rischi.protezionecivile.gov.it/it/vulcanico/eruzione-vulcanica).

As can be seen in Figure 4.58 and as is known, there are no volcanoes in the Adriatic Maritime Area. Nor are there volcanoes in the Adriatic coastal belt and the areas to the east of the Appenines.

4.1.1.1 Dangerousness and risk of flooding

The geomorphological design of Italy, broken down into small size hydrographic basins connected to a complex orography, gives rise to a natural predisposition towards hydrogeological instability. This is added to by the merely geological components that often combines lithologies that amplify the effects of the geomorphological set-up, making hydrogeological instability more frequent and intense. Normally the latter are divided into two large categories associated with the most frequent and damaging manifestations: flooding and landslides.

Most of this instability occurs inland, where the altimetric and slope class components accentuate the unstable conditions in the slopes, exasperating the dynamism of surface waters.

Despite this, the coastal belt is also subject to hydrogeological instability such as, for example, retraction of the crags or coastal flooding. Flooding is the most frequent type of instability associated with hydraulic dangerousness. For this reason, knowledge of these phenomena in both normative and scientific terms, is both abundant and continuously updated. From a normative point of view there are two important tools: the Hydrogeological System Plans (PAI) and the Flood Risk Management Plan (PGRA). In the PAI the mapped areas are governed by the Technical Norms for Implementation from the Excerpt Plans, which are used to apply guidelines for transforming the territory and its use, thereby affecting town planning, by means of opinions being expressed on compatibility with planning for the basin. In this regard, they are the reference point for more specific actions to mitigate and control dangerousness and risk. Territorially the refer to the (ex) Basin Authorities.

Sub-area	Percentage of the area subject to dangerousness due to flooding, compared to the 10 km coastal belt
A/1	23.52
A/2	36.17
A/3	57.30
A/4	4.22
A/5	5.95
A/6	6.18

Table 4.24 Percentage extent of areas subject to danger of flooding, compared to the total area for each coastal belt in the sub-areas of the "Adriatic" Maritime Area.

The PGRA cover managing the water risk and aim to pave the way for forecasting, for emergency planning tools. In these, goals are defined for managing the risk of flooding for the areas in which there is a significant potential risk of flooding, or where it is believed that this may arise in the future. They specifically highlight the reduction in potential negative consequences for human health, the territory, assets, the environment, cultural heritage, and economic and social activities, by giving priority to implementing non structural interventions and actions to reduce the dangerousness.

Figure 4.58 PAI mapping of the areas subject to danger of flooding, and Sub-areas of the "Adriatic" Maritime Area. SOGESID 2022 processing of PCN data - MITE National Geoportal.

Pursuant to Directive 2007/60/CE, the PGRA now deal with each aspect of the risk of flooding, in terms of prevention and protection. In addition, when determining the measures to attain the goals, the PGRA take the following aspects into account: the full capacity and extent of flooding; the routes for the water to run off and the zones with a natural capacity for expanding full capacity; management of the land and waters; planning and forecasting development of the territory; use of the territory; nature conservation; navigation and port infrastructures; costs and benefits; morphological conditions, and weather and sea states at the river mouth.

As assessment of the water dangerousness along the coastal belt in the Adriatic Sea Area can be done by getting the perimeters of the areas subject to a danger of flooding (PAI) from the National Geoportal, and adopting the coastal zone as a zone of interest, as marked out on the European Copernicus Portal, supporting the MSFD. On average this zone has a width of 10 km and, at times, follows the morphological conformation expanding into the coastal plains and therefore having a greater coverage area in these places.

As described before, for the entire coastal belt of the Adriatic Maritime Area, the calculation of the areas marked out as being in danger of flooding is about 2,800 sq.km out of an area of about 14,000 sq.km. Therefore, about 20% of the coastal belt in question is subject to the danger of flooding. In detail, and as indicated in the table below, the coastal belts most exposed to the danger of flooding are those in sub-areas A/3 (57,3% of the area at risk of flooding), A/2 (36.17%) and A/1 (23.52%). Morphologically, these areas are characterised by very extensive coastal plains, at altitudes near mean sea level, and they are crossed by important water courses.

The coastal belts in sub-areas A/4, A/5 and A/6, on the other hand, have a more irregular morphology, with steeper slopes and frequent high, rocky coasts, where flooding is normally less in extent, but greater in terms of intensity and force. In fact, the areas subject to danger of flooding in relation to the overall areas of the coastal belts calculated, are all small in extent. In fact, in the coastal belt in sub-area A/4, only 4,22% is classified as being in danger of flooding, while in the coastal belts in sub-areas A/5 and A/6 only 6% of the total extent is classified as being in danger of flooding.

Figure 4.59 PGRA mapping of the areas subject to risk of flooding, and Sub-areas of the "Adriatic" Maritime Area. SOGESID 2022 processing of PCN data - MITE National Geoportal.

For the maritime area in question, the territorially competent district Authorities are: The Po Mouth District Authority, the Southern Appenines District Authority, and the Eastern Alps District Authority.

In order to characterise the coastal belt, as described and motivated previously as the approximately 10 km strip from the coastline inland, proposed by the Copernicus Geoportal, the perimeters of the areas at risk of flooding were acquired from the National Geoportal - MITE, which were processed and analysed using a GIS procedure. As for the PAI perimeters for the danger of flooding, it was also possible to quantify the areas subject to a risk of flooding for the PGRA as well, and to identify the sectors of the coastline in the maritime sub-areas most exposed to this type of hydrogeological risk. The table below shows the results of this analysis, which shows that the coastal sectors in maritime sub-areas A/2 and A/3 to be those with territories most subject to the risk of flooding. These measure 1750 sq.km for sector A/2 and more than 1100 sq.km for sector A/3. In addition, one sees that the sector in sub-area A/6 (Adriatic Puglia) is where the areas classified as being high and very high risk are the most extensive.

SUB-AREA	PGRA – Risk of flooding (sq.km.)				
	R1 - moderate	R2 - medium	R3 - high	R4 - very high	Total risk
A/1	250	266	34	63	612
A/2	1060	561	36	94	1750

SUB-AREA	PGRA – Risk of flooding (sq.km.)				
	R1 - moderate	R2 - medium	R3 - high	R4 - very high	Total risk
A/3	697	365	77	4	1142
A/4	25	56	7	27	114
A/5	27	48	12	35	123
A/6	63	114	93	183	453

Table 4.25 Areas in sq.km of the areas within the flood risk perimeter in the Flood Risk Management Plan for each sector of the coastal belt in the sub-areas of the "Adriatic" Maritime Area (PCN - MITE National Geoportal data, processed by SOGESID).

Calculating the percentages of the extent of the areas within the PGRA flood risk perimeters, compared to the total extent of each coastal belt sector in the maritime sub-areas A/2 and A/3, those with the highest values are found again. For the coastal belt in sub-area A/3 about 67% is subject to the risk of flooding, whereas for A/2 the percentage area calculated is about 63%. However, looking at the percentages for the areas at very high risk, the highest values are recorded for sectors that correspond to sub-areas A/1 (4,83 %) and A/6 (3,7%), whereas the sector in sub-area A/3 has the highest percentage for areas at high risk (4,5%).

SUB-AREA	PGRA – Risk of flooding (percentage of 10 km coastal belt)				
	R1 - moderate	R2 - medium	R3 - high	R4 - very high	Total risk
A/1	19.13	20.40	2.60	4.83	46.95
A/2	38.11	20.16	1.29	3.37	62.93
A/3	40.91	21.41	4.50	0.21	67.04
A/4	1.55	3.48	0.40	1.64	7.07
A/5	1.70	2.97	0.76	2.20	7.63
A/6	1.26	2.30	1.88	3.70	9.14

Table 4.26 Percentage extent of the areas within the flood risk perimeter in the Flood Risk Management Plan compared to the extent of each sector of the coastal belt in the sub-areas of the "Adriatic" Maritime Area (PCN - MITE National Geoportal data, processed by SOGESID).

Finally, comparing both the representation of the areas at risk as shown schematically in the figures in the text, and the tables commented in above, one sees a substantial similarity between both the perimeters in the Hydrogeological System Plans and the Flood Risk Management Plan, and the information contents related to the various degrees of dangerousness and water risk.

4.1.1.2 Dangerousness of landslides

Figure 4.60 PAI mapping of the areas subject to danger of landslides and Sub-areas of the "Adriatic" Maritime Area. SOGESID 2022 processing of PCN data - MITE National Geoportal.

The dangerousness of landslides lies in the probability of occurrence of a potentially destructive phenomenon, of a certain intensity, and a certain time and in a given area (Varnes, 1984). The greatest criticality in analysing the dangerousness of a landslide, generally lies in the lack of information in the dates of activation of the landslide, and therefore, the difficulty of determining the frequency time. Due to these limitations, the analysis most often done is that of susceptibility or spatial dangerousness, which makes it possible to identify portions territory in which there is a greater probability of landslides occurring (Trigila *et al*., 2015). In the Hydrogeological System Plans, the areas at danger of landslides include not only the landslides that have already occurred, but also zones in which these may evolve, and zones potentially susceptible to new landslide phenomena. The PAI constitute an essential tool for correct territorial planning, by applying the limitations and regulation of use of the territory.

Italy is the European Country most affected by landslides, with more than 600,000 of the nearly 900,000 recorded in Europe (EuroGeoSurveys Survey; Herrera *et al*., 2017).

The mosaic of the areas at danger of landslides according to the Hydrogeological System Plans . PAI, was put together by ISPRA (v. 3.0 - December 2017) using a legend standardised into 5 classes for the entire country: very high danger P4, high P3, medium P2, moderate P1, and areas to be monitored AA.

Comparing the ISPRA 2017 national mosaic with that from 2015, one finds an increase of 2.9% in the overall area classified by the PAI (classes P4, P3, P2, P1 and AA) and 6.2% for the more dangerous classes (high P3 and very high P4). A reduction of 19.5% was recorded for areas to be monitored, most of which were reclassified as dangerous areas. These changes are mainly linked to additions to / revision of the perimeters by the Districtual Basin Authority, also with more detailed studies, and mapping of new landslide phenomena.

In Italy, the overall extent of the areas at danger of landslide according to the PAI, and areas to be monitored is 59,981 km^2 (19.9% of the area of the country). The extent of areas in very high danger of landslide is 9,153 km^2 (3%), for high danger the area is 16,257 km^2 (5.4%), medium danger 13,836 km^2 (4.6%), moderate 13,953 km^2 (4.6%), and requiring monitoring 6,782 km^2 (2.2%).

Sub-area	Percentage of the area subject to dangerousness due to landslides, compared to the 10 km coastal belt
A/1	0
A/2	0

A/3	0.49
A/4	14.48
A/5	14.48
A/6	1.93

Table 4.27 Percentage extent of areas subject to danger of landslides, compared to the total area for each coastal belt in the sub-areas of the "Adriatic" Maritime Area. SOGESID 2022 processing of PCN data - MITE National Geoportal.

If we look at the higher dangerousness classes (high P3 and very high P4), subject to the most restrictive limitations on use of the territory, the areas come to 25,410 km^2, which is 8.4% of the area of the Country. Overall, the PAI have drawn up perimeters for more than 860,000 areas in danger of landslides, if which about 470,000 are in classes P3 and P4. By taking these perimeters and superimposing the boundaries of the coastal belt identified by the European Copernicus Portal, using GIS techniques, one gets the extent of the areas at risk of landslides that fall within the coastal belt, subsequently divided up by the maritime sub-area that characterises each section of the coastline. About 470 sq.km are in danger of landslide in the entire coastal belt that falls within the Adriatic Maritime Area. Therefore, with less than 4% of the area in danger of landslide for the entire 10 km wide coastal belt, this type of instability is decidedly less common than flooding.

In addition, as one would expect, on observing the areal distribution of the PAI perimeters for danger of landslides, one finds a framework fully symmetrical with that for danger of flooding. The areas most subject to flooding are spacious and without steep slopes, and so are obviously not subject to landslides, which are recorded in more steep zones with a rocky sub-strate. In fact, for the coastal belts in sub-areas A/1 and A/2 there are no areas in danger of landslides, and less than 10 sq.km is classified in terms of danger of landslides in the coastal belt in sub-area A/3 (0.49%).

The most extensive areas within the perimeters of danger of landslides fall within the coastal zones in sub-areas A/4 and A/5, where they occupy more than 14% and are connected with a more irregular morphology and particular lithological conditions and land coverage. Finally, almost 2% of the areas at danger or landslides is found for the coastal belt in sub-area A/6.

4.2.6 Waters (marine-coastal, swimming, transition)

The main aim of the national water policy is to guarantee sufficient "good quality" water to meet the needs of the people and the natural environment. The risks to human health linked to the consumption of water, relate mainly to their pollutant and contaminant contents, which also pose a threat to aquatic ecosystems, such as a scarcity of water and drought, which have serious consequences for many economic sectors.

In 2015 the six-year monitoring period, in terms of the Draft Directive on Waters (Directive 2000/60/CE), which calls for attaining "good" condition of all bodies or water. This goal was not achieved fully not only in Italy, but in other countries in the European Union as well. Taking the complexity and impacts the bodies of water are subject to into account, in order to reinstate the quality and quantity that can guarantee good capacity for self-purification and support for the related ecosystems, choosing policies to safeguard the waters and defining organisational, managerial, and normative tools are of fundamental importance.

4.2.6.1 Marine-coastal waters

➢ <u>"MACROINVERTEBRATES Biological Quality Element"</u>

The "Benthic Macroinvertebrates M-AMBI-CW" indicator relates to the quality of the marine-coastal waters, and especially to classification of the Biological Quality Elements (EQB) of the marine bodies of water.

The M-AMBI (*Multivariate-Azti Marine Biotic Index*) is a multimetric index that includes calculation of the AMBI, the Diversity index H and the number of species (S). The value of the M-AMBI varies from 0 to 1, and corresponds to the Ecological Quality Ratio (RQE) called for by the Draft Directive on Waters 2000/60/EC (Source: Ispra 2021 yearbook). This index is used to provide a brief ecological classification of the ecosystem, using structural parameters (diversity, specific richness, and ratio between tolerant / sensitive species) of the mobile seabed macrozoobenthic community.

The species are broken down into five ecological groups opportunists (I order), opportunists (II order), tolerant, sensitive/tolerant, and sensitive), based on sensitivity to the environmental stress gradients.

The index describes the quality status of the Benthic Macroinvertebrates EQB in 5 classes:

1. High.
2. Good.
3. Sufficient.
4. Poor.
5. Bad.

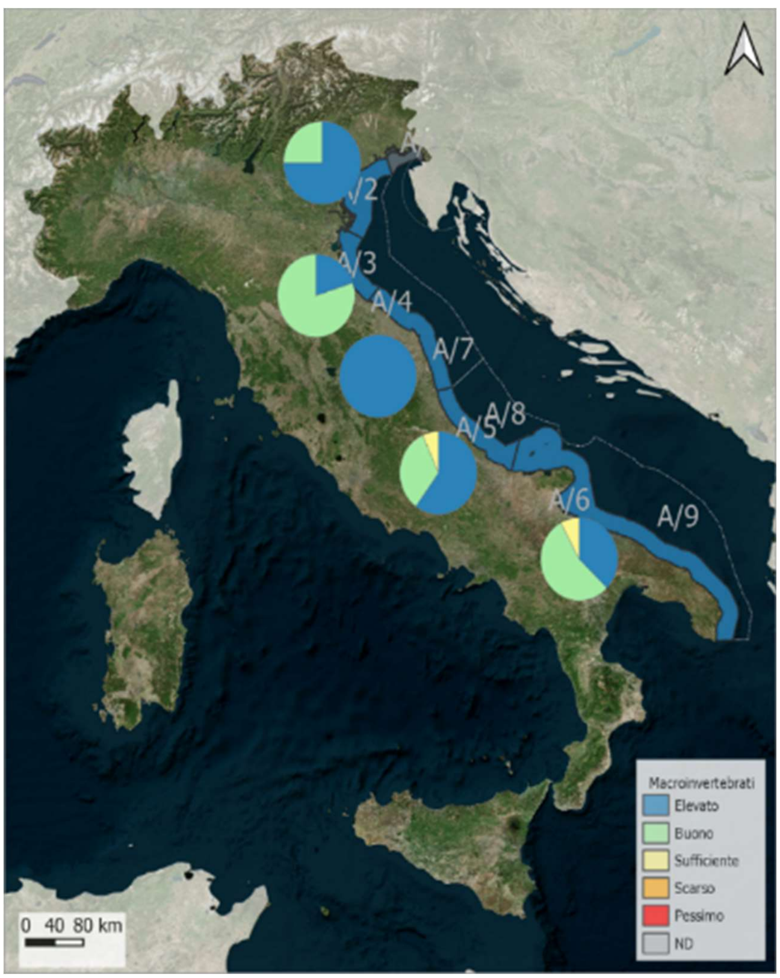


Fig. 4.61 Adriatic Macroinvertebrates – coastal waters

This indicator is relevant because it is laid down by the national norm and provides a significant response to pressures of anthropic origin.

It can be applied to environmental questions at a regional level but of national significance, despite the level of information detail not being optimal. In addition, it is easy to interpret and is reliable in technical and scientific terms, offering a representative overview of the environmental conditions, while providing a basis for comparison internationally (source Ispra 2021 yearbook).

For the Adriatic Maritime Area the data refers to the Italian coastal stations monitored between 2016 and 2017 for the Benthic Macroinvertebrates EQB and classified based on DM 260/2010, using the M-AMBI index, and was transferred to the National WISE (*Water Information System for Europe*) Hub by the ARPA as part of the flow of EIONET - SoE (*European Topic Centre on Inland, Coastal and Marine waters - State of the Environment*) data. For the 2016-2017 period, of the 98 monitoring stations for 5 coastal regions of the 7 in the Adriatic Maritime Area (Veneto, Emilia Romagna, Marche, Abruzzo, and Puglia), 50,52% were in a high ecological state, 44,33 % in a good state, and 5,15% in a sufficient state (Source ISPRA 2021 yearbook). There were 49 stations in a high ecological state, 43 in a good state, and the remaining 5 in a sufficient state. In the Sub-areas of the Adriatic Maritime Area, the greater percentage of stations fell in the high and good state (Fig.4 .61)

In terms of the "Benthic Macroinvertebrates" biological quality element, for the coastal regions for which data is available, no critical situations were found for the years 2016 and 2017. The trend for the 2016-2017 period was positive compared to previous years, and overall the environmental quality according ti the "Benthic Macroinvertebrates" EQB improved (Source Ispra 2021 yearbook).

Within the Country in 2019, as can be seen in figure 4.62 below, overall there were no situations of particular criticality in the coastal regions for which data is available.

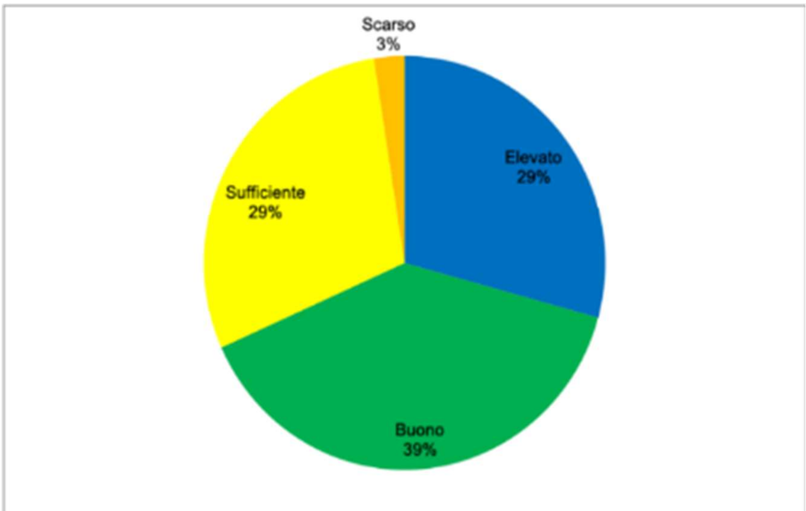


Fig. 4.62 Benthic Macroinvertebrates EQB ecological state. (Source ISPRA 2021 on EIONET-SoE data)

Regarding the Adriatic Maritime Area, in 2019 4 of the 7 Regions were monitored (Emilia Romagna, Marche, Abruzzo, and Puglia). At an individual Region level, a comparison of the data fir the various years in some Regions showed a stationary trend, with most of the stations classified in the high and good state categories (Fig.4.63). The comparison done for 3 Regions (Emilia-Romagna, Abruzzo, and Puglia) and 24 stations, for the years 2015-2016, 2017-2018, and 2019 showed a stationary trend, with the greater percentage of stations that fall into the high and good state categories for all the years. (Source Ispra 2021 yearbook).

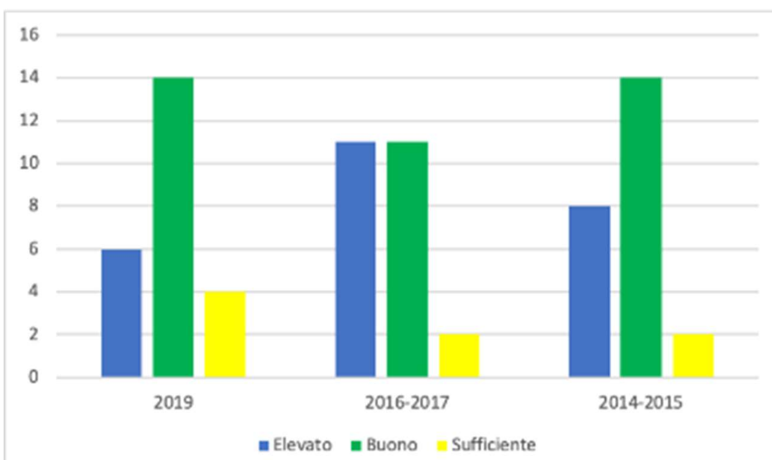


Fig. 4.63 Comparison of the Benthic Macroinvertebrates EQB ecological classification for the years 2019, 2016-2017 and 2014-2015 (Source ISPRA 2021 on EIONET-SoE data).

- <u>"A" CHLOROPHYLL Biological Quality Element"</u>

As regards the pelagic habitats Mediterranean-wide, both within the EU sub-regional cooperation, and in terms of the Barcelona Convention, no shared metrics were defined, nor established approaches to characterising and evaluating the state of these habitats.

The composition and abundance of phytoplankton are assessment elements provided for by Directive 2000/60/CE but, despite the efforts made at a Community level, for the "Phytoplankton" Biological Quality Element (EQB), to date only the chlorophyll parameter is used (indicator of 338/478 phytoplanktonic biomass) and the composition and abundance of phytoplankton are not used for evaluation purposes. At a national level the pelagic habitats are monitored by the ARPA, whereas when it comes to off-shore environments, some activities have been carried out by the CNR, "A" chlorophyll is a primary indicator of phytoplankton biomass, and is particularly sensitive to changes in the trophic levels, brought about by the addition of nutrient (N and P) loads, coming from basins in the coastal belt.

An analysis of its spatial trends makes it possible to establish the relationships between the loads of nutrients weighing on the coastal systems, and the response of the latter in terms of producing phytoplanktonic biomass. It also makes it possible to monitor the efficacy of any strategies and actions applied in order to control and remove the nutrients. (Source Ispra 2021 yearbook).

Evaluating the ecological state of the coastal waters according to the "Phytoplankton" EQB, in terms of D.Lgs. 152/2006 and s.m.i.. makes it possible to set quality goals to be maintained and/or achieved. This classification is done in accordance with the provisions contained in D.Lgs. 152/2006 and s.m.i., and based on the type of body of water. More specifically, for macro type 1, which corresponds to coastal sites strongly affected by inflows of continental fresh water, the "chlorophyll a" value is calculated using the geometric mean. For the types included in macro types 2 and 3, which correspond to coastal sites moderately affected or not affected by inflows of continental fresh water respectively, to calculate the "chlorophyla" value one takes the 90th percentile for the standardised distribution of data. The high / good class limit for macro types 1 and 2 is 2,4 mg/m^3 whereas it is 1,1 mg/m^3 for macro type 3. The good sufficient class limits are 3,5, 3,6 and 1.8 mg/m^3 fkr macro types 1, 2 and 3 respectively.

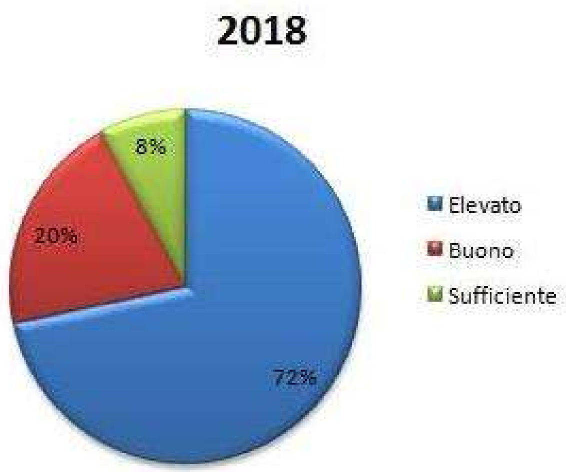


Fig. 4.64Chlorophyll "a" EQB Classification 2018 (Source: Ispra 2021 yearbook)

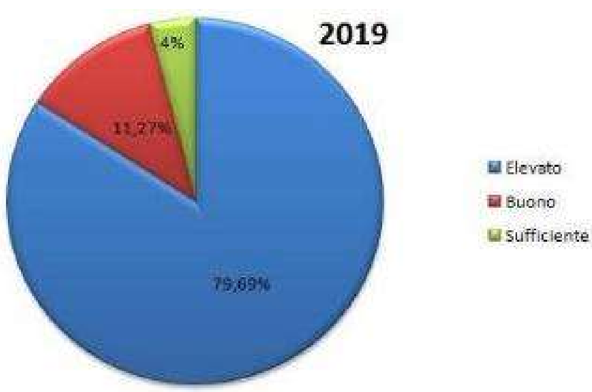


Fig.4.65Chlorophyll "a" EQB Classification 2019 (Source: Ispra 2021 yearbook)

For each Region the seasons were classified by the Phytoplankton EQB on a scale of "high - good - sufficient - poor - bad), based on the value of the "chlorophyll a" index, evaluated in relation to the macro type of the body of water to which the stations belong (Source Ispra 2021 yearbook). The data processed refers to the stations in the Regions that have fully formalised the submission of information on classification of the ecological state of the Coastal Waters Phytoplankton EQG, to SINTAI.

Overall, nationwide one finds that in 2018, of the coastal stations 72% were in the high state, whereas in 2019 this percentage went up considerably (80%).

A good state is found for 20% of the stations for 2018, and 11.3% in 2019. Finally, stations in a sufficient state went down from 8% in 2018 to 4% in 2019. Between 2018 and 2019 there was an increase in stations in a high state (from 207 to 212), compared to those in good and sufficient state (Figures 4.64 and 4.65) (Source Ispra 2021 yearbook). For the Adriatic Maritime Area, the data refers to the Italian coastal marine stations monitored in 2019 for the Chlorophyll "a" Phytoplankton EQB.

In 2019 of the 160 monitoring stations for 6 of the 7 coastal Regions in the Adriatic Maritime Area (Friuli Venezia Giulia, Veneto, Emilia Romagna, Marche, Abruzzo and Puglia), 81% were in a high ecological state, 13,13% were in a good ecological state, and 5% were in a sufficient ecological state.

There were 131 stations in a high class, 21 in the good class, and 8 in the sufficient class (Source Ispra 2021 yearbook). Compared to 2018 there was an increase in the high class and a reduction in the good and sufficient classes respectively. In the Sub-areas in the Adriatic Maritime Area, the biological quality classification in terms of the phytoplankton EQB of the coastal waters is high (Fig. 4.66). Overall the environmental quality in terms of the Phytoplankton EQB compared to the data available for 2018 improved, excepting for Sub-area A/3.

In fact, in sub-area A/3 of the 15 Chlorophyll "a" sampling stations, none were excellent, 9 were in a good state, and 6 were in a sufficient state (Source Ispra 2021 yearbook).

The sufficient state ruling relates, most of all, to the coastal stations in the Upper Adriatic Sea (Emilia-Romagna Region), which belongs to macro type I (High Stability). This confirms the direct role of the Po River and other basins in the Upper Adriatic, in keeping trophic levels high. A reduction in the stations in a sufficient state in Puglia between 2018 and 2019 should also be highlighted (Source Ispra 2021 yearbook).

Fig. 4.66 Chlorophyll "A" ISPRA 2019 - processed by SOGESID

The figure below shows the Chlorophyll "A" data from 2012 to 2015, which shows the classifications of the ecological state of the relative sampling stations.

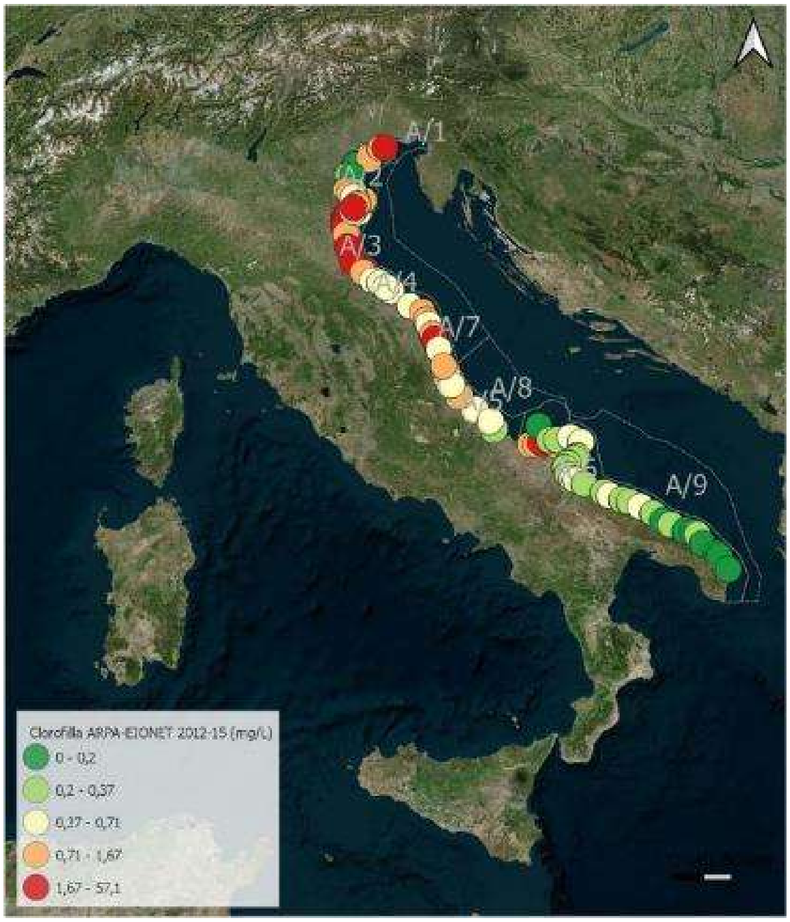


Fig. 4.67- Clorophyll "A" ARPA-EIONET 2012-2015 (2015) – Processed by Sogesid

4.2.6.2 Swimming waters

➢ <u>CLEAN COAST INDEX (CCI)</u>

By means of Legislative Decree n° 190/2010, implementing the Draft Directive on the Strategy for the Marine Environment, Italy has carried out an intense plan for monitoring marine waste, including that on the beaches, since 2015. Any solid material made or transformed by man, abandoned or lost in the marine or coastal environment or that reaches the sea in any way, is deemed to be marine waste.

Twice a year, in spring and autumn, the Environment Protection Agencies (ARPA) on the coast monitor the solid waste in sample areas of 68 reference beaches along the Country's entire coastline. To determine the degree of cleanliness of the beaches simply and objectively, based on the density of the waste in the section of the coast monitored, the Clean Coast Index (CCI) was calculated. This indicator was developed and is applied internationally (Ispra, 2021).

The Clean Coast Index can be used to classify the beaches in 5 categories, based on the density of the waste found in the sections of beach monitored:

- Very clean beach
- Clean beach
- Moderately clean beach
- Dirty beach
- Extremely dirty beach.

The index was calculated using data gathered gathered during monitoring done as part of the Marine Strategy, using a methodology defined at a European level. Monitoring of waste on beaches is done by the National Environment Protection System (SNPA), with technical and scientific coordination by the Italian National Institute for Environmental Protection and Research (ISPRA). The Ministry of Ecological Transition (MITE) is the competent Authority for guaranteeing coordination of the actions called for in applying the Marine Strategy. The index is displayed using symbols in different colours, from green to red, positioned on a map at the beaches monitored. A representation is also provided of the percentage of monitored beaches that fall into the various categories, by sub-region (Adriatic, Ionian and Central Mediterranean, and Western Mediterranean).

The index reflects the perception of beach users, as to the state of cleanliness of the beaches (Alkalay et al. 2007; Cruz et al. 2020). It is therefore a user-friendly tool for finding out about the state of Italian beaches, in terms of waste density. It also allows one to assess whether there is a reduction in waste on the beaches over the years, which can be identified by an increase in the percentage of clean and very clean beaches compared to previous years.

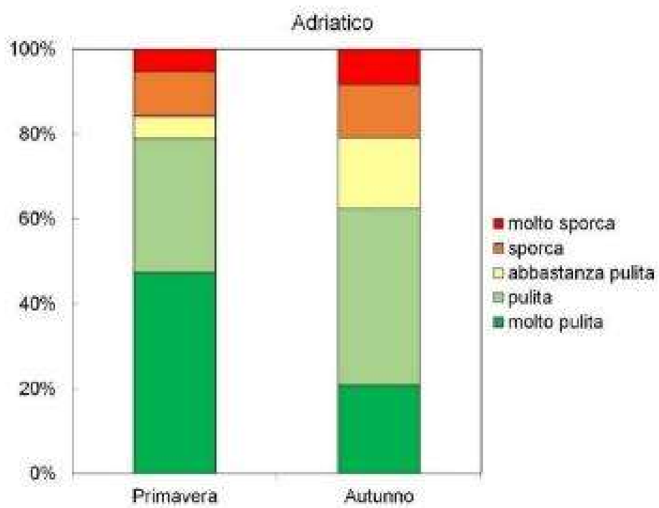


Fig. 4.68 Breakdown in percentage terms of the various beach categories classified according to the Clean Coast Index in the Adriatic sub-Region in 2020

Source: ISPRA processing of ARPA data

In 2020 the CCI was calculated nationwide for 57 beaches in spring and 67 in autumn because, due to the COVID-19 restrictions or other cases of force majeure, not all the beaches envisaged for the monitoring plan were sampled.

In spring 89% of the beaches monitored were clean or very clean, compared to 7% of beaches that were dirty or extremely dirty. In autumn 76% of the beaches were clean or very clean, compared to 9%+that were dirty or extremely dirty. The other beaches were found to be moderately clean. The percentage of clean or very clean beaches was clearly higher than previous years: 52% of the beaches were found to be clean or very clean in 2018, whereas in 2019 this figure was 58% (Ispra, 2021). In spring, on the Adriatic 79% of the beaches monitored were found to be clean or very clean, while 16% were dirty or extremely dirty. In autumn, however, 62% of the beaches were clean or very clean, and 21% were dirty or extremely dirty (Figure 4.68) (Ispra, 2021).

The figures below show the data from the Ispra 2021 yearbook, by sub-area.

In Spring 2020 only sub-area A/1 had 1 station with an extremely dirty value, while sub-area A/5 had 2 stations with a dirty value.

Fig. 4.69 Clean Coastal Index ISPRA 2020 SPRING - Processed by SOGESID

SUB-AREA	N° stations with Very Clean value	N° stations with Clean value	N° stations with Moderately Clean value	N° stations with Dirty value	N° stations with Extremely Dirty value
A/1	1	1	1		1
A/2		2			
A/3	4				
A/4	1				
A/5	2	1		2	
A/6	1	2			

Tab 4.28 CLEAN COASTAL INDEX ISPRA 2020 SPRING– Processed

In autumn 2020 both sub-area A/1 and sub-area A/4 had 1 station with an extremely dirty value, whereas sub-area A/2 had 1 station with a dirty value, and sub-area A/5 had 2 stations with this value.

Fig. 4.70 CLEAN COASTAL INDEX ISPRA 2020 AUTUMN - Processed by SOGESID

SUB-AREA	N° stations with Very clean value	N° stations with Clean value	N° stations with Moderately Clean value	N° stations with Dirty value	N° stations with Extremely Dirty value
A/1		1	2		1
A/2		3		1	
A/3	2	2			
A/4	1		2		1
A/5	2	1		2	
A/6		3			

Tab. 4.29 CLEAN COASTAL INDEX ISPRA 2020 AUTUMN - Processed by SOGESID

In 2020 the Italian beach situation seemed better than previous years, with higher percentages of clean and very clean beaches, and low percentages of dirty or extremely dirty beaches. Especially the Ionian and Central Mediterranean sub-region had almost all clean or very clean beaches in 2020, whereas the Adriatic was the sub-region with the highest percentage of dirty or extremely dirty beaches (Ispra 2020).

- Quality of swimming waters

In terms of the Directive on Swimming Waters, each season more than 22,000 swimming waters are monitored in Europe. The monitoring data and other information on managing swimming waters are submitted to the European Environmental Agency by 30 European Countries, to be evaluated for the purposes of the annual European report and more detailed national reports.

The rules for classifying swimming waters throughout the European Community into the four quality classes (excellent, good, sufficient, and poor), are laid down by the National Environment Protection System, by means of checking and monitoring in terms of Community Directive 2006/7/CE.

The swimming waters are classified based on two microbiological parameters (escherichia coli and intestinal enterococchi), defined in the Directive on Swimming Waters. The aim of the Directive is to evaluate the degree of "swimmability" of water associated with a health and hygiene risk, and to provide indications as to the presence of microbiological contamination. In fact, on the one hand it provides environmental indications of the degree of microbiological pollution (faecal pathogens), and on the other expresses the probability of contracting a pathology associated with said pollution during a recreational activity (from excellent to poor class, the probability increases). In addition, it allows an indirect estimation of the efficacy of the waste water treatment systems, and evaluation of the efficacy time of any remediation measures adopted. The norm provides that improvement measures are to be put in place so that the swimming waters are at least in the sufficient class and, in any case, all water can improve its quality status or maintain it if it is already excellent. Of all the swimming waters, 97,3% are in line with the Directive's minimum quality standards, classified as "sufficient" or excellent (Sources: European Environment Agency 2021).

During the 2020 swimming season, 5,520 swimming waters were monitored, 4,848 coastal and transition, and 672 inland, for a total of 32,636 samples taken and analysed (Tab. 4.30).

Tab. 4.30 Reports in the 2020 season (Sources: *European Environment Agency* 2021)

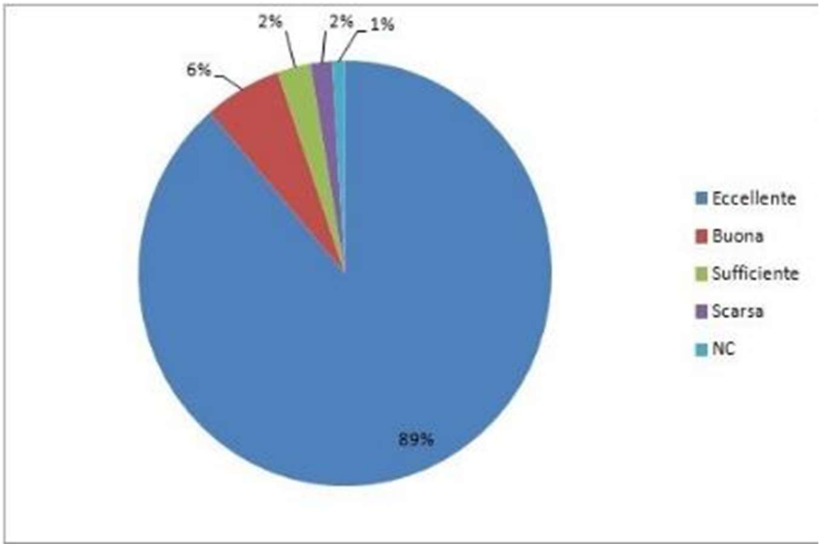
Bathing waters in the season 2020	
Total reported	5520
Coastal	4848
Inland	672
First identified in 2020	11
Delisted in 2020	26
Total reported samples	32636

Bathing water quality in the season of 2020	
Excellent	4891 (88.6%)
Good	337 (6.1%)
Sufficient	143 (2.6%)
Poor	93 (1.7%)
Not classified	56 (1%)

Of the 5,520 swimming waters monitored, 4,891 were in the excellent class, 337 in the good class, 143 in the sufficient class, and 93 in the poor class. 56 waters were not classified and so cannot be evaluated.

The classification was done using the results of monitoring done during the 220-swimming season, and those from the three previous seasons (2019-2018-2017) (Source Ispra 2021 yearbook). Nationwide, the percentage of excellent and good quality waters is high and near the European average (88.6% compared to 93% for the EU). As can be seen from figure 4.71 most of the waters were in the excellent class (89%), 6% were classified as good, and 2% as sufficient. However, there are still criticalities, due to the presence of poor class (2%) and non classifiable (1%) waters, for which a quality judgement cannot be expressed, due to changes or anomalies found in the frequency of sampling and so they do not offer a useful number of samples for classification purposes.

Fig. 4.71 National classification of swimming waters
(Source: ISPRA processing of data from the Health Ministry - 2021)



Both at a regional level and in general one can state that the number of waters in the excellent and good classes is very high. Overall, the number of excellent class waters prevails, although there are only three regions / autonomous provinces (Trento, Bolzano, and Umbria) in which all the water are in the excellent class. (Fig. 4.72)

In 13 Regions (Piedmont, Lombardy, Veneto, Friuli Venezia Giulia, Liguria, Marche, Lazio, Abruzzo, Molise, Campania, Calabria, Sicily and Sardinia) there are poor waters. This result pushes us away from attaining the goal set in the Draft Directive on Waters 2000/60/CE. Of these Regions, 11 have unclassified waters, not subjected to evaluation, as they did not reach the minimum number of samplings (Source Ispra 2021 yearbook).

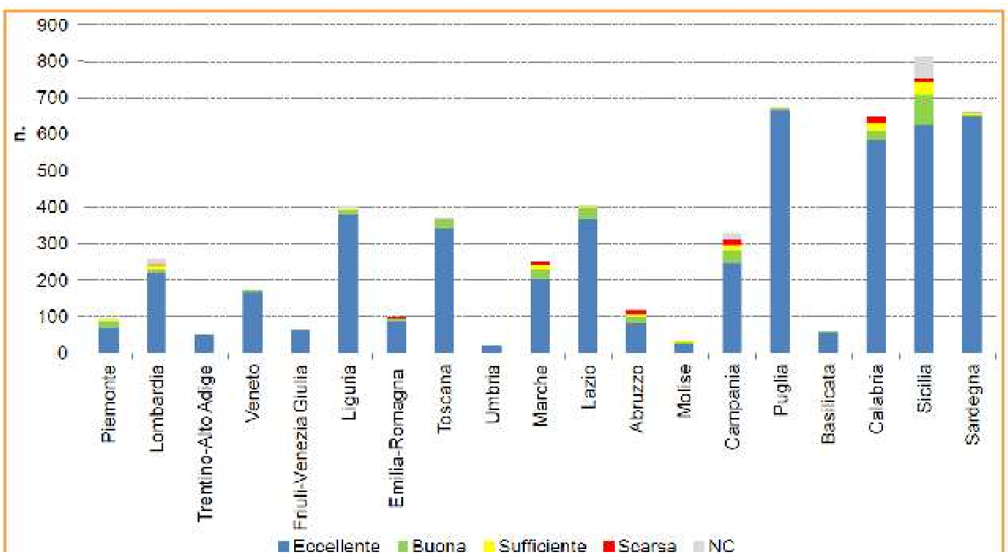


Fig. 4.72 Classification of quality of waters in the Italian regions (Source: ISPRA processing of data from the Health Ministry - 2021)

Trend analysis

During the 2018 swimming season, the Regions identified 5,539 swimming waters, of which 88,9% were excellent, while about 11,1% was made up of waters:

- non classifiable waters (2%)
- good class waters (5.5%)

- sufficient class waters (2.2%)
- poor class waters (1.4%)

About 89% of the waters were classified excellent.

However, there are still waters of poor class and waters that cannot be classified (Fig. 4.73)

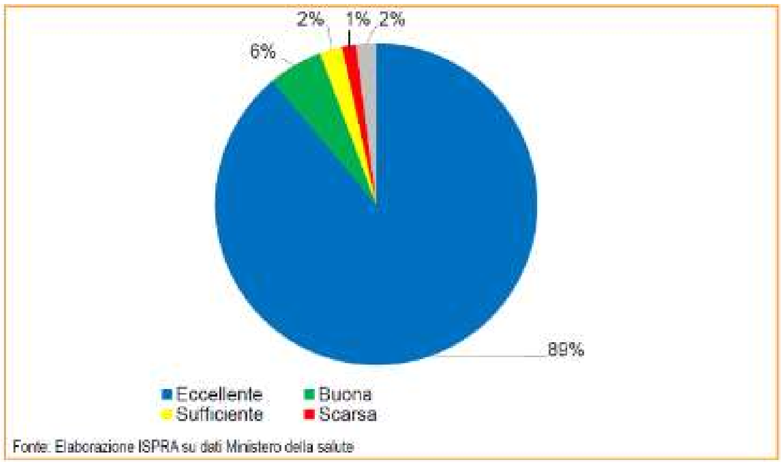


Fig. 4.73 National classification percentages 2015-2018 (Source: Ispra 2021)

The first classification of use for trend purposes was from 2013, based on data covering the period 2013 to 2018. The trend was positive up to 2017 because the poor waters diminished and the superior quality waters increased, especially those that were excellent or good.

From 2017 to 2019 this trend reverses: there is a reduction in excellent waters and an increase in the poor class. Finally, in 2020 there was a slight improvement: in fact, the poor quality waters diminished again, which those in a superior class increased, especially in the excellent class (Fig. 4.74).

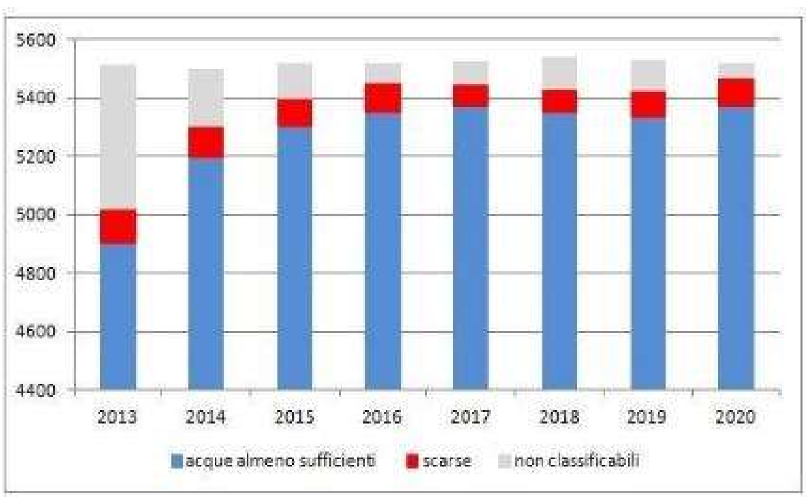


Fig. 4.74 Analysis of the trend for the quality of swimming waters (Source: ISPRA processing of data from the Health Ministry - 2021)

By analysing the data it was possible to follow whether or not the Directive's goal was reached. This calls for at least sufficient waters (excellent, good, and sufficient), and the absence of poor waters.

The trend analysis shows gradual attainment of the goals, even though in 2018 there was a slight drop off, due to worsening, with a slight reduction in the percentage of swimming waters classified as excellent, and a minimal increase in those of poor quality. (Fig. 4.75). This result led to slowing down in attaining the goals set by the norm.

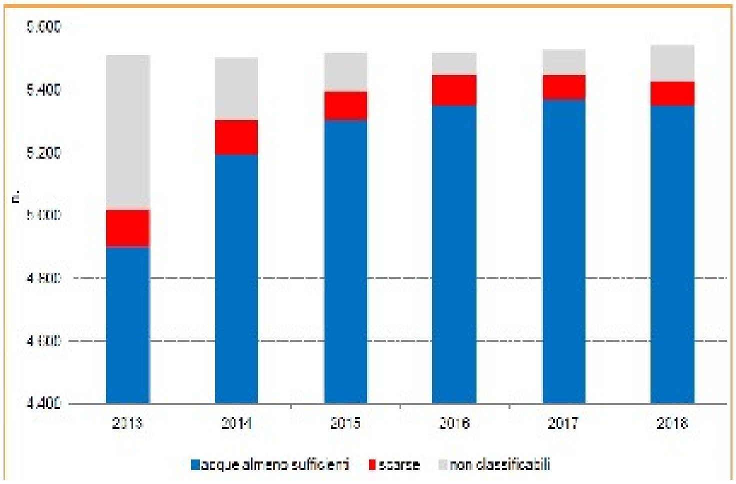


Fig. 4.75 Trends and attainment of the Directive's goals (Source: ISPRA processing of data from the Health Ministry - 2021)

Various factors influence the quality status of swimming water, the most important of which is still the purification systems. If compromised due to factors that alter their efficacy (heavy rain or faults), they release unpurified waste into the environment, which can be harmful to the quality of the swimming waters. These events often impede attainment of the goals set in the Directive on Waters. During the 2021 swimming season 2,663 swimming waters were monitored. In the Adriatic Maritime Area the excellent quality along with good quality of swimming waters almost reached 100% in all the Sub-areas excepting for Sub-area A/5 where poor water was encountered. This is why the goals set in the Directive on Waters has not been reached (Fig. 4.76).

Fig. 4.76 Quality of Swimming Waters 2021-EMODNET ISPRA - Processed by SOGESID

- <u>Presence of Ostreopsis Cf. Ovata</u>

As part of the swimming checks, algae that are potentially toxic present in aquatic environments are monitored, to also understand any correlations with global warming. Since the end of the 1990s the benthic part of Italy's coastal waters have been ever more frequently affected by the presence of Dinoflagellates, including *Ostreopsis ovata Fukuyo* a potentially toxic micro-alga. A massive presence of this micro-alga has given rise to episodes or bloom in recent years and, in some cases, phenomena of human poisoning and suffering, or the death of benthic marine organisms. The *Ostreopsis cf. ovata* indicator assesses the presence of the micro-alga, trends in its blooming, and possible damage to the benthic marine environment, while contributing to the environmental assessment of swimming waters in terms of DM 19/4/2018.

The blooming trend is also monitored for the purposes of safeguarding the health of bathers.

The surveys are carried out by the Regional Environmental Agencies (ARPA), for the purposes of checking waters set aside for swimming, in accordance with the current norm (DM 30/3/2020, D.M. 19 April 2018 and D.Lgs. 116/08 and s.m.i.). This is done as part of ARPA / Region projects, or as one of the activities for monitoring potentially toxic species in waters earmarked for mollusc farming (coasts in Friuli-Venezia-Giulia).

Complete information is contained in the documentation and quality known at national level, and updated annually by the ARPA who make it available under the coordination of ISPRA, and it is reliable as the methods for measuring and gathering the data follow the shared national protocol. Good spatial and temporal coverage make it possible to provide indications on the evolution of the environmental situation (Source Ispra 2021 yearbook).

Nationwide, in 2020 monitoring was done in 13 coastal regions out of 15, excepting for Molise and Basilicata. The 200 stations identified and monitored have ideal hydromorphological characteristics for the development of the micro-alga (presence of macro-algae, rocky sub-strata, shallow water with moderate hydrodynamism, natural reefs and flow barriers, or piers).

In addition, stations were identified and monitored that recorded the presence and/or blooming of the micro-alga in previous years. The monitoring was generally done between June to September 2020, while in some cases it was postponed to October in Campania, Lazio, Marche, and Veneto. Sampling was done at fortnightly and monthly intervals, and intensified if the reference values were exceeded (30,000 cell./l, 100,000 cell/l), as indicated in the emergency phases described in the supervisory plans laid down in the Guidelines by the Health Ministry, contained in DM 30/3/2010 and DM 19/4/2018, and in ISTISAN Report 14/19. During sampling, samples were taken of water, macro-algae, following agreed methodologies, and edible marine organisms, such as sea urchins and mussels in Campania, during the attention / emergency phases, to research and quantify the toxin.

In addition, the chemical/physical parameters of the water were measured, and recorded in a specific field schedule, along with information on the sampling site, any manifest signs of micro-algae blooming, or suffering in marine organisms like sea urchins, mussels, star fish, fish, macro-algae, etc.

This monitoring made it possible to assess the space-time trend of the indicator for each individual sampling point. In 6 regions exceeding of 30,000 cells/l was exceeded, which is deemed to be an alert value in terms of the Health Ministry's Guidelines. In 5 Regions a value of 100,000 cells/l was exceeded, which is deemed to be an emergency value.

This means that the sensitive areas in which the presence of the micro-alga is found, being a potential risk for the proliferation of toxic algae, must be reported in the environmental profile of swimming waters to be subjected to surveillance in the form of monitoring (DM 30/3/2010 and s.m.i.). In 2020 episodes of suffering in marine organisms were observed: mussels (Lazio), limpets, crabs, and gastropods (Friuli-Venezia-Giulia), and a mucilaginous web in the macro-algae in Friuli-Venezia-Giulia during peak blooming.

In 2020 there was an increase in sites with the presence of the micro-alga 71% (142 sites) compared to 54,8% (114 sites) in 2019, which describe the spatial distribution of the indicator. At this stage it is not possible to evaluate the environmental state only based on the presence of the alga, as there is no environmental reference value that represents a risk to the health of marine-benthic organisms (Source Ispra 2021 yearbook).

Figure below shows that the trend is negative, since the trend over the eleven years taken into account, does not show a clear change in direction. In fact, since 2010 there is an increase over time of about 20 percentage points of sites with the presence of *Ostreopsis ovata* with 48 % in 2010 and 71 % in 2020.

In addition, minimal variations in the number of sites with the presence of micro-alga were found for the 2010-2015 period and large variations for the period 2016 to 2020 (Source Ispra 2021 yearbook).

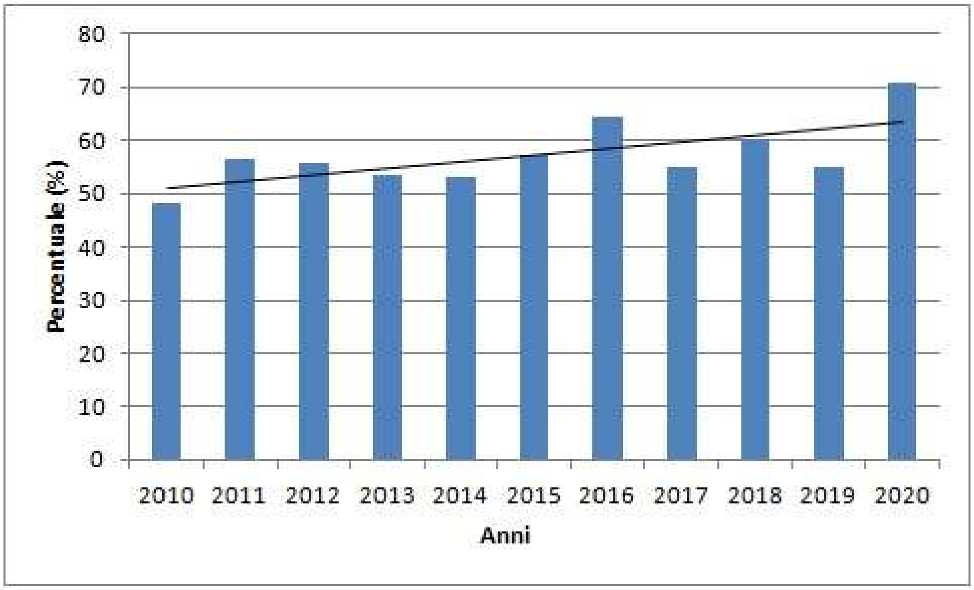


Fig.4.77 Percentage of positive sites from 2010- 2020 (Source Ispra 2021 yearbook)

For the Adriatic Maritime Area monitoring in 2020 was done in 6 of the 7 coastal Regions (Friuli-Venezia-Giulia, Veneto, Emilia-Romagna, Marche, Abruzzo, and Puglia). The *Ostreopsis cf. ovata* was found in 3 coastal Regions (Friuli, Marche and Puglia), whereas it was not found in any of the samples taken on the coasts of Veneto, Emilia-Romagna, and Abruzzo (Fig.4.78).

Fig. 4.78 OSTREOPSIS OVATA ISPRA 2020 – Processed by SOGESID

Two hotspots were found in the Adriatic Maritime Area, one in Friuli-Venezia-Giulia, that is, Sub-Area A/1, where cases of suffering were observed in marine organisms like limpets, crabs, and gasteropods, and the other in Puglia, that is, Sub-Area A/6, with a 100% presence of this toxic alga and a concentration in the column of water exceeding 30,000 cells per litre (Fig.4.79). This is the alert threshold, for which safeguarding measures must be adopted.

In Friuli a mucilaginous web was found on the macro-algae during peak blooming, and in Puglia episodes of suffering were observed in marine organisms.

In fact, blooms can lead to suffering or death of benthic marine organisms, resulting in worsening of the quality of the water. They come about in summer and autumn months, often along with brown-reddish coloured mucilaginous films that cover extensive portions of the sea bed and hard sub-strata, as well as the presence of flocculi suspended in the column of water.

The conditions that seem to facilitate an increase in concentration are: shallow water, presence of rocky sub-strata and/or macro-algae, poor hydrodynamism due to the natural morphology of the coast or the presence of piers and artificial barriers to contain coastal erosion, very stable weather and sea conditions, and water temperatures above 25°C, which can be correlated to the climate changes in progress. (Source Ispra 2021 yearbook).

4.2.6.3 Transition waters

➢ <u>Benthic Macroinvertebrates</u>

The ecological classification index for the Macroinvertebrate Biological Quality Element M-AMBI (Multivariate-Azti Marine Biotic Index), is applied to the coastal lagoons in the Mediterranean (TW) and is based on an analysis of the structure of the macrozoobenthic community on the mobile sea bed. This index takes into account the tolerance / sensitivity of the species, the diversity of the community, and the specific richness, and it is based on extensive bibliographical backing that is able to summarise the complexity of the mobile sea bed communities, making it possible to read the ecosystem in question ecologically. The class limits are defined and contained in the reference norm (DM 260/2010). The value of the M-AMBI varies from 0 to 1, and corresponds to the Ecological Quality Ratio (RQE) called for by the Draft Directive on Waters 2000/60/EC (Source: Ispra 2021 yearbook).

The M_AMBI responds to pressures of anthropic origin, which affect the transition areas, and describes the ecological quality state in 5 classes:

1. High.
2. Good.
3. Sufficient.
4. Poor.
5. Bad.

Of the 84 transition bodies of water in Italy, to which the M-AMBI index was applied during the three-year 2017-2019 monitoring period, 7.1% were in a “high” ecological state, 35.7% in a “good” state, 28.6% “sufficient”, 3.1% in a “poor” state, and 15.5% in a “bad” ecological state (Source Ispra 2021 yearbook).

Nationwide, 42,9% of the transition bodies of water attained the quality objective (“good” or “high”) (Fig.4.79).

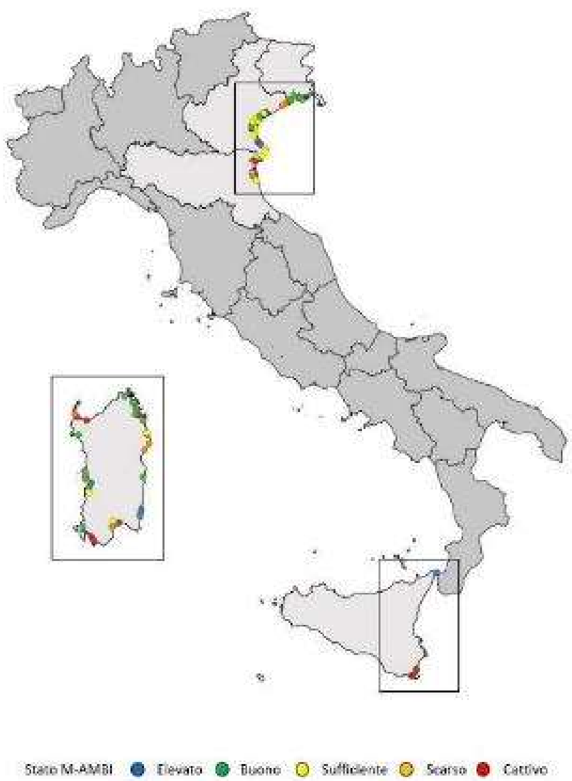


Fig. 4.79 Classification of the ecological state of the Italian bodies of water M-AMBI. (Source Ispra 2021)

At a Regional level, during the 2017-2019 three-year period, 3 of the 7 Regions in the Adriatic Maritime Area were monitored (Friuli-Venezia-Giulia, Veneto, and Emilia-Romagna). During the 2017-2019 period the Puglia Region did not apply the M-AMBI index for benthic macroinvertebrates (Source Ispra 2021 yearbook).

The data for the individual Regions show that most of the stations were classified as being on a good and sufficient state. Of the stations in a high state, 1 was in Friuli-Venezia-Giulia, and 1 on Veneto. Water bodies in a poor or bad ecological state were found in Veneto and Emilia-Romagna (Tab. 4.31)

REGION	N° stations with High value	N° stations with Good value	N° stations with	N° stations with Poor value	N° stations with Bad value

			Sufficient value		
Friuli-Venezia-Giulia	1	9	3	0	0
Veneto	1	4	11	2	1
Emilia-Romagna	0	0	3	1	2

Tab. 4.31 BENTHIC MACROINVERTEBRATES ISPRA 2017-2019

In the Adriatic Maritime Area, during the 2017-2019 three-year period, the ecological quality goal was achieved in 76.9% of the bodies of water in SUB-AREA A/1 and 26.3% in SUB-AREA A/2, whereas in SUB-AREA A/3 no body of water achieved the quality goal (Fig. 4.80)

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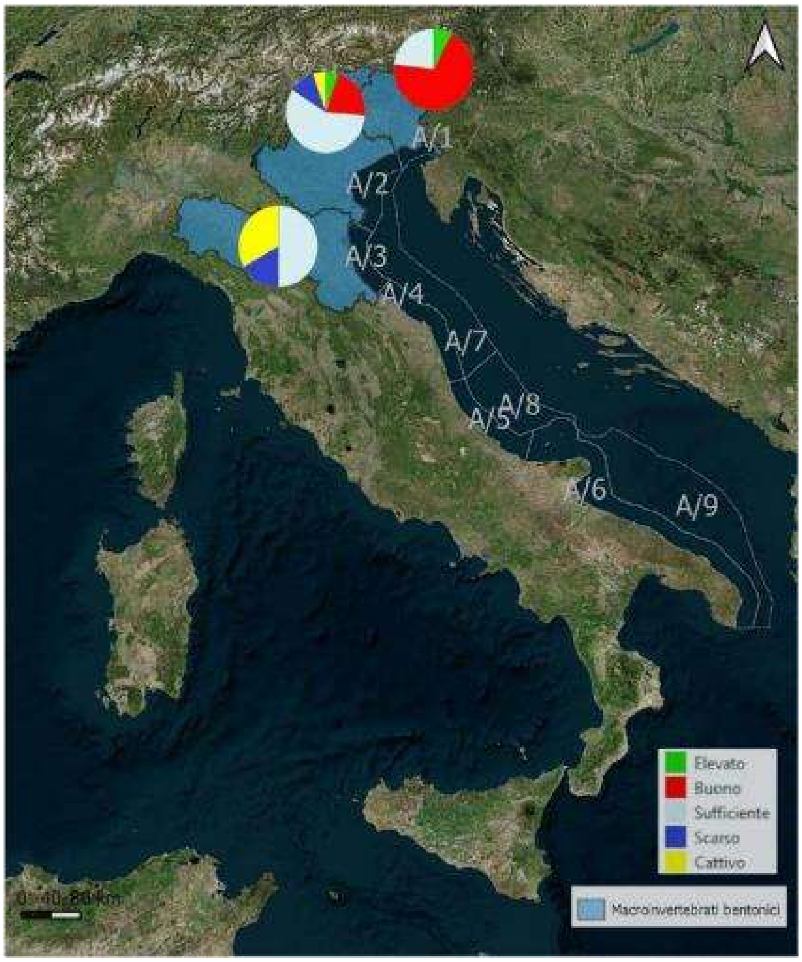


Fig. 4.80 Benthic Macroinvertebrates ISPRA 2017-2019 - Processed by SOGESID

➢ <u>Macrophytes</u>

The MaQI (Macrophyte Quality Index) (Sfriso et al., 2014) formally adopted by Italy to classify the ecological state of the transition settings within the realm of Directive 2000/60/CE, adds the two macro-algae and aquatic seagrasses biological quality elements.

The MaQI responds to pressures of anthropic origin, which affect the transition areas, and describes the ecological quality state in 5 classes:

1. High.
2. Good.

3. Sufficient.
4. Poor.
5. Bad.

Applying the MaQI index to the transition waters in Italy provides a general assessment of the macrophyte components for the Friuli-Venezia-Giulia, Veneto, Emilia Romagna, Campania, Puglia, Sicily and Sardinia Regions, for which data is available, taking in a total of 86 bodies of water. In the count and in processing transition waters of a "river mouth" type were not considered, as currently this indicator does not apply to them (Source Ispra 2021 yearbook).

The MaQI is an index that adds the two macro-algae and seagrass biological quality elements. The evaluation includes total coverage and relative abundance of the dominant macro-algae, coverage of the individual species of seagrass, number of species present, and their ecological role,

Of the 86 bodies of water monitored in the 2017-2019 three-year period in the Italian Regions that have transition waters, 25.6% were in a "high" ecological state, 23.3% in a "good" state, 12.8% in a "sufficient" state, 32.6% in a "poor" state, and the remaining 5.7% in a "bad" state. At a national level, therefore, 48.9% of the transition bodies of water attained the quality objective ("good" or "high") (Fig.4.81).

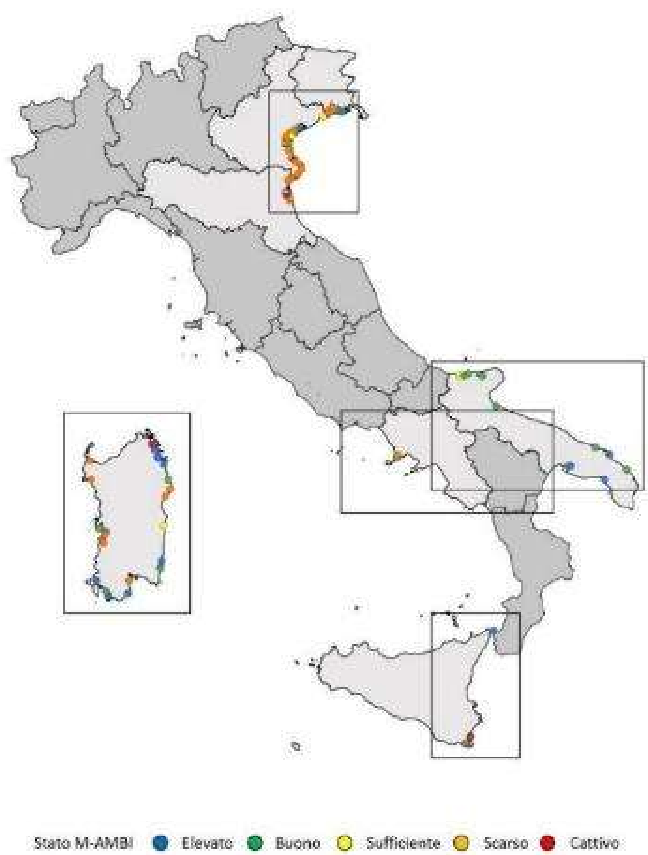


Fig. 4.81 Ecological state of bodies of water - MaQI **for transition waters nationwide (Source Ispra 2021)**

At a Regional level, during the 2017-2019 three-year period, 4 of the 7 Regions in the Adriatic Maritime Area were monitored (Friuli-Venezia-Giulia, Veneto, Emilia-Romagna, and Puglia). The data for the individual Regions shows that 8 stations were classified as high and sufficient, with 11 in a good state. There were 19 stations in a poor state, in all the Regions excepting for Puglia. (Tab. 4.32)

REGION	N° stations with High value	N° stations with Good value	N° stations with Sufficient value	N° stations with Poor value	N° stations with Bad value

Friuli-Venezia-Giulia	4	1	3	5	0
Veneto	1	3	3	10	1
Emilia-Romagna	0	0	1	4	1
Puglia	3	7	1	0	0

Tab. 4.32 Macrophytes ISPRA 2017-2019

For the Adriatic Maritime Area, in the 2017-2019 three-year period 90.9% of the bodies of water in SUB-AREA A/6 achieved the quality goal. Lower percentages were reached in SUB-AREA A/1 with 38.5% and SUB-REA A/2 with 22.2%, whereas in SUB-AREA A/3 no body of water was found to be in a “high” or “good” state (Fig.4.82)

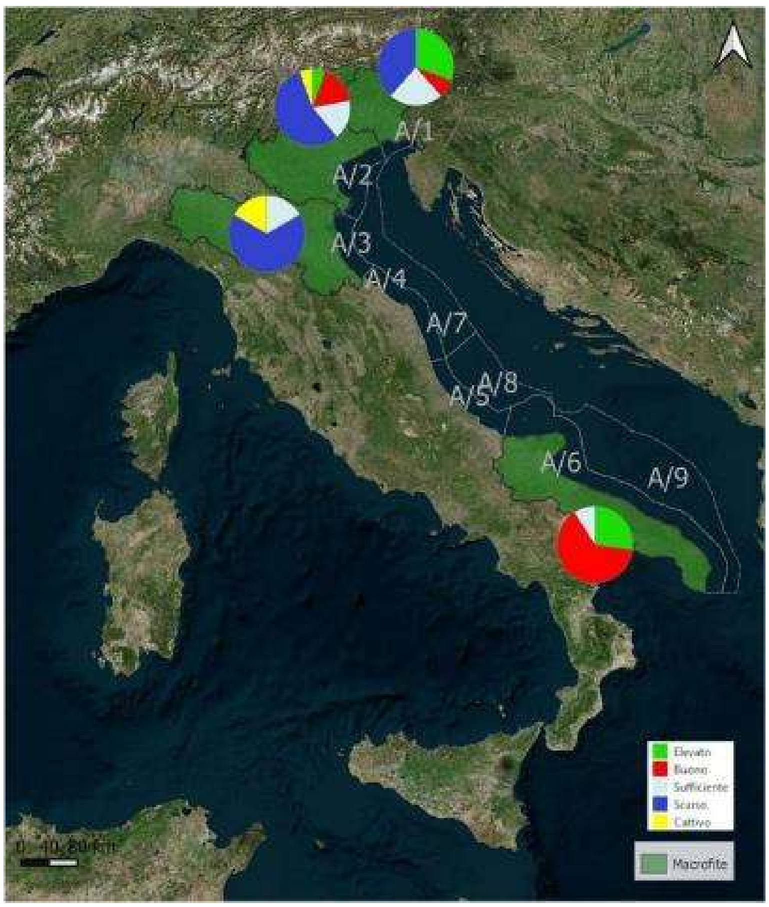


Fig. 4.82 Macrophytes ISPRA A 2017-2019 - Processed by SOGESID

4.2.7 Air and climate changes

4.2.7.1 Climatic factors

4.2.7.1.1 Climate changes in the marine environments

As indicated in the National Strategy for Adapting to Climate Changes (SNACC) first, and then the National Plan for Adapting to Climate Changes (PNACC), the effects of climate changes on the marine ecosystems are able to profoundly alter their integrity in terms of both diversity and functioning. In fact, climate changes affect all levels of the ecological organisation, and changes in individuals, populations, and communities have been observed, as well as in the structure and functioning of ecosystems. The increase in the temperature of the seas, acidification, and the introduction of alien species reduce the resilience of marine ecosystems. As regards the Mediterranean basin in particular, global warming has led towards tropicalisation, which seems to point towards a reduction in indigenous species with an affinity for the cold. The Mediterranean Tapeweed, on the other hand, seems to have been affected positively by global warming, recently showing signs of flowering, production of fruit, and germination events. Nevertheless, the expanses of Mediterranean Tapeweed are regressing greatly, mainly due to the direct anthropic impact. Also, in the Mediterranean, due to its modest size the characteristic of being semi-closed, the changes induced by global warming can give rise to responses at a biological level that are faster than is found in other systems on a global scale. For example, the changes in temperature and intensity of precipitation have had significant consequences in the Mediterranean biota.

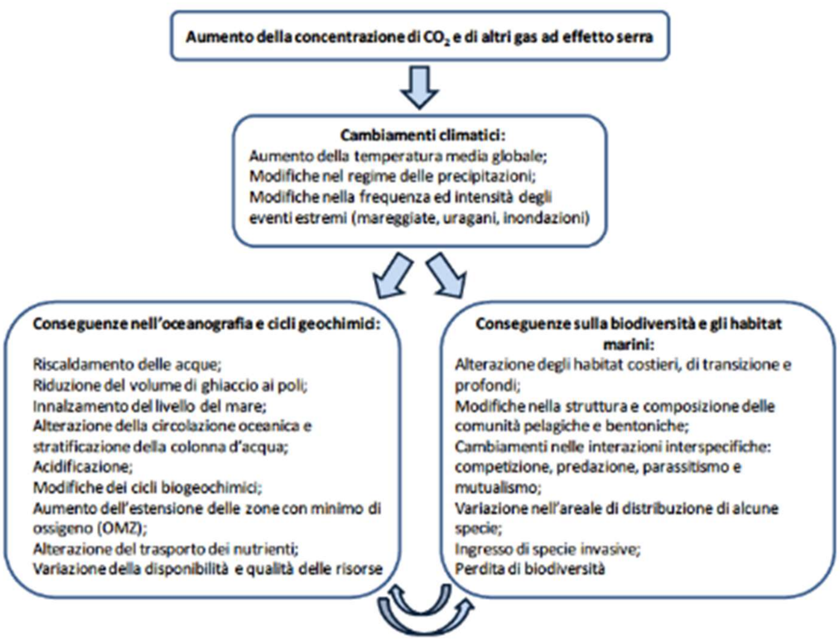


Figure 4.83 - Simplified diagram of tne interactions between climate changes and changes in the marine ecosystems
[Source: SNACC]

In order to identify and evaluate the analysis of the impacts of climate changes on the marine / coastal areas of Italy, one can adopt the climate zoning by homogeneous marine areas devised in the PNACC, in which identification of these homogeneous marine areas was done looking at the physical variables available for the marine areas, that is, surface temperature and sea level, and applying a specific cluster analysis methodology (similar to that used for land areas).

This analysis makes it possible to identify areas in the Mediterranean Sea that could be exposed to similar climate changes, in terms of specific indicators.

More specifically, to this end "**homogeneous climatic macro-regions**" were identified, with similar climatic conditions, for the period 1987-2010 (climatic zoning). A cluster analysis methodology was applied to do so, using a re-analysis of the Copernicus marine services (http://marine.copernicus.eu) (also indicated by the acronym “REAN”). Two primary variables were considered in particular, to describe the evolution of the climate on Italian seas: the water surface temperature (SST) and the sea level (SSH).

This also made it possible to analyse the climate anomalies expected based on future climatic projections (2021-2050)

[44], obtained using the NEMO (https://www.nemo-ocean.eu) oceanic model applied to the Mediterranean Sea (also indicated by the acronym “MEDSEA”).

By zoning the future climatic anomalies based on the forecast climate changes over the period 2021-2050, it was possible to identify the “**homogeneous climatic areas**”, by superimposing the homogeneous climatic macro-regions and the anomalies zoning, in order to define areas with the same current climatic condition, and the same projection for future climatic anomaly. Mapping of the climatology for the SST and SSH indicators is shown in figure 4.85 (upper panels). As indicated by the frequency distributors (Figure , lower panels), for the central Mediterranean, the surface temperature shows a variability of about 4°C, while the seal level shows a variability of about 30 cm. In addition, these indicators are characterised by a significant correlation (correlation coefficient = 0,69).

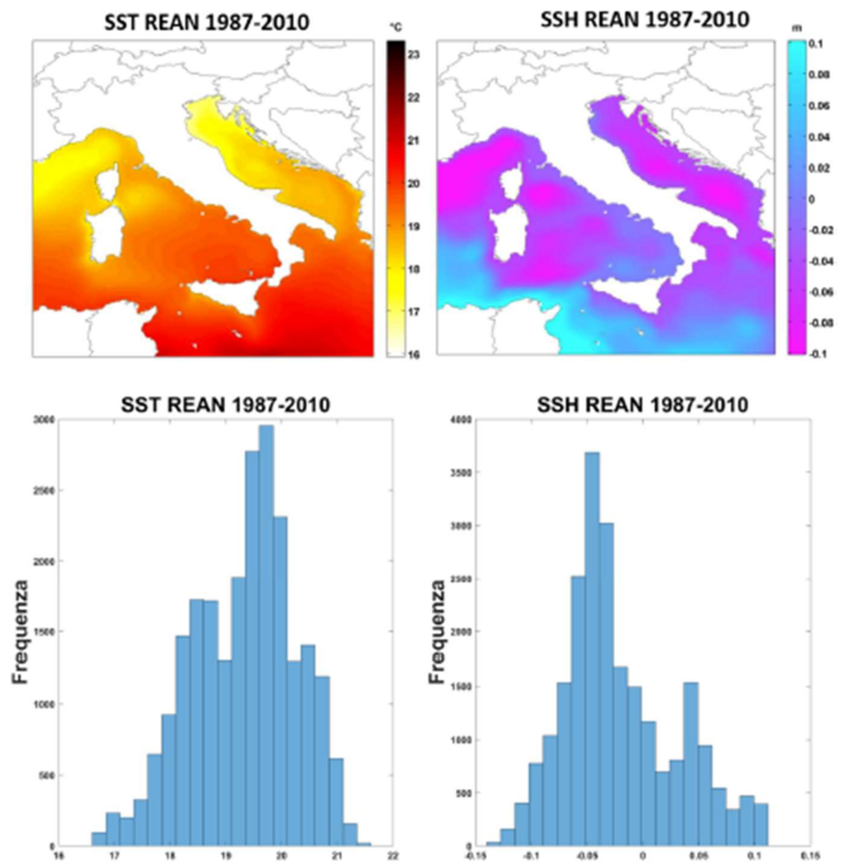


Figure 4.84 - Climatologies of the SST and SSH indicators (upper panels) and related frequency distribution (lower panels), for the Central Mediterranean, obtained from the REAN dataset for the period 1987-2010 [Source: PNACC]

Comparing these indices made it possible to identify 3 consistent clusters used to define the homogeneous marine climatic macro-regions for the Central Mediterranean.

[44] For the RCP8.5 climatic scenario

Figure 4.86 shows the marine climatic zoning for the reference period available (1987-2010), obtained starting with the REAN reanalysis. In addition, Figure 2 provides the distributions related to each macro-region identified for the Central Mediterranean, for the SST and SSH indicators.

For each climate macro-region in the Central Mediterranean, data analysis highlighted the following main climatic characteristics:

- **Homogeneous marine climatic macro-region 1M**: includes the Adriatic Sea, Ligurian Sea, and the northern part of the Sea of Sardinia. This macro-region is characterised by the lowest surface temperature and sea level values.
- **Homogeneous marine climatic macro-region 2M**: includes mainly the Ionian and Tyrrhenian Seas. This macro-region is characterised by surface temperatures of around 20°C and sea level values of around -3 cm.
- **Homogeneous marine climatic macro-region 3M**:mainly includes the southern part of the Central Mediterranean. This macro-region is characterised by the highest values for surface temperature and sea level.

Macroregione	SST (°C)	SSH (m)
1M	18.2	-0.07
2M	19.6	-0.03
3M	20.3	0.05

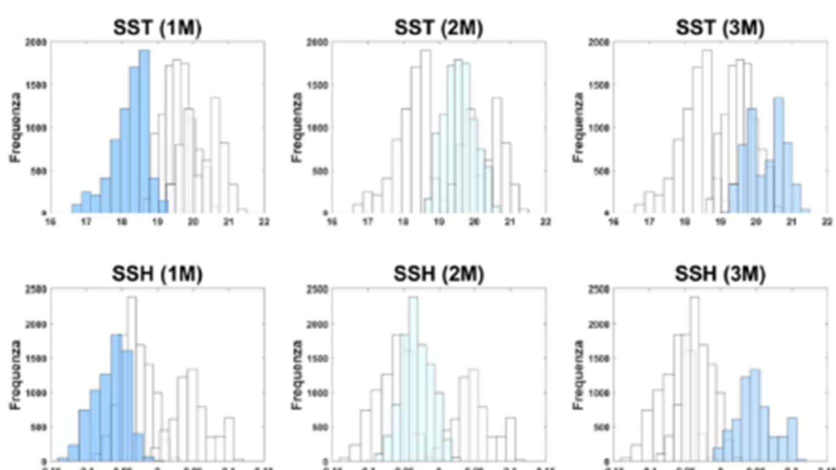


Figure 2.85 - Marine climatic zoning obtained from the clusters calculated for the REAN dataset for the reference climatic period (1987-2010) considering a box in the Central Mediterranean [Source: PNACC]

4.2.7.1.2 Temperature

The year-on-year variability in temperature in Italy is illustrated by the series of annual anomalies in the mean, minimum, and maximum temperature, compared to the climatological average 1961-1990 (Figure .86 and figures 4.87).

With a mean anomaly of +1.54°C, the year 2020 was the hottest since 1961. As from 1985 the anomalies have always been positive, with the exception of 1991 and 1996. The year 2020 was the twenty-fourth consecutive year with a positive anomaly compared to the norm. The 2011-2020 decade was the hottest since 1961.

The maximum temperature anomaly was higher than that for the minimum temperature, as happened in recent years. One significant element was the marked maximum temperature anomaly (+1.82°C), which puts 2020 with 2015 in first place in the history of the records, whereas the minimum temperature anomaly was in sixth place in the series.

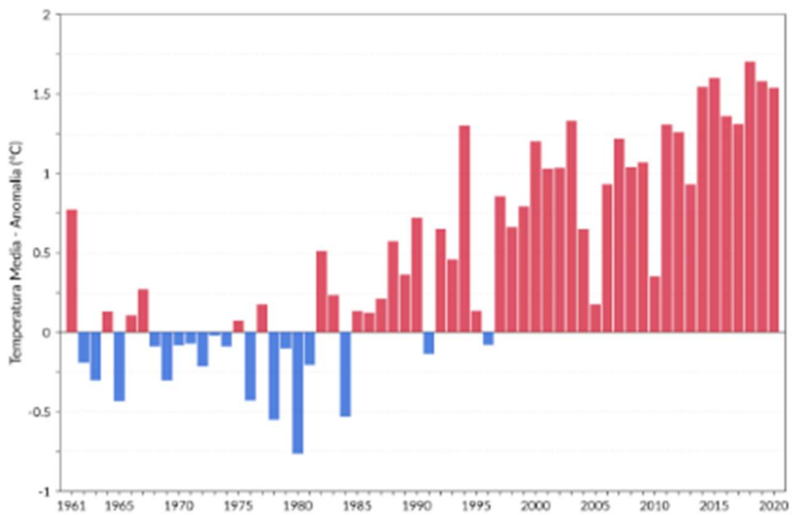


Figure 4.86 - Anomalies in Italy for the average, minimum, and maximum temperatures, compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

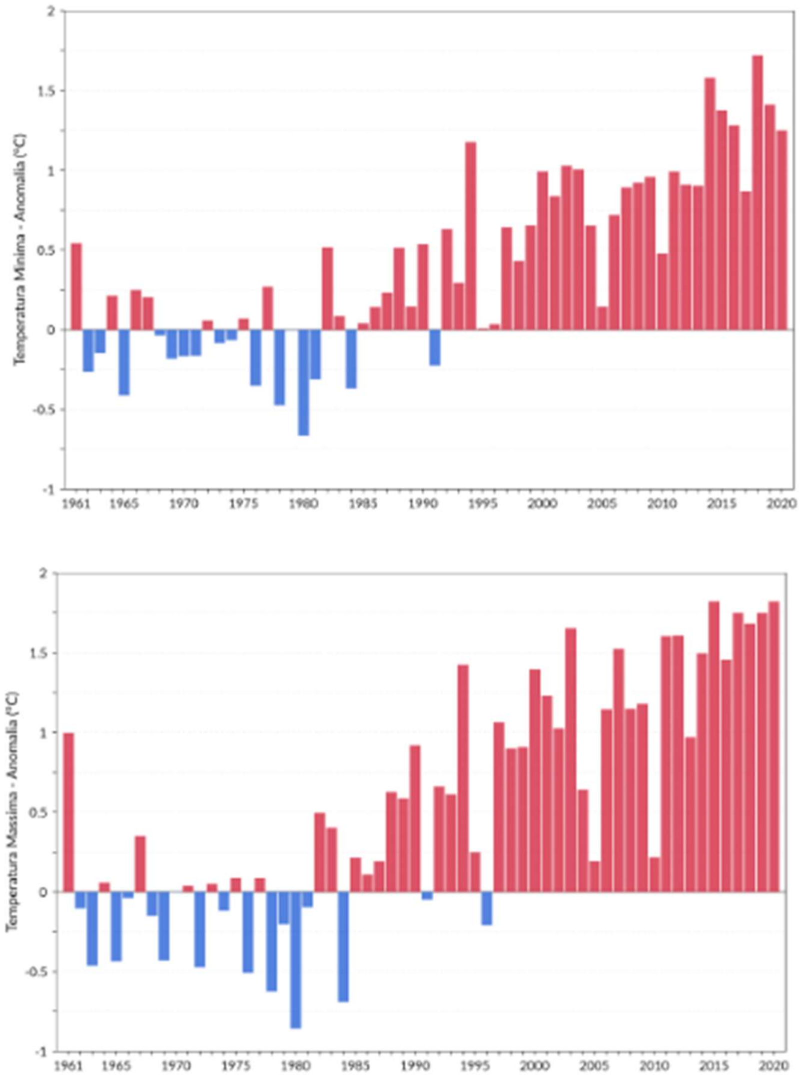


Figure 4.87 - Series of mean anomalies in Italy for the average, minimum, and maximum temperatures, compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

Figure 4.88 shows the series of temperature anomalies on a seasonal basis. The relatively hottest season was winter, in which the seasonal average temperature is calculated by combining the months of January and February with December of the previous year, and, with a mean anomaly of +2.36°C it stands in second place in the historical series. Spring (+1.54°C) and summer (+1.56°C) were the eighth and tenth hottest in the series respectively. Autumn took eleventh place, with a lesser anomaly (+1.04°C).

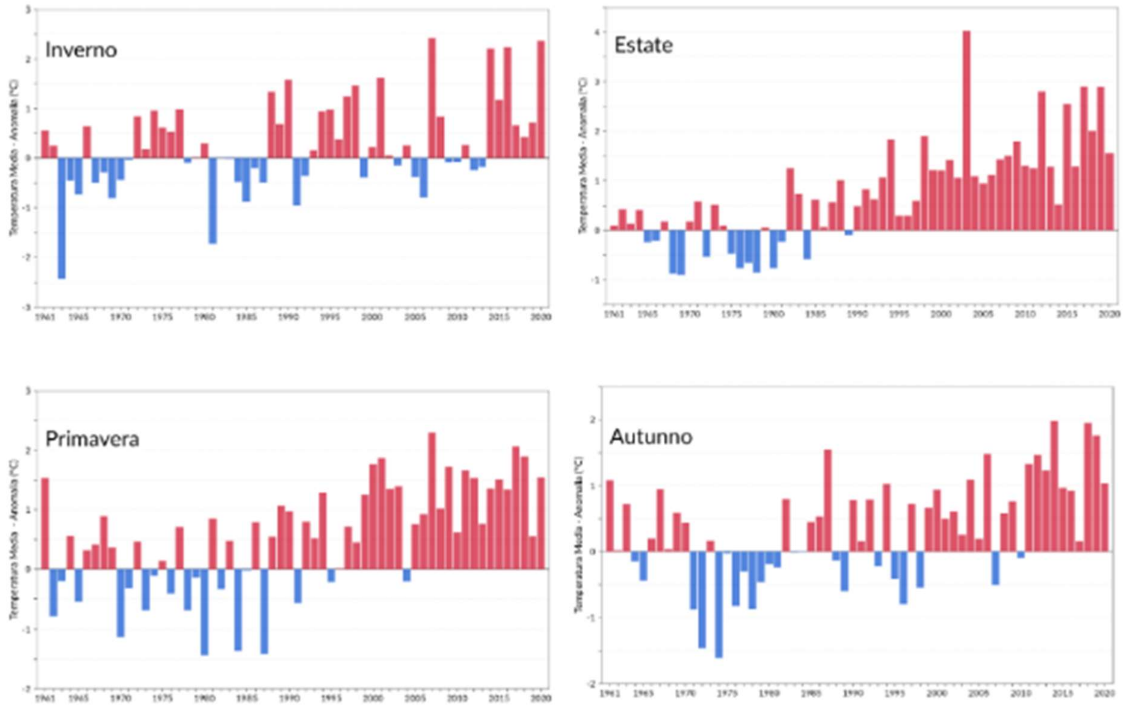


Figure 4.88 - Series of mean seasonal anomalies in Italy for the average temperature, compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

Table 4.33 shows the updated estimates for the temperature trends. Since a change in temperature trend dates back to the start of the 1980s, when a period began that was characterised by more marked heating during the last century, the trends are calculated for the 1981-2020 period. Taking the updated 2020 data as a reference, one finds that the rate of change in the maximum temperature (+0.42 ± 0.06)°C / 10 years, is greater than that for the minimum temperature (+0.35 ± 0.04)°C / 10 years. On a seasonal basis, the highest temperature increase trends are recorded in summer (+0.50 ± 0.08)°C / 10 years and spring (+0.44 ± 0.10)°C / 10 years. The summer trend is slightly lower than was estimated in 2019 (+0.52 ± 0.10)°C / 10 years, while the winter trend (+0.35 ± 0.12) °C / 10 years is higher than estimated in 2019 (0.29 ± 0.12)°C / 10 years, but is within a standard deviation. All the trends are statistically significant.

INDICATORE	TREND (°C/10 anni)
Temperatura media	+0.39 ± 0.05
Temperatura minima	+0.35 ± 0.04
Temperatura massima	+0.42 ± 0.06
Temperatura media inverno	+0.35 ± 0.10
Temperatura media primavera	+0.44 ± 0.10
Temperatura media estate	+0.50 ± 0.08
Temperatura media autunno	+0.29 ± 0.09

Table 4.33- Trends (and related standard error) for the temperature in Italy from 1981 to 2020 [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

For a systematic analysis of temperature extremes, ISPRA takes come indices defined by the OMM into consideration, and the selection criteria for which for Italy and related calculation methods hark back to those for similar evaluations at a global or continental scale.

The index related to the number of days with freezing (average number of days with minimum temperature less than or equal to 0°C) was lower than the normal 1961-1990 value (Figure 4.89), with an anomaly of about -15 days, putting it in sixth place among the lowest in the series since 1961.

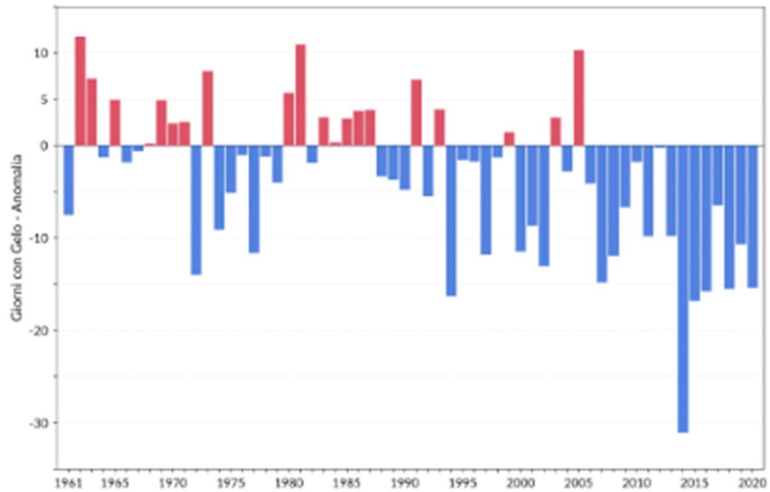


Figure 4.89 - Series of mean annual anomalies in Italy for the number of days with freezing, compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

In terms of both the mean number of tropical nights (with a minimum temperature higher than 20°C, Figure 4.90) and the mean number of summer days (with a maximum temperature higher than 25°C, Figure), 2020 was the twenty-fourth consecutive year with positive anomalies compared to the climatological average. With an anomaly of about +15 days compared to 1961-1990 for the mean number of tropical nights, 2020 is seventh highest in the historical series since 1961, whereas with an anomaly of about +13 summer days, 2020 is in eighteenth position in the historical series since 1961.

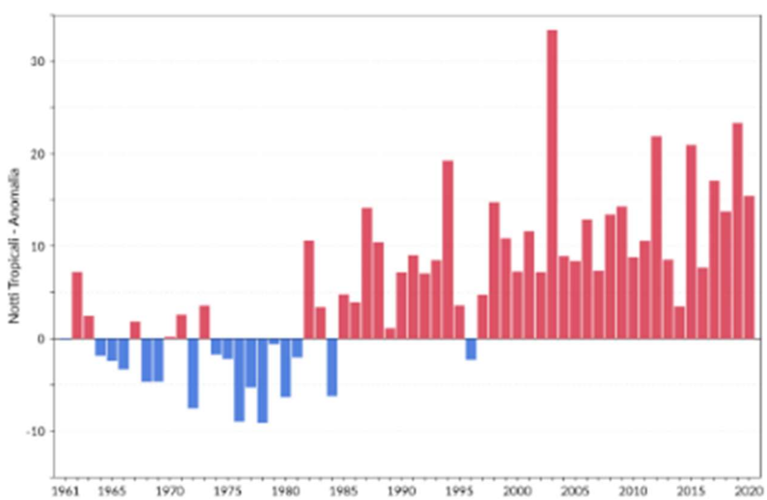


Figure 4.90 - Series of mean annual anomalies in Italy for the number of tropical nights, compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

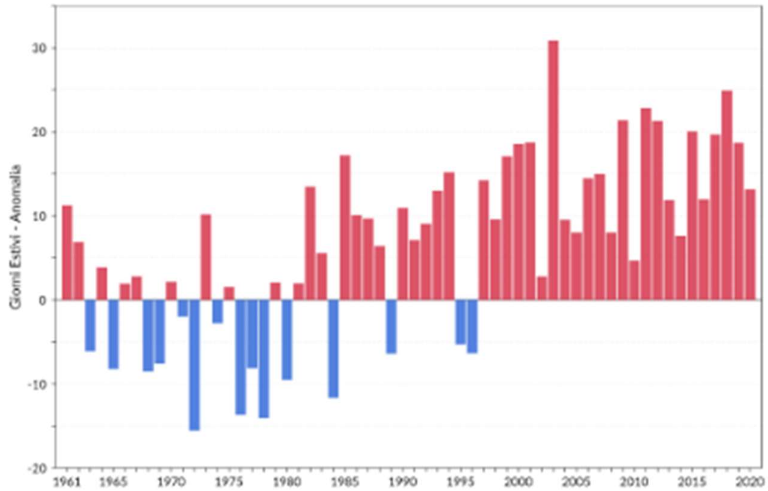


Figure 4.91 - Series of mean annual anomalies in Italy for the number of summer days, compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

The WSDI (Warm Spell Duration Index) identifies extended and intense periods of heat during the year, and represents the number of days in the year in which the maximum daily temperature exceeds the 90th percentile of the distribution in the reference climatic period, for at least six consecutive days. The percentile values are calculated for a window of 5 days centred on each day in the year. Unlike the indices based in a pre-established threshold value, this index, which counts the excesses compared to a threshold defined by the percentile, represents the variations in the local climate. The WSDI identifies hot periods in a relative sense, which can occur in any season. With an anomaly of about +17 days compared to the 1961-1990 value, 2020 stands in fourteenth place for the years with the highest positive anomalies, and was the twenty-fifth consecutive year with a WSDI higher than the climatological average (figure 4.92).

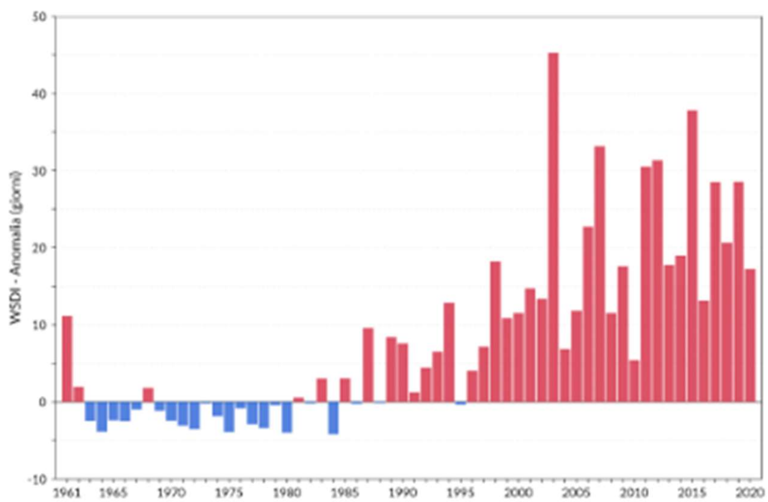


Figure 4.92 - Series of mean annual anomalies in Italy in the WSDI (Warm Spell Duration Index), compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

Other temperature extremes indices are based on comparison with the statistical distribution of normal values for cold nights (TN10p, percentage days in a year with a minimum temperature below the 10th percentile of the corresponding distribution for the climatological period), the cold days (TX10p, percentage of days with a maximum temperature below the 10th percentile), hot nights (TN90p, percentage days witn a minimum temperature above the 90th percentile), and hot days (TX90p, percentage days with a maximum temperature above the 90th percentile). As shown by Figure 4.93, cold nights and days show a clear trend of diminishing, whereas hot days and nights shown a clear trend of increasing. Over the last thirty-six years the cold nights and days were almost always lower than the climatological mean, and the hot nights and days were almost always higher than the climatological mean. The year 2020 recorded the ninth highest hot nights value (TN90p), third lowest value for cold nights (TN10p), seventh highest value for hot days (TX90p), and lowest value for cold days (TX10p). Over the last seven years, the six lowest values for cold days in the entire series have been recorded. Essentially, the analysis of the extremes indices shows no exceptional peak values or period of extreme heat. All the seasons contributed to 2020's positive anomaly, with temperatures higher than average. One contribution to point out is the reduction in "cold" extremes: "cold" days and cold nights, and days with freezing. In particular, the reduction in days with freezing was amply supported by the January and February temperatures, which were clearly above the average.

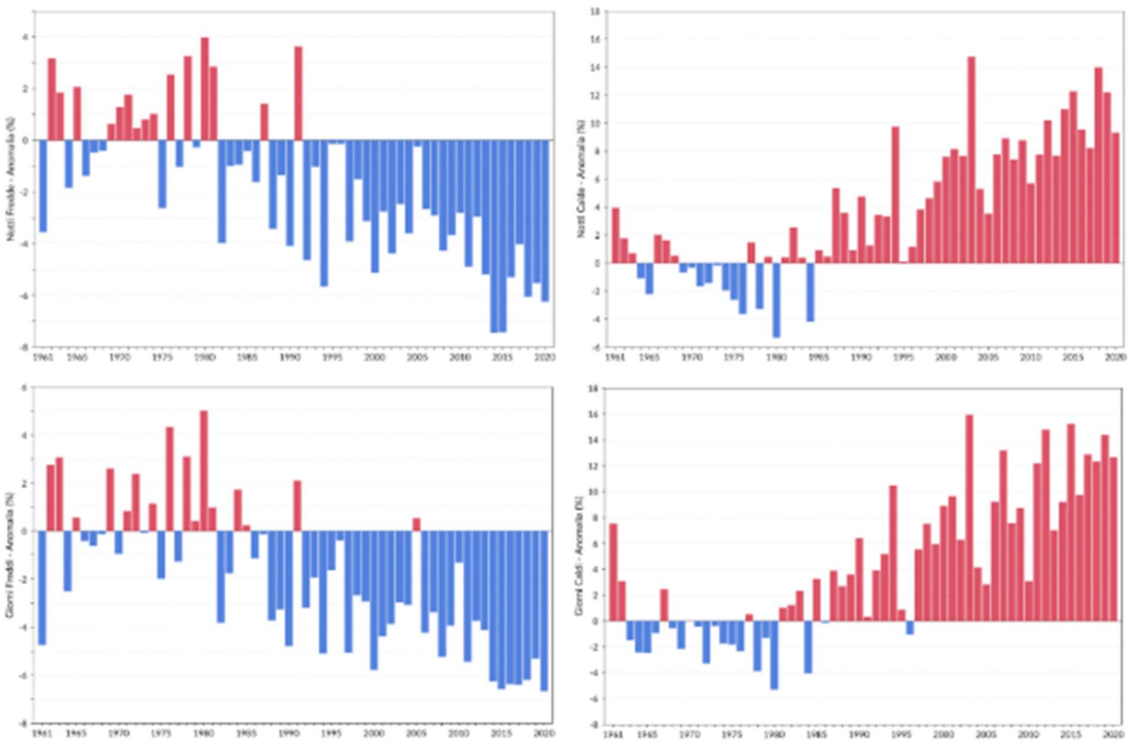


Figure 4.93 - Series of annual mean anomalies for the number of cold nights (TN10p), hot nights (TN90p), cold days (TX10p) and hot days (TX90p) in Italy, expressed as a % of days/year compared to the normal 1961-1990 value
[Source: ISPRA, Climate indicators in Italy for 2020, 2021]

4.2.7.1.3 Sea surface temperature

The indicators for the surface temperature of the Italian seas are calculated based on data processed by the *National Oceanic and Atmospheric Administration* (NOAA). These represent the estimated monthly mean values on a regular grid with a spatial resolution of 1° x 1°, obtained by stable spatial reconstruction of the sea surface temperature on a global scale. The estimates were based in integrating satellite measurements and data from the *International Comprehensive Ocean-Atmosphere Data Set SST* (ICOADS, http://icoads.noaa.gov/), which refer to measurements taken by ships, buoys, and other types of platforms.

Six groups of points were selected from the grid, each of which represents one of the Italian seas (Figure 4.94).

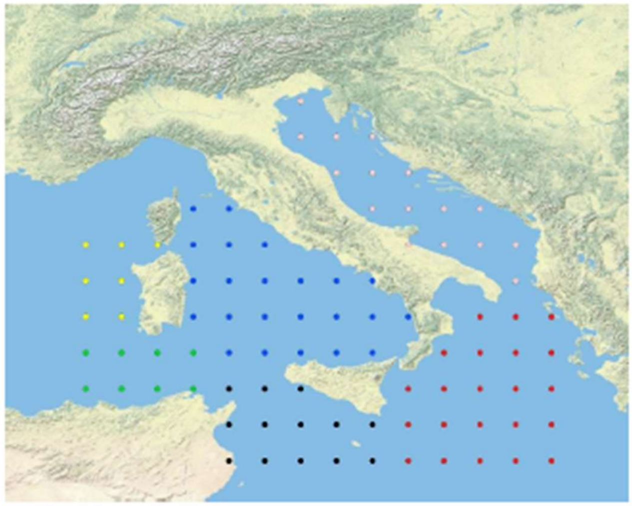


Figure 4.94 - Grid points selected for the mean temperature of Italian seas. Blue: Tyrrhenian; Red: Adriatic; Red: Ionian; Black: Strait of Sicily; Green: Strait of Sardinia; Yellow: Sardinian Sea [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

The average annual values for the mean sea water surface temperatures in Italy in 2020 obtained in this way are between 18.5°C (Adriatic) and 20.4°C (Ionian and Strait of Sicily) (Figure 4.95).

The lowest monthly values are recorded in February for the Adriatic Sea, Sea of Sardinia, and the Strait of Sardinia, and in March for the other seas, that is, the Tyrrhenian, Ionian, and Strait of Sicily. The highest monthly values are recorded in August for all the seas. The lowest value was recorded in the Adriatic Sea (12.0°C) and the maximum in the Tyrrhenian (28.0°C).

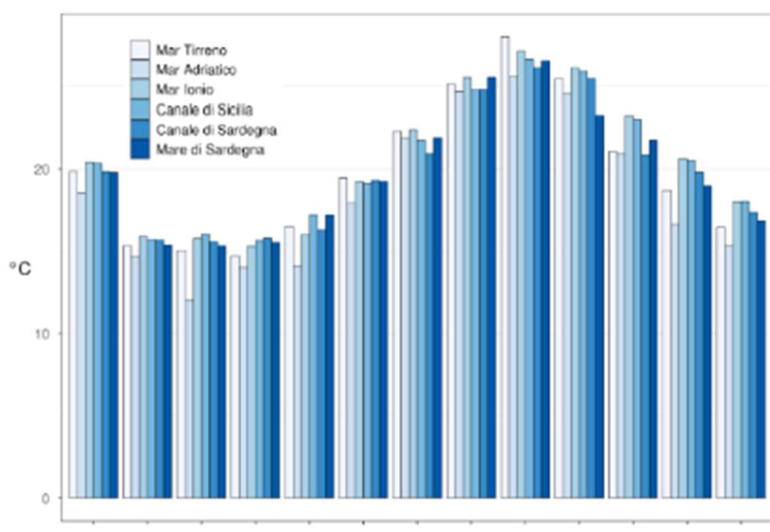


Figure 4.95 - Mean sea surface temperature in 2020 in Italy (annual and monthly) [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

Similar to the air temperature, the sea surface temperature in Italy in 2020 (Figure 4.96) was higher than the 1961-1990 climatological average. The mean anomalies were positive i8n all months and intensified during the year up to August. The positive differences from the normal values with at their maximum in August (+1.7°C) and May (+1.4°C), whereas the smallest difference occurred in October (+0.3°C). On examining the series of mean annual anomalies compared to the 1961-1990 thirty-year reference climatology, with a mean anomaly of +0.95°C 2020 took fourth place in the entire series (Figure). Nine of the last ten years have recorded positive anomalies that were higher than the entire series. Over the last twenty-two years the mean anomaly has always been positive.

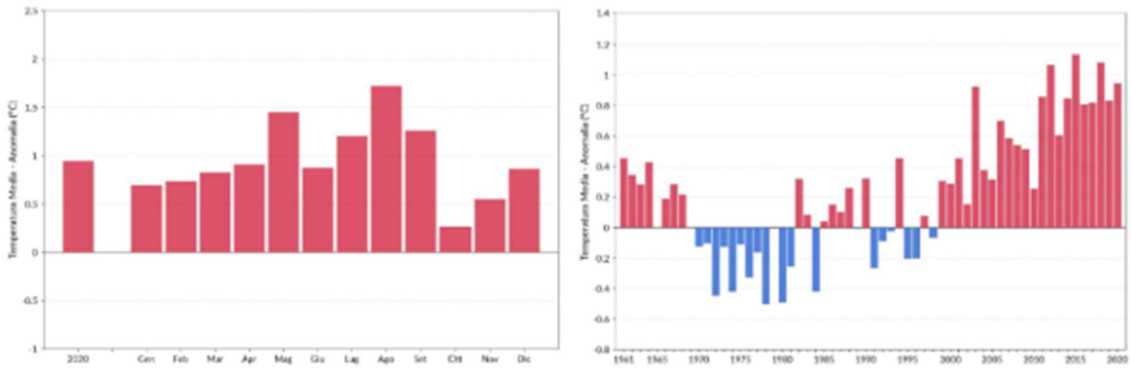


Figure 4.96 - Mean 2020 anomaly (annual and monthly, on the left) and series of mean annual anomalies (on the right) of the mean sea surface temperature in Italy compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

4.2.7.1.4 Precipitation

The precipitation trend in Italy in recent decades is illustrated by the series of accumulated annual precipitation anomalies over the 1961-2020 period, compared to the 1961-1990 climatological value Figure 4,97 and Figure 4.98).

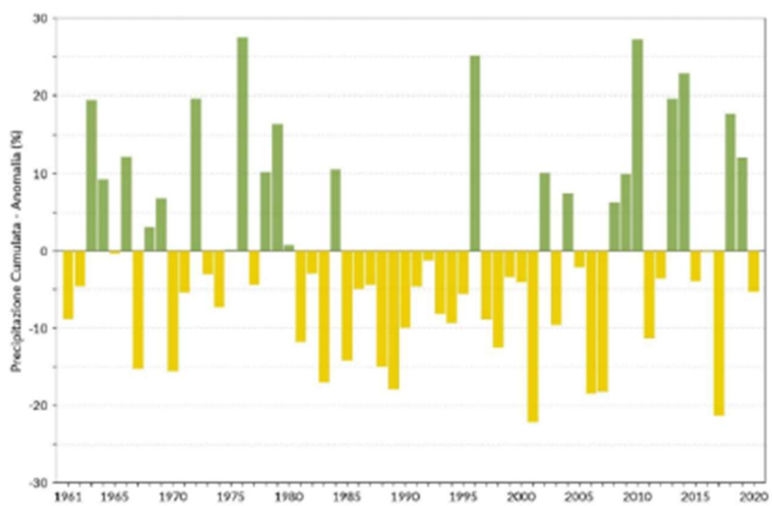


Figure 4.97 - Series of mean anomalies in Italy, expressed as percentage values, for the accumulated annual precipitation, compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

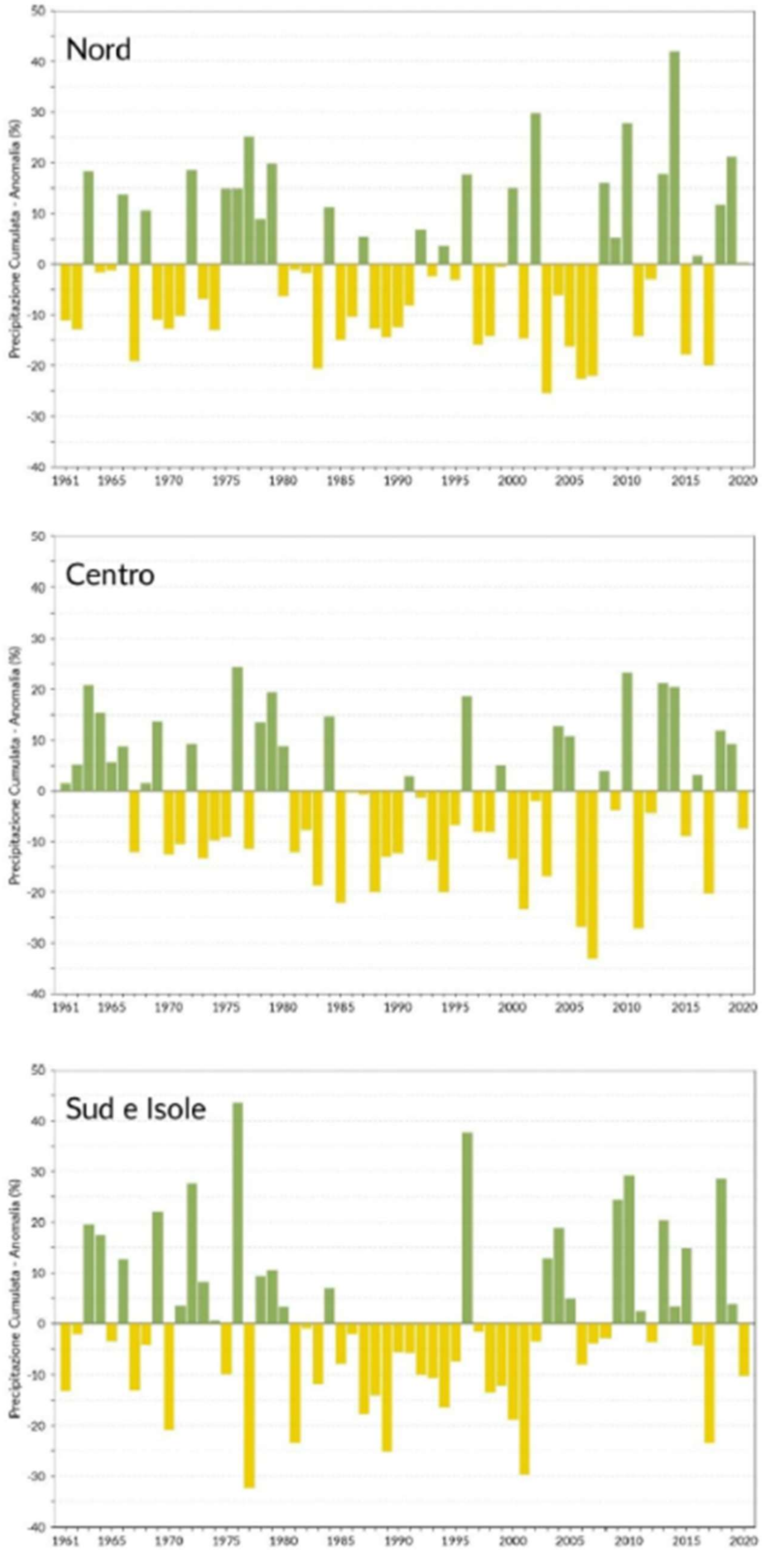


Figure 4.98 - Series of mean anomalies in Northern, Central, and Southern Italy, and the Islands, expressed as percentage values, for the accumulated annual precipitation, compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

With a mean accumulated precipitation anomaly in Italy of about -5%, the year 2020 takes twenty-third place in the least rainy years of the entire series since 1961.

The series of seasonal accumulated precipitation anomalies (Figure 4.99) shows that only summer was a more rainy season than the norm, whereas on average the other seasons were drier. Winter was the driest season (-40%) and takes seventh place among the least rainy, while spring (-11%) and autumn (-7%) recorded more contained negative anomalies. The summer took eleventh place among the most rainy (+26%).

Figure 4.99 - Series of mean anomalies, expressed as percentage values, for the accumulated seasonal precipitations, compared to the normal 1961-1990 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

Table 4.34 summarises the accumulated precipitation trends for the 1961-2020 period. These trends were firstly calculated for the annual series, by aggregating the stations for the whole of Italy, the North, Centre, South, and Islands, and then for the seasonal series for the entire country. In all cases no statistically significant trends were found.

PRECIPITAZIONE CUMULATA	TREND (%/10 anni)
ANNUALE	
Italia	(0.0 ± 0.1)
Nord	(+0.5 ± 1.1)
Centro	(-1.0 ± 1.1)
Sud e Isole	(+0.2 ± 1.2)
STAGIONALE (Italia)	
Inverno	(-2.2 ± 2.1)
Primavera	(+1.0 ± 1.4)
Estate	(-1.3 ± 2.2)
Autunno	(+2.0 ± 1.9)

Table 4.34 - Trends (and related standard error) for accumulated precipitation from 1961 to 2020 [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

As for temperature, to evaluate the trend for the frequency, intensity, and extreme values for precipitation, some indices defined by the OMM were taken into consideration. The temporal series of anomalies in indices for northern, central, and southern Italy is shown below, obtained by aggregating data from the stations that belong to each macro-area. The criteria for selecting the useful series and calculation methods for the indices, mirror similar evaluations at a global or continental scale. To facilitate using a larger number of series, the 1971-2000 climatological thirty year period was taken as a reference, and the results are presented in the form of series of index anomalies from 1971 to 2020.

The R10mm index represents the number of days in the year on which there was precipitation was more than or equal to 10 mm (Figure 4.100). The R95p index represents the sum in the year of the daily precipitations exceeding the 95th percentile of the distribution of daily precipitati8ons, on the rainy days in the climatological period 1971-2000 (Figure 4.100). The daily intensity index (SDII, Simple Daily Intensity Index) represents the accumulated annual precipitation divided by the number of rainy days in the year, where rainy days are taken to be those with precipitation exceeding or equal to 1 mm (Figure 4.100).

Overall, the analysis of the temporal series of these indices, based on the stations available, does not show clear signs of variations in the frequency and intensity of precipitation in the medium-long term. The analysis shows that in the North in 2020, positive anomalies were recorded for all three precipitation indices.

Figure 4.100 - Series of mean anomalies in North, Central, South and Islands, for the number of days in the year with precipitation exceeding or equal to 10 mm (R10mm - left), precipitations in very rainy days (R95p - centre), and the daily rain intensity (SDII) compares to the normal 1971-2000 value [Source: ISPRA, Climate indicators in Italy for 2020, 2021]

4.2.7.2 Air and atmospheric pollution

4.2.7.2.1 Emission of pollutants into the atmosphere

As party to the "*Convention on Long Range Transboundary Air Pollution*" (CLRTAP) of the United Nations Economic Commission for Europe (UNECE), each year Italy submits data on the emission of pollution into the atmosphere, in order to fulfil the obligations laid down by the Protocols implementing the Convention. The same data is also transmitted in terms of the Directive on the reduction of national emissions of certain pollutants of the atmosphere.

More specifically, this presentation consists of the national inventory of LRTAP emissions, communicated by compiling the *Nomenclature Reporting Format* (NRF) and the *Informative Inventory Report* (IIR).

The IRR contains information on the national inventory, including descriptions of the methods, data sources, and QA/QC activities carried out, and an analysis of the trends. the inventory takes into account anthropogenic emissions of the following substances: sulphur oxides (SOx), nitrogen oxides (NOx), ammonia (NH_3), non-methane volatile organic compounds (NMVOC), carbon monoxide (CO), total suspended particulate (TSP), particulate with particle size < 10 µm (PM_{10}), particulate with particle size < 2,5µm ($PM_{2,5}$), black carbon (BC), lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As), chrome (Cr), copper (Cu), nickel (Ni), selenium (Se), zinc (Zn), polychlorinated biphenyl (PCB), aromatic polycyclic hydrocarbons (IPA), dioxin (Diox), and hexachlorobenzene (HCB). The national inventory is updated annually in order to reflect revisions and improvements to the methodology and the availability of new information. The changes are applied retroactively to the previous years, which explains any difference in the data published previously.

In the 1990-2019 period, the emissions of almost all the pollutants analysed, show a downward trend. The reductions are particularly significant for the main pollutants: SOx (-94%), NOx (-71%), CO (-70%), COVNM (-55%), BC (-62%), cadmium (-60%), mercury (-57%), lead (-95%) and hexachlorobenzene (-93%). The main driving factors behind these trends are the reductions in the transport, industrial, and road sectors, due to the implementation of various European Directives that have introduced new technologies, limits to plant emissions, limitation of lead content in liquid fuels, and the change to cleaner fuels. In addition, emissions were also down due to improved energy efficiency and the promotion of renewable energy.

The energy sector is the main source of emissions in Italy, with a quota of more than 80%, including escaped emissions, for many pollutants (SOx 88%; NOx 91%; CO 94%; $PM_{2,5}$ 88%; BC 94%; PAH 84%). The industrial process sector is an important source of emissions, linked specifically with the engineering sector, at least for particulate, heavy metals, and POP, whereas significant SOx emissions result from the production of cement and from the production of carbon black and sulphuric acid. The solvents and other products production sector is characterised by COVNM emissions. The farming sector is the main source of NH_3 emissions in Italy, with a quota of 94% of the national total. Finally, the waste sector, and especially waste incineration, is a significant source for Cd (12%).

Total emissions by pollutant in Italy from 1990 to 2019 are shown in Table 4.35.

		1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
SOx	Gg	1,784	1,322	756	411	222	127	119	117	109	105
NOx	Gg	2,125	1,989	1,504	1,289	934	719	699	646	639	627
NMVOC	Gg	1,994	2,059	1,630	1,340	1,117	901	884	925	897	894
NH3	Gg	467	452	454	419	377	364	377	371	358	355
CO	Gg	6,797	7,072	4,751	3,467	3,073	2,271	2,195	2,261	2,052	2,062
As	Mg	37	28	39	28	17	9	9	8	8	7
Cd	Mg	11	11	10	9	5	4	5	5	5	4
Cr	Mg	86	69	44	50	40	35	35	35	35	34
Cu	Mg	193	216	222	230	203	189	180	171	173	171
Hg	Mg	15	14	14	12	8	7	7	7	7	6
Ni	Mg	114	110	107	112	41	30	30	30	30	28
Pb	Mg	4,280	1,996	964	298	218	199	203	206	205	199
Se	Mg	8	8	8	9	8	8	7	7	7	7
Zn	Mg	948	952	906	981	877	815	832	874	887	851
TSP	Gg	350	346	303	275	287	237	231	239	218	215
PM10	Gg	293	288	248	223	234	191	186	193	174	172
PM2.5	Gg	227	225	195	173	196	158	153	160	142	139
BC	Gg	47	46	42	38	32	22	21	21	19	18
PAH	Mg	90	92	60	64	87	71	70	74	67	65
Dioxin	g ITeq	503	485	408	334	318	281	280	296	277	271
HCB	kg	139	107	28	22	12	12	11	11	10	10
PCB	kg	152	163	152	174	128	109	114	117	116	112

Table 4.35- Historical series of emission of pollutants into the atmosphere in Italy [Source: ISPRA, Italian Emission Inventory 1990-2019, 2021]

4.2.7.2.2 Emissions of greenhouse gases

In 2019, overall emissions of greenhouse gases in Italy came to about 376 million tonnes of CO_2 equivalent (418 million if you exclude the LULUCF sector[45]). The total emissions of greenhouse gases, in CO_2 equivalent terms, excluding emissions and absorption by LULUCF, reduced by 19,4% between 1990 and 2019, going from 519 to 418 million CO_2 equivalent tonnes.

The most important greenhouse gas, CO_2, accounts for 81.2% of all greenhouse gas emissions, and recorded a reduction of 22.7% between 1990 and 2019. In the energy sector in particular, the emissions of CO_2 in 2019 went down by 20.7% compared to 1990. Respectively, CH_4 and N_2O emissions account for 10.3% and 4.1% of all greenhouse gas emissions in Italy. Emissions of CH_4, in particular, reduced by 12.9% from 1990 to 2019, while N_2O reduced by 33.9%. Of the other greenhouse gases, HFC accounts for 4,0% of total emissions, PFC and SF_6 stand at 0.2% and 0.1% of total emissions respectively, which NF_3 weighs in at about 0.01%. Of these gases HFC emissions are increasing greatly, and this significant upward trend means that will even more important in the coming years. In terms of total emissions, the quota of the various sectors remained pretty much unchanged over the 1990-2019 period. Specifically, for the year 2019, most of the overall greenhouse gas emissions can be attributed to the energy sector, with a percentage of 80.5%, followed by industrial processes and the use of products and agriculture, which account for 8.1% and 7.1% respectively, and waste that contributes 4.3% to the total emissions.

As has been said, the energy sector is the largest contributor to the emission of total greenhouse gas emissions for the country. Emissions by this sector went down by 20.9% from 1990 to 2019. More specifically, CO_2 from this sector went down by 20.7% from 1990 to 2019 and represent 96.3% of total greenhouse gas emissions by

[45] Land use, land use change and forestry.

the energy sector, whereas CH_4 emissions, despite being reduced by 33.2%, represent a quota of the total for the sector of only 2.3%. Emissions of N_2O went down by 0.2% from 1990 to 2019, equal to 1.4%. In particular, in terms of total CO_2 equivalent, an increase in emissions was only observed in the transport and other sectors, at about 3.2% each from 1990 to 2019. In 2019 these sectors represented 31.3% and 24.2% of total emissions for the energy sector respectively. For the industrial processes sector, emissions went down by 16.0% from 1990 to 2019. Specifically, in terms of compounds, emissions of CO_2 represent 44.0% and showed a reduction of 49.1%, CH_4 went down by 67.9% but only represents 0.1%, whereas N_2O the levels of which represent 1.9% of total industrial emissions, went down by 91.1%. The reduction in emissions is mainly due to a reduction in the chemical industry (due to fully operational technology for damping down in the adipic acid industry) and emissions from the production of minerals and metals. There was a considerable increase in emissions of fluorinated gases (about 400%), the level of which, of total emissions in the sector, is 54.0%.

It should be noted that, without prejudice to the reasons explained, the economic recession had a period of significant influence on production levels in most industries, and consequent emissions in recent years.

For agriculture, the emissions relate mainly to the levels of CH_4 and N_2O that account for 64.3% and 34.3% of the sector's total respectively. CO_2, on the other hand, only accounts for 1.5% of the total. The reduction observed in the total level of emissions (-17.3%) is due mainly to the reduction in CH_4 emissions from enteric fermentation (-14.6%), which accounts for 44.9% of the sector's emissions, and a reduction in N_2O in farming land (-20.6%), which represents 27.2% of the emissions from this sector. As regards land use, the change in land use and forestry (LULUCF), from 1990 to 2019 total absorption increased significantly. CO_2 represents almost all the emissions and absorptions for this sector (98.4%). Finally, emissions from the waste sector increased by 5.1% from 1990 to 2019, mainly due to an increase in the emissions from disposal of solid waste in the land (11.9%), which accounts for 75.1% of waste emissions. The most important greenhouse gas in this sector is CH_4 that accounts for 89.5% of emissions from the sector, and increased by 5.2% from 1990 to 2019. The N_2O emission levels went up by 40.1%, whereas CO_2 went down by 89.2%. These gases represent 10.2% and 0.3% for the sector respectively.

Table 1.36 provides an overview of the greenhouse gas emission trends by sector in Italy from 1990 to 2019.

Category	1990	1995	2000	2005	2010	2015	2017	2018	2019
			kt CO_2 equivalent						
A. Energy: fuel combustion	**412,204**	**425,568**	**448,477**	**477,889**	**420,035**	**350,910**	**342,747**	**338,568**	**329,135**
CO_2: 1. Energy Industries	136,941	139,941	144,273	159,227	136,885	105,486	104,529	95,545	91,312
CO_2: 2. Manufacturing Industries and Construction	90,772	88,969	94,893	90,786	68,900	54,552	52,136	53,221	48,838
CO_2: 3. Transport	100,319	111,531	121,443	126,616	114,172	105,039	99,741	103,133	104,283
CO_2: 4. Other Sectors	76,042	75,580	79,175	92,328	90,907	77,658	78,243	78,741	76,703
CO_2: 5. Other	1,071	1,496	837	1,233	652	459	326	341	453
CH_4	2,444	2,701	2,468	2,301	3,159	3,005	3,105	2,922	2,939
N_2O	4,615	5,349	5,388	5,398	5,361	4,710	4,667	4,665	4,607
1B2. Energy: fugitives from oil & gas	**13,117**	**12,374**	**11,147**	**9,755**	**9,014**	**8,115**	**7,731**	**7,395**	**7,507**
CO_2	4,048	4,002	3,262	2,557	2,377	2,574	2,351	2,295	2,757
CH_4	9,058	8,360	7,873	7,185	6,625	5,531	5,370	5,090	4,741
N_2O	12	12	12	13	12	10	10	9	9
2. Industrial processes	**40,422**	**38,316**	**39,123**	**47,209**	**37,000**	**33,232**	**33,817**	**34,570**	**33,937**
CO_2	29,335	27,281	25,832	28,718	21,703	14,976	14,976	15,248	14,941
CH_4	129	134	73	74	60	42	44	44	41
N_2O	7,199	7,701	8,599	8,251	1,224	613	697	684	641
HFCs	444	927	2,489	7,617	12,054	15,387	16,321	16,445	16,801
PFCs	2,907	1,492	1,488	1,940	1,520	1,688	1,314	1,657	1,028
Unspecified mix of HFCs and PFCs	NO	25	25	25	25	25	25	23	24
SF_6	408	680	604	550	394	472	417	446	444
NF_3	NO	77	13	33	20	28	23	22	18
3. Agriculture	**35,672**	**35,751**	**34,829**	**32,335**	**30,020**	**29,563**	**30,109**	**29,686**	**29,517**
CO_2: Liming	1	1	2	14	18	14	17	15	16
CO_2: Urea application	465	512	525	507	335	425	418	405	396
CO_2: Other carbon-containing fertilizers	44	54	44	42	28	20	20	22	17
CH_4: Enteric fermentation	15,497	15,319	15,048	13,179	12,761	12,912	13,301	13,257	13,241
CH_4: Manure management	4,843	4,606	4,571	4,685	4,539	4,253	4,211	4,142	4,132
CH_4: Rice Cultivation	1,876	1,989	1,656	1,752	1,822	1,668	1,646	1,601	1,583
CH_4: Field Burning of Agricultural Residues	15	15	15	16	15	16	15	15	15
N_2O: Manure management	2,817	2,688	2,601	2,399	2,320	2,126	2,150	2,117	2,082
N_2O: Agriculture soils	10,111	10,563	10,363	9,737	8,178	8,125	8,325	8,107	8,031
N_2O: Field Burning of Agricultural Residues	4	4	4	4	4	4	4	4	4
4A. Land-use change and forestry	**-3,491**	**-23,673**	**-20,916**	**-35,037**	**-41,923**	**-43,682**	**-20,339**	**-36,003**	**-41,561**
CO_2	-5,702	-24,905	-22,366	-35,995	-42,702	-44,274	-22,411	-36,608	-42,235
CH_4	1,286	303	714	299	350	264	1,511	153	181
N_2O	925	929	735	658	430	328	561	453	493
6. Waste	**17,304**	**19,996**	**21,890**	**21,883**	**20,404**	**18,617**	**18,309**	**18,332**	**18,184**
CO_2	512	458	208	230	177	99	92	54	55
CH_4	15,470	18,223	20,144	19,907	18,358	16,633	16,330	16,402	16,275
N_2O	1,323	1,315	1,538	1,746	1,869	1,885	1,887	1,876	1,853
Total emissions (with LULUCF)	***515,229***	***508,331***	***534,550***	***554,034***	***474,551***	***396,754***	***412,374***	***392,547***	***376,719***
Total emissions (without LULUCF)	***518,720***	***532,004***	***555,466***	***589,072***	***516,474***	***440,437***	***432,714***	***428,549***	***418,281***

Table 1.36 - Greenhouse gas mission trends in Italy

4.2.7.2.3 The shipping and fishing sectors

As regards the <u>shipping</u> sector, this category of the national inventory of emissions includes all emissions resulting from the fuels used for this purpose. Overall, emissions for this sector went down from 1990 to 2019, due to a reduction in fuel consumption for port activities and shipping. The number of movements, up since 1990, has inverted the trend in recent years. In 2019 shipping was a significant category in terms of emissions of SOx, NOx, PM_{10}, $PM_{2.5}$ and BC.

For maritime transport, as from European Union Directive 1999/32/CE, a start was made to keep track of shipping's environmental impact, and especially the sulphur content of fuels for maritime use. This directive was amended by Directive 2005/33/CE that defined the Baltic Sea, English Channel, and the North Sea as control areas for sulphur emissions (SECA) limiting the sulphur content in fuel for these areas, and introducing a 0,1% limit to the sulphur content of fuel used in European ports from 2010. EU legislation, along with the national norm, resulted in the introduction of a limit to the sulphur content in marine diesel of 0.2% from 2002 (2% previously) and 0.1% from 2010. Meanwhile for fuel oil specific limits are laid down for the maximum sulphur content of 1.5% in port, as from 2008, and 2% in domestic waters and 1% in port from 2010. For internal shipping ways, which include shipping on the Po River and ferries in the Venice Lagoon, the same norm applies.

As regards the fishing sector, unlike the shipping sector, this falls into the ENERGY sector (NFR sector 1). For this sector too, data related to emissions is derived from the extent of fuel consumption for fishing, and this data is rather reliable thanks to the different taxation regime applied to the fishing sector, which makes separate accounting of this type of consumption possible.

The tables below show the historical series for both the shipping sector (Table 4.37) and the fishing sector (Table 4.40) for all atmospheric pollutants and for the main greenhouse gases.

	U.M.	1990	1995	2000	2005	2010	2015	2019
CO_2	Mg	5,470,111	5,162,995	5,903,449	5,458,701	5,248,905	3,900,056	4,484,485
NOx	Mg	95,554	87,969	102,480	94,942	93,283	70,655	82,483
CO	Mg	102,271	115,567	124,770	122,864	109,417	62,221	57,304
SOx	Mg	77,936	70,306	81,490	49,729	28,378	21,336	25,037
COVNM	Mg	56,408	61,981	59,867	53,505	40,851	24,140	22,032
PM10	Mg	9,334	8,865	9,646	8,937	7,891	5,575	6,240
PM2,5	Mg	9,301	8,832	9,607	8,903	7,856	5,549	6,209
Nickel	kg	4,722	4,342	5,038	4,652	4,542	3,457	4,031
Black carbon	Mg	1,331	1,246	1,404	1,308	1,225	9,34	1,063
Zinc	kg	852	785	910	840	819	623	726
Methane	Mg	1,395	1,500	1,529	1,365	1,130	687	698
Selenium	kg	348	320	371	343	334	254	296
Benzene	Mg	1,536	1,030	517	456	368	197	159
Lead	kg	52,674	19,598	9,141	156	146	109	128
Copper	kg	149	137	159	147	143	109	127
Arsenic	kg	148	136	158	146	142	108	126
N_2O	Mg	127	118	137	128	126	95	110
Chrome	kg	88	81	93	86	84	64	75
Aromatic polycyclic hydrocarbons (APH)	kg	76	74	83	77	73	53	60
Cadmium	kg	19	17	20	19	18	14	16
Ammonia	Mg	11	10	12	11	11	8	9
Dioxin and furans	g (teq)	0	0	0	0	0	0	0
Hexachlorobenzene	kg	0	0	0	0	0	0	0
Polychlorophenyls	kg	0	0	0	0	0	0	0

Table 4.37 - Historic series of polluting and climate altering emissions from the domestic shipping sector [Source: ISPRA, National Inventory of Emissions into the Atmosphere 1990-2019, 2021]

	U.M.	Abruzzo	Calabria	Campania	Emep gridded emissions	Emilia-Romagna	Friuli-Venezia-Giulia	Lazio	Liguria	Lombardy	Marche	Molise	Piedmont	Puglia	Sardinia	Sicily	Tuscany	Trentino Alto Adige	Umbria	Total
CO_2	Mg	11,951	52,403	585,695	2,031,330	65,639	125,587	162,945	326,713	39,214	45,631	5,067	12,092	153,636	205,332	260,679	229,678	3,503	1,635	4,484,485
NOx	Mg	166	846	11036	38876	1143	2013	3010	5797	530	765	86	163	2705	3531	4652	4067	47	22	82,483
CO	Mg	813	1,798	6,025	4,301	1,718	5,392	2,811	7,847	136	1,639	180	42	4,307	6,285	6,094	5,797	12	6	57,304
SOx	Mg	10	63	826	21,951	79	139	218	418	0	53	6	0	191	250	336	292	0	0	25,037
COVNM	Mg	192	417	1,657	1,404	613	2,617	1,046	2,978	59	605	43	18	1,557	2,679	3,522	1,689	5	2	22,032
PM10	Mg	14	45	398	4,238	56	117	123	258	56	40	4	17	137	175	220	193	5	2	6,240
PM2,5	Mg	13	45	396	4,234	55	116	121	257	56	40	4	17	132	173	211	191	5	2	6,209
Nickel	kg	72	4	78	1,954	12	172	410	51	38	41	12	12	273	368	395	62	3	2	4,031
Black carbon	Mg	2	10	112	553	14	22	31	61	31	8	1	9	30	38	51	44	3	1	1,063
Zinc	kg	2	7	92	350	9	17	28	47	7	6	1	2	24	31	41	33	1	0	726
Methane	Mg	6	14	83	192	15	42	30	73	2	13	1	1	38	54	57	53	0	0	698
Selenium	kg	1	3	37	143	4	7	12	19	3	3	0	1	10	13	17	13	0	0	296
Benzene	Mg	2	4	17	28	4	12	7	19	1	4	0	0	10	15	15	14	0	0	159
Lead	kg	0	0	5	109	0	1	2	3		0	0		1	2	2	2			128
Copper	kg	1	1	11	61	1	4	8	6	1	1	0	0	6	8	9	4	0	0	127
Arsenic	kg	1	1	11	61	1	4	8	6	1	1	0	0	6	8	9	4	0	0	126
N_2O	Mg	0	1	15	51	2	3	4	8	1	1	0	0	4	5	6	6	0	0	110
Chrome	kg	0	1	8	36	1	2	4	4	1	1	0	0	3	4	5	3	0	0	75
APH	kg	0	1	8	26	1	2	2	5	0	1	0	0	2	3	4	3	0	0	60
Cadmium	kg	0	0	2	8	0	0	1	1	0	0	0	0	1	1	1	1	0	0	16
Ammonia	Mg	0	0	1	4	0	0	0	1	0	0	0	0	0	0	1	0	0	0	9
Dioxin and furans	g (teq)	0	0	0	0	0	0	0	0		0	0		0	0	0	0			0
Hexachlorobenzene	kg	0	0	0	0	0	0	0	0		0	0		0	0	0	0			0
Polychlorophenyls	kg	0	0	0	0	0	0	0	0		0	0		0	0	0	0			0

Table 4.38 - Polluting and climate altering emissions for the domestic shipping sector by Region in 2019 [Source: ISPRA, National Inventory of Emissions into the Atmosphere 1990-2019, 2021]

	U.M.	1990	1995	2000	2005	2010	2015	2019
CO_2	Mg	616,455	707,202	634,272	773,121	571,164	456,130	528,390
NOx	Mg	8,373	9,605	8,543	10,378	7,661	6,134	7,140
CO	Mg	2,147	2,463	2,191	3,225	2,550	2,133	1,831
COVNM	Mg	930	1,067	949	1,352	1,019	822	793
PM10	Mg	883	1012	900	1,094	807	646	753
PM2,5	Mg	883	1012	900	1,094	807	646	753
Nickel	kg	601	690	614	745	550	440	513
Black carbon	Mg	485	557	495	601	444	355	414
Zinc	kg	108	124	110	134	99	79	92
Selenium	kg	44	50	45	54	40	32	37
Methane	Mg	35	41	36	48	36	30	30
Arsenic	kg	19	22	19	23	17	14	16
Copper	kg	19	22	19	23	17	14	16
Benzene	Mg	18	21	19	25	19	15	16
N_2O	Mg	12	14	12	15	11	9	10
Chrome	kg	11	13	11	14	10	8	10
Aromatic polycyclic hydrocarbons (APH)	kg	8	9	8	10	7	6	7
SOx	Mg	1,182	904	114	17	3	2	2
Cadmium	kg	2	3	2	3	2	2	2
Ammonia	Mg	1	2	1	2	1	1	1
Dioxin and furans	g (teq)	1	1	1	1	1	1	1
Hexachlorobenzene	kg	1	1	1	1	1	0	1
Polychlorophenyls	kg	0	0	0	0	0	0	0
Lead	kg	39	45	40				

Table 4.39 - Historic series of polluting and climate altering emissions from the fishing sector [Source: ISPRA, National Inventory of Emissions into the Atmosphere 1990-2019, 2021]

	U.M.	Abruzzo	Calabria	Campania	Emilia-Romagna	Friuli-Venezia-Giulia	Lazio	Liguria	Marche	Molise	Puglia	Sardinia	Sicily	Tuscany	Veneto	Total
CO_2	Mg	22,726	34,828	47,367	25,729	21,969	24,989	15,036	33,871	4,049	65,695	58,947	119,287	25,207	28,690	528,390
NOx	Mg	307	471	640	348	297	338	203	458	55	888	797	1,612	341	388	7,140
CO	Mg	79	121	164	89	76	87	52	117	14	228	204	413	87	99	1,831
COVNM	Mg	34	52	71	39	33	38	23	51	6	99	88	179	38	43	793
PM10	Mg	32	50	67	37	31	36	21	48	6	94	84	170	36	41	753
PM2,5	Mg	32	50	67	37	31	36	21	48	6	94	84	170	36	41	753
Nickel	kg	22	34	46	25	21	24	15	33	4	64	57	116	24	28	513
Black carbon	Mg	18	27	37	20	17	20	12	27	3	51	46	93	20	22	414
Zinc	kg	4	6	8	4	4	4	3	6	1	11	10	21	4	5	92
Selenium	kg	2	2	3	2	2	2	1	2	0	5	4	8	2	2	37
Methane	Mg	1	2	3	1	1	1	1	2	0	4	3	7	1	2	30
Arsenic	kg	1	1	1	1	1	1	0	1	0	2	2	4	1	1	16
Copper	kg	1	1	1	1	1	1	0	1	0	2	2	4	1	1	16
Benzene	Mg	1	1	1	1	1	1	0	1	0	2	2	4	1	1	16
N_2O	Mg	0	1	1	1	0	0	0	1	0	1	1	2	0	1	10
Chrome	kg	0	1	1	0	0	0	0	1	0	1	1	2	0	1	10
APH	kg	0	0	1	0	0	0	0	0	0	1	1	2	0	0	7
SOx	Mg	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Cadmium	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Ammonia	Mg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Dioxin and furans	g (teq)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hexachlorobenzene	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polychlorophenyls	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

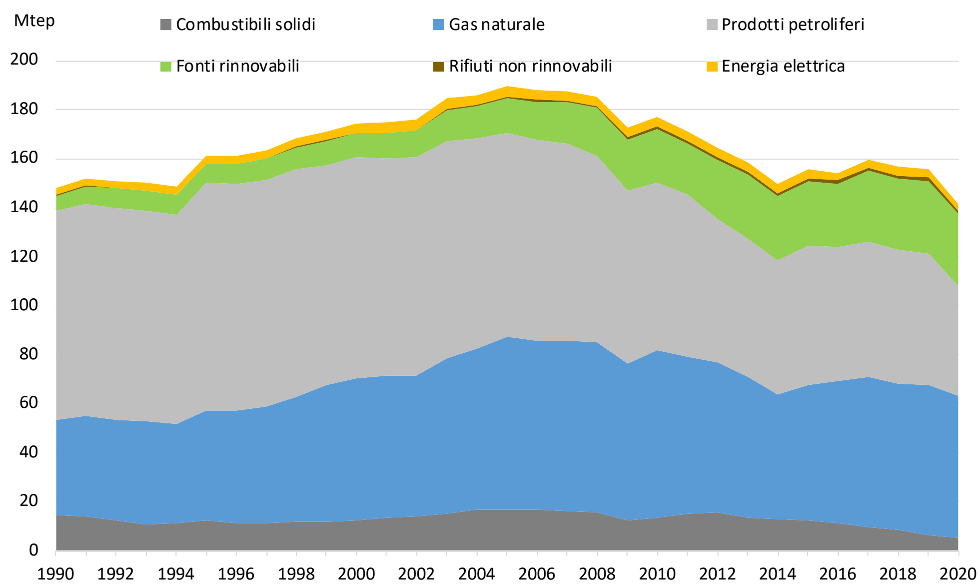
Table 4.40 - Polluting and climate altering emissions for the fishing sector by Region in 2019
[Source: ISPRA, National Inventory of Emissions into the Atmosphere 1990-2019, 2021]

4.2.7.3 Energy

4.2.7.3.1 Primary energy consumption

The gross internal energy consumption in Italy in 2020 stood at around 142 Mtep, of which 41% was derived from natural gas, 32% from petroleum products, 21% from renewable sources, and the remainder from solid fuels (coal and waste) and from imported electricity.

Consumo interno lordo di energia in Italia



Consumo interno lordo di energia in Italia nel 2020

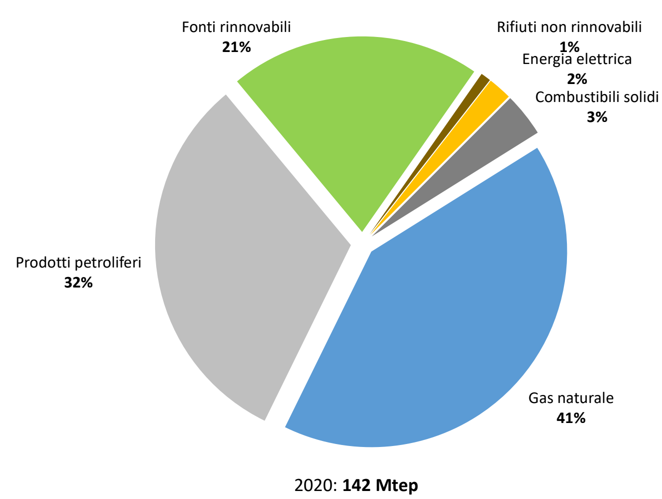


Figure 4.101 - Gross internal energy consumption in Italy
[Source; Sogesid processing of Eurostat data]

According to the latest estimates, the demand for primary energy in Italy went up in 2021 by more than 8% compared to 2020. Almost 60% of this increase came about in the 2nd quarter of the year, when energy consumption went up by about 7 Mtep (+24%) compared to the minimum levels in spring 2020, which was mostly affected by restrictions on mobility and production activities, in order to contain the first wave of the pandemic associated with COVID-19. Excluding the first quarter of the year, with only a marginal variation, the second half of the year also saw a rise in energy demand, albeit less so than the spring months: 7% in the 3rd quarter and 6% the 4th (both in terms of trend changes). Compared to the 2019 levels, energy consumption at the end of 2021 was still almost 2 percentage points down, despite having already "regained" 12 Mtep of the 15 Mtep reduction in 2020, when the demand for energy was more than 9% down compared to 2019.

From a longer term point of view, after the long period of reductions in demand that began in the middle of the first decade of this century, when the 2005 maximum energy demand levels (189 Mtep) went down by more than 30 Mtep (especially in the recession years that began in 2009), the national energy system saw a moderate upturn, driven by the growth in GDP and industrial activity. With the slowdown in economic growth, already back in 2019 the demand for energy showed a downward turn (compared to 2018), albeit marginal, before the drop in 2020.

Despite the clear upturn in 2021, at the end of the year the energy need was still clearly lower than the 2005 levels (by more than 15%), and just above the minimum levels of 2014, after the pandemic had pushed them well below this threshold (more than 10 Mtep). In 2021 the demand for energy is estimated to have grown in overall terms by more than 12 Mtep compared to 2020. Of this, 40% can be assigned to the greater demand for petrol, about a third to gas, almost 20% to importing of electricity, and the rest to solid and renewable energy. In greater detail, the demand for petrol rose to a little more than 53 Mtep, 5 more than in 2020 (+10%): after a result that continued to be negative in the first quarter of the year (tending towards 8% down) and strong upturn in the 2nd quarter (+34%), petrol consumption also increased in the second half of the year, albeit it less sharply (more than 7% in the 3rd quarter, and +13% in the 4th).

However, petrol consumption in 2021 was still well below pre-covid levels (-5 Mtep), having reversed only about half the reduction recorded during 2020 2020 (-10 Mtep compared to 2019, down 17%). Before 2020 there had been a slight downturn in the demand for petrol in 2019 as well (-1% compared to the previous year), after a marked increase in 2018 and the overall marginal fluctuations over the 2015-2017 period, which followed on from the strong reductions in the 1st half of the decade.

In 2021 the demand for gas experienced significant growth (+4 Mtep sul 2020, +7%): after the positive changes in trend of the 1st quarter (+1 Mtep, +5%, mainly due to the climate) and the 2nd quarter (+2 Mtep, +21%, due to both the climate and recommencement of production activities and the production of electricity) and the fall in the 3rd quarter (-4%, due to the thermoelectric downturn, given the strong increase in imports), the 4th quarter also produced a marked increase trending at more than 8% (+1,4 Mtep, mainly due to the thermoelectric effect, but also the climate). The overall value for 2021 (more than 62 Mtep) is the highest value since 2011 and therefore marks full recovery of the demand for gas, which was 1.5 Mtep higher than in 2019 (+2,4%). In 2020, the reduction in the demand for gas exceeded 4% (-2.7 Mtep), due to both the reduced recourse to thermoelectric generation, and the lower demand for direct uses (-4%, due to the climate and industrial result). Net importation of electricity came back strongly in 2021 to stand at about 9.5 Mtep, more than 30% higher than in 2020 (when it was greatly down compared to 2019, down 15%): the decisive come back in the first nine months of the year (+3 Mtep, +66% trend) was only partly curbed by the drop in the 4th quarter, mainly due to maintenance of the nuclear power stations in France.

In terms of renewables, a marginal increase in 2021 compared to 2020 is estimated, exclusively associated with thermal renewables, whereas for RES electricity there was almost no change compared to the previous year. This followed a slight increase in 2020 (1%), following on from more decisive positive variations in 2019 (+3%) and 2018 (+10%), and the overall negative result for the three-year period prior to that. In 2021 consumption of solid fuels (that is, coal and non-renewable biomass) were estimated to be up compared to 2020 by about half a Mtep (+10%, to almost 6 Mtep), a result that came about especially in the 3rd quarter, due to greater recourse to thermoelectric sources. Despite the upturn in trend, in 2021 recourse to solid fuels was still decidedly down compared to pre-covid levels in 2019, by about 15%. In fact, for solid fuels a clear reduction was recorded compared to the previous year, exceeding 2020, in line with the fall in 2019 and faster than the 10% mean downturn over the previous three years.

The solid quota in the energy mix at the end of 2021 was less than 4% and equal to its level in 2020.

The downward trend recorded in recent years, from an average of 8.5% in the first half of the last decade to 5% in 2019 and 4% in 2020, was therefore halted, due to the phasing out of electricity generation. In this regard, one can see the possible increase in recourse to solid fuels in generating electricity, to deal with the forecast lower levels of gas imports from Russia, as a result of the Ukranian crisis.

In 2021 fossil fuel sources were estimated to come to about 122 Mtep overall, which accounts for 73% of the primary energy needs for the year. Despite the final value, consumption of fossil fuels were considerably up compared to 2020 (+10 Mtep), and in relative terms their part in the energy mix went up marginally compared to the 2020 levels (when they accounted for 72.6% of the annual need, the lowest ever), due to the strong growth in electricity imports (+33%). Compared to the quota in 2019 (about 74.3%), in 2021 recourse to fossil fuels reduced anyway, by more than 1 percentage point. From an 87.5% average for the 2000-2007 period, the fossil fuel quota dropped to 73,3% in 2014, then over the next three years, 2015-2017 it went up again to 76,4%, driven by contributing factors (climate, drop in imports and hydroelectricity to minimum levels). The subsequent reduction in 2018 (two percentage points down on 2017) therefore seems to be mainly due to overcoming the factors that previously favoured growth, as testified to by the 2019 data, which was only marginally down compared to 2018.

The upturn in the gas quota from 2015-2017, along with the substantially stable petrol trend, saw gas take over as the prime source in the Country (almost 4 Mtep higher than petrol consumption in 2017). The drop in petrol consumption in 2020 reinforced the position enjoyed by gas, which reached a level of about 37,5% higher than the petrol quota. In 2021 the divide between the sources went down once more (by about 5 percentage points), because the increase in gas consumption was less decisive than for petrol in both relative and absolute terms. Also 2021 saw the long period of constant reduction in recourse to coal halted, after having taken consumption back in 2018 to below the 10 Mtep threshold, and a more definite decline in 2019 and 2020 (to stand at less than 6 Mtep at the end of the year). As anticipated, despite the upturn in trend, the quota of solids in the energy mix (less than 4%) was lower than pre-covid levels in 2019 in 2021 as well, and was more than half the levels of just three of four years before.

The impact of renewable energy sources (RES) in the prime energy mix at the end of 2021 exceeded 21%, but it was down by more than 1 percentage point compared to the maximum levels reached in 2020 (22,8%). However, RES's quota is still about half a percentage point above the 2019 levels.

Excluding the growth in 2020 (due mainly to the drop in petrol and gas due to the reduction in activity), the 2021 result confirms a moderate growth trend for renewables, which was already seen in the previous three years, following the stalling in the 2015-2017 period (reduced hydraulicity, slowing of growth of intermittents, and increase in fossil fuels due to the economic recovery after the crisis).

4.2.7.3.2 Final energy consumption

In terms of final energy consumption in Italy, in 2020 about 103 Mtep was consumed, at levels of 31% for the use of both gas and petroleum products, 23% electrical uses, 10% final renewable consumption, and the remainder for heat, solid fuels, and non-renewable waste.

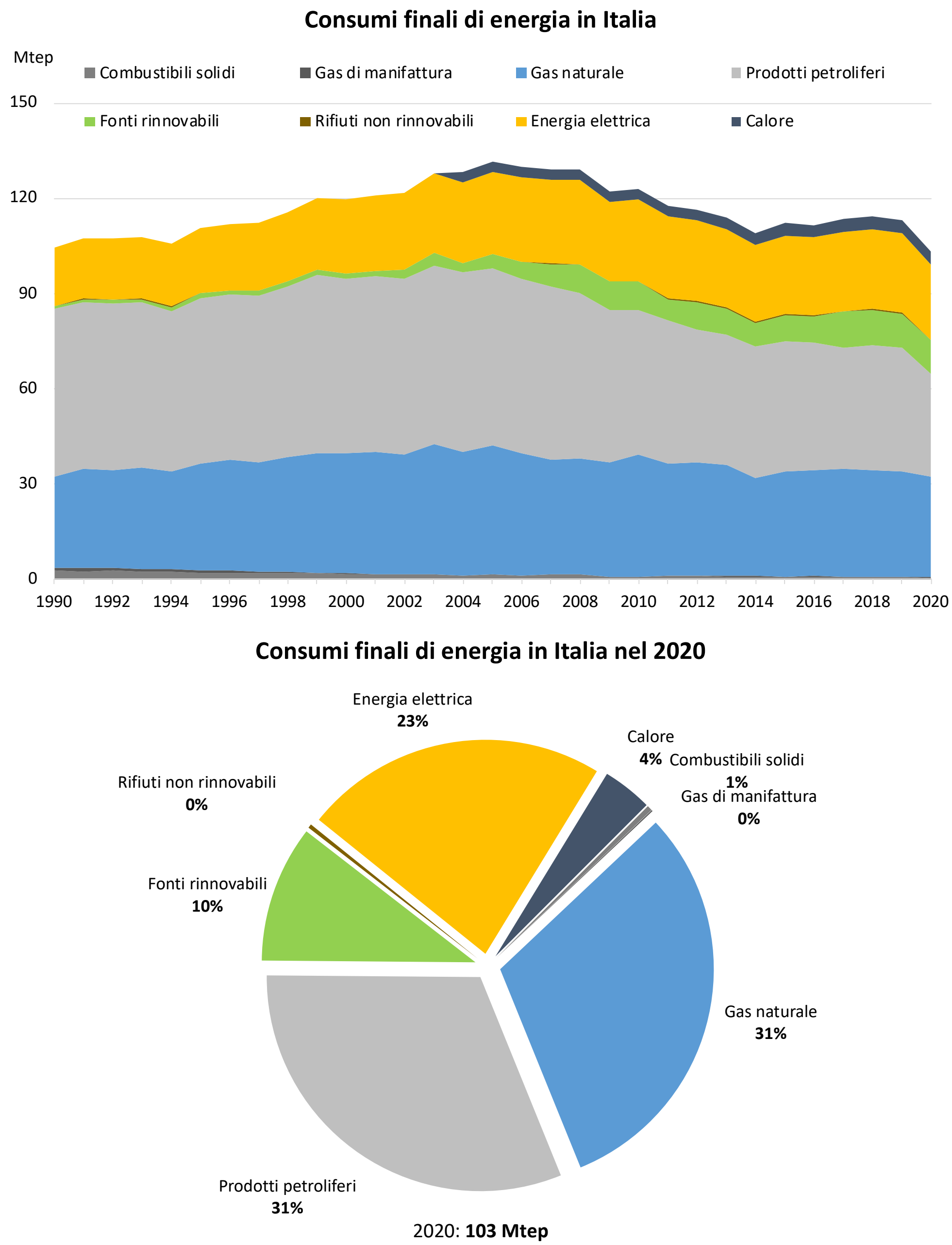


Figure 4.102 - Final energy consumption Italy by source
[Source: Sogesid processing of Eurostat data]

The table below shows the electricity consumption by sector, recorded for each Region in 2020

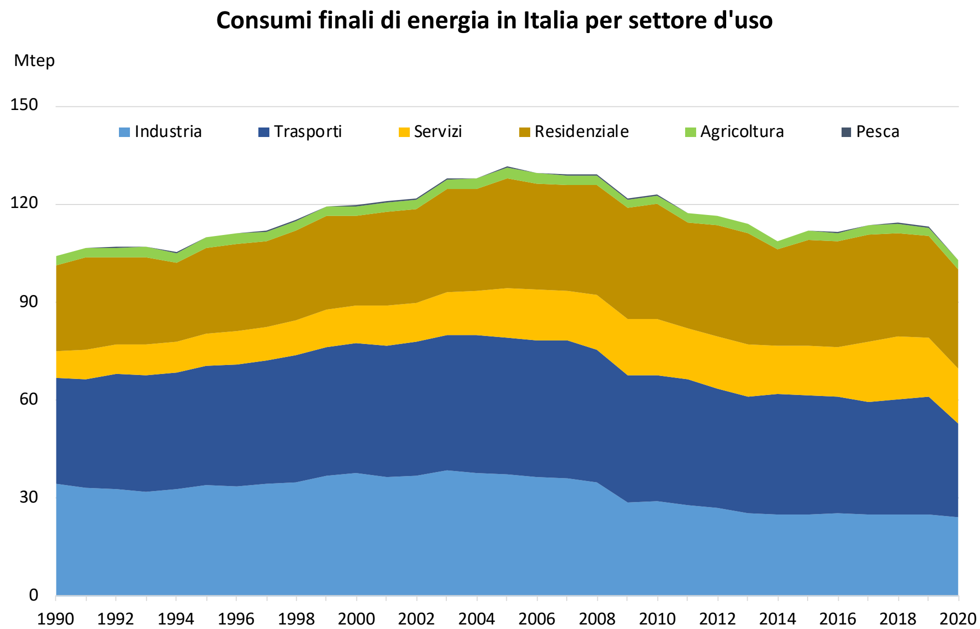
	Agriculture	Industry	Services	Domestic	Total	Consumption per inhabitant (kWh/inhab.)
Piedmont	381	11,020	6,219	4,623	22,244	5,183
Valle d'Aosta	7	416	317	161	901	7,244
Lombardy	1,006	32,438	16,898	11,457	61,798	6,190
Trentino Alto Adige	308	2,458	2,515	1,159	6,439	5,975
Veneto	811	14,893	7,807	5,644	29,155	5,992
Friuli-Venezia-Giulia	133	5811	2,212	1377	9,533	7,927
Liguria	37	1558	2,505	1700	5,799	3,825
Emilia-Romagna	796	12633	8,151	5175	26,755	6,009
Northern Italy	**3,478**	**81,226**	**46,623**	**31,296**	**162,623**	**5,911**
Tuscany	345	7,984	5,579	4,157	18,066	4,911
Umbria	137	2,636	1,243	938	4,955	5,711
Marche	136	2,808	1,967	1,567	6,478	4,302
Lazio	319	4,292	9,374	6,518	20,503	3,574
Central Italy	**938**	**17,720**	**18,164**	**13,180**	**50,001**	**4,241**
Abruzzo	137	2,808	1,719	1,318	5,982	4,642
Molise	45	672	310	281	1,308	4,386
Campania	311	4,573	5,698	5,532	16,114	2,829
Puglia	529	6,935	4,123	4,175	15,762	4,003
Basilicata	49	1,464	594	501	2,609	4,740
Calabria	139	781	1,938	2,036	4,893	2,597
Sicily	455	5,613	4,805	5,666	16,540	3,407
Sardinia	232	3,626	1,900	2,226	7,983	4,975
Southern Italy and Islands	**1,895**	**26,472**	**21,088**	**21,736**	**71,191**	**3,539**
ITALY	**6,311**	**125,417**	**85,875**	**66,212**	**283,815**	**4,777**

Table 4.41 - Electricity consumption by Region and by Sector (GWh) and by inhabitant (kWh/inhab.) in 2020 [Source: Terna]

In terms of consumption sectors, in 2020 the highest consumption recorded was in the residential sector, also due to the effects of the measures to contain the pandemic.

In fact, in 2020 the residential sector accounted for almost 30% of final consumption in Italy, followed by the transport sector at about 28% of all consumption, industry (23%), and services (16%).

Agriculture (3%) and especially fishing (0.2%) stayed at more marginal levels in terms of final energy consumption. In addition, in 2020 the shipping sector weighed in at about 0.5% of the final overall energy consumption recorded in Italy.



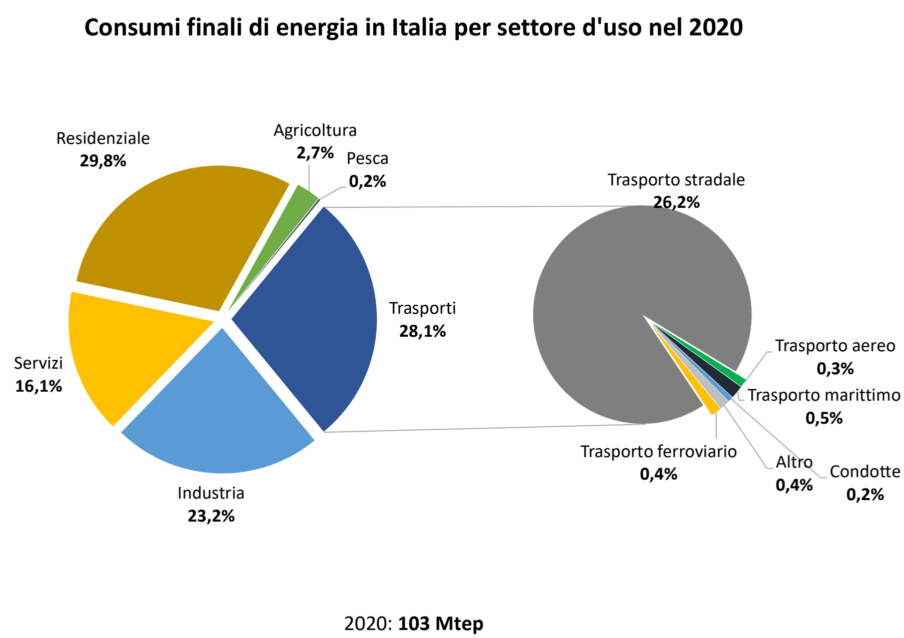


Figure 4.103 - Final energy consumption Italy by sector
[Source: Sogesid processing of Eurostat data]

According to the latest estimates, in 2021 final energy consumption in Italy stood at about 10 Mtep more than the 2020 levels (+9%). More than half this result occurred in the 2nd quarter, during which the demand for energy on the part of the final use sectors was more than 5 Mtep higher that in the same period in 2020 (about +25%), when unprecedented drops in trends were recorded due to limitations on production activities and movement. For the 3rd and 4th quarters a decisive upturn in consumption trends (about +7%) is estimated, even though this is lower than the spring period.

The growth trend for final consumption is slightly higher than that for primary energy consumption, since the upturn in gas and petrol consumption (+10% overall) went ahead almost twice as much as the demand for electricity (+5.6%).

At least half the increase in consumption was due to the upturn in petroleum products for transport, up by more than 5 Mtep compared to 2020 levels (+12%), when it went down by about 18% due to the dramatic collapse of land and air vehicular transport. Despite the clearly positive change in trend, petrol consumption in 2021 remained below pre-Covid levels (by 4 Mtep, down 8%),despite recovering almost half the 10 Mtep "lost" in 2020.

More than 60% of the upturn in petrol consumption in 2021 was concentrated in the 2nd quarter, which can be compared to spring 2020 affected by the first lockdown to contain the pandemic (+38% compared to the 2nd quarter of 2020), while decisive positive variations were also recorded in the summer months (+8%) and autumn (+13% compared to the 4th quarter of 2020, once again affected by a wave of the pandemic).

After the reduction in 2020 (down 3.5% on 2019), natural gas consumption for direct uses was also clearly up by about 2,7 Mtep compared to 2020 (almost +8%), due to both climatic factors and recommencement of production activities. Positive variations in trend were recorded for all four quarters, from +6% for the first three months, to +26" in the 2nd quarter, as well as in the second half of the year in which the data indicates an upturn in demand for gas of about 3%. Unlike petroleum products, the demand for gas in 2021 went back above pre-Covid levels, by more than 1 Mtep compared to 2019 (+4%).

After a strong decline in 2020 (down 5% on 2019), the demand for mains electricity clearly grew, +5% compared to 2020, mainly driven by the industrial sector. The positive result for the first quarter (+2% trend) was followed by +14% in the 2nd quarter, and about +4% in the third and fourth quarters.

The upturn in trend for energy consumption in 2021 came about after the drop in 2020 (-10% on 2019), while the overall demand for energy at the end of the year remained below pre-Covid levels anyhow (-2%). The data shows how the 2020 collapse was recorded after the marginal downturn in 2019.

After the constant downward trend that started before the economic crisis (albeit at a decidedly slower tempo than recorded during the crisis years) to a minimum in 2014 (120 Mtep, -18% compared to 2005), final energy consumption after the 2015-2018 four-year period returned to a moderately upward trend. With the recommencement of production and movements in 2021, final consumption levels returned to above the minimum levels of 2014 (+3-4%), after the pandemic had brought them sharply below that threshold in 2020 (about 6 Mtep lower), and to the same levels as the demand at the end of the 1980s.

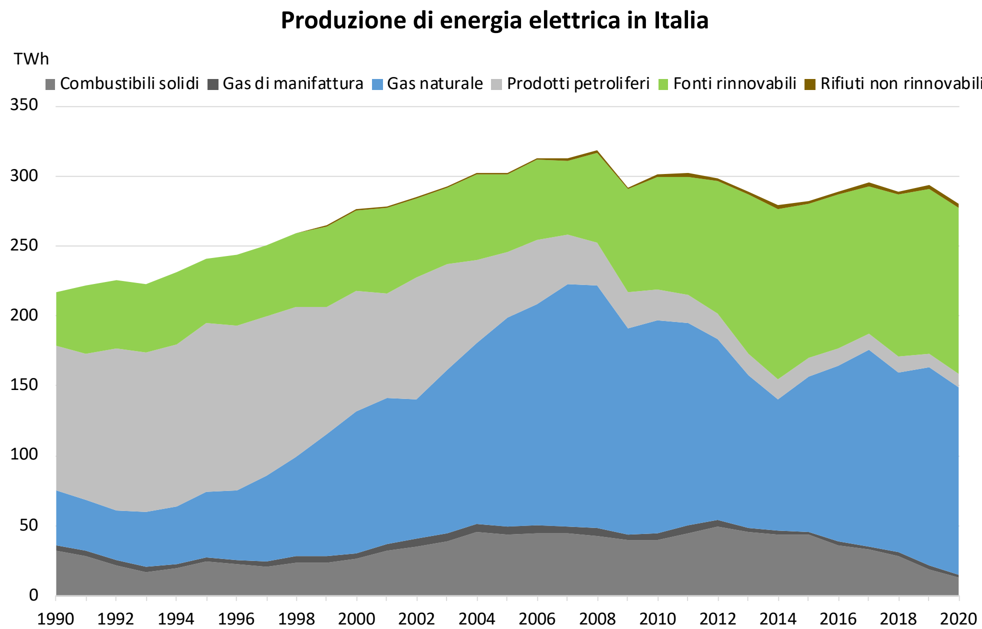
In terms of contributions by sector, about half the upturn in demand for energy in 2021 is due to the upturn in transport consumption, which was mainly responsible for the drop in 2020 (about 70% of the overall annual reduction compared to 2019). After a decisive fall to the minimum levels of 2013 (-14% compared to 2005) the transport sector evolved along a moderately upward trajectory up to 2019. After the collapse in 2020 that suddenly took consumption in this sector to about -30% compared to 2005 levels (in 2019 the gap was smaller than 10%), the partial recovery in 2021 almost halved that variation.

The industrial sector also contributed about one fifth to the overall upturn in consumption compared to 2020, after it had been responsible for about 15% of the drop in 2020. After the decisive contraction in trend during the years of the economic crisis (-4% annual mean between 2008 and 2015), and the marginal variations between 2016 and 2018, in 2019 the sectorial energy demand was estimated to be falling, in line with the slowdown in industrial production. After the health emergency had taken energy consumption for the sector below about 15 Mtep at the end of 2020, compared to the maximum levels in 2005 (-38%), the 2021 upturn brought consumption to the pre-Covid levels of 2019 (-33% compared to 2005).

Finally, the civil sector also made a contribution to the increase in consumption in 2021 (about a quarter), which cannot be overlooked, both due to the upturn in the services sector and the climate, both factors that had an impact on the 2020 drop. Unlike the industry and transport sectors, consumption in this sector followed a substantially constant trend, reaching just about the 2005 levels at the end of 2021.

4.2.7.3.3 Electricity generation

In 2020 about 280 Twh of electricity was produced in Italy. Of this, 48% involved the use of natural gas, and 42% was from renewable sources.



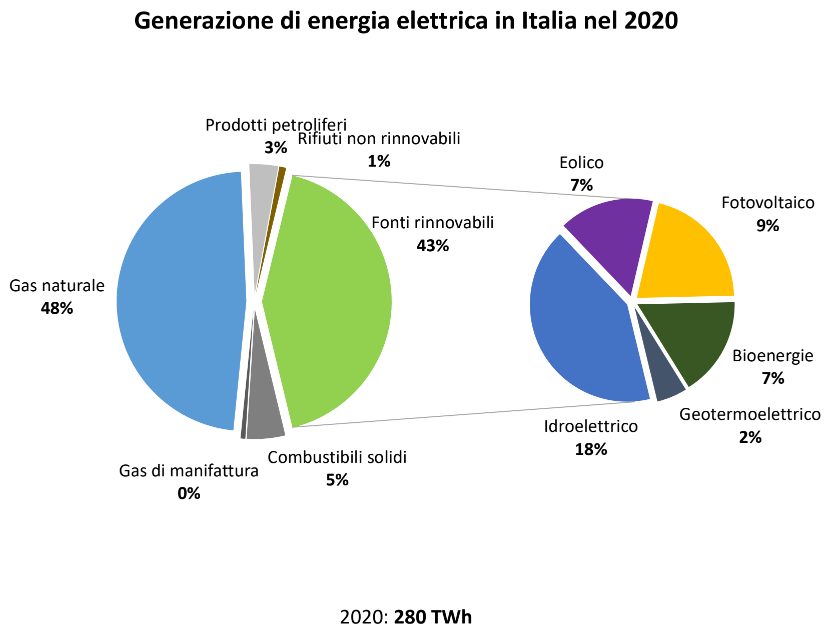


Figure 4.104 - Gross electricity generation in Italy [Source: Sogesid processing of Eurostat Terna data]

At a regional level, details of the electricity generation plants are indicated in the table below.

	Hydroelectric	Thermoelectric	Wind	Photovoltaic	Total
Piedmont	3.854	4,959	19	1,714	10,545
Valle d'Aosta	1,023	14	3	25	1065
Lombardy	6175	11546	0	2527	20247
Trentino Alto Adige	3395	323	0	454	4172
Veneto	1185	3300	13	2080	6577
Friuli-Venezia-Giulia	522	1717	..	561	2800
Liguria	92	1458	66	119	1734
Emilia-Romagna	685	6493	45	2170	9393
Northern Italy	**16930**	**29808**	**146**	**9650**	**56534**
Tuscany	376	3175	143	867	4561
Umbria	530	574	2	499	1605
Marche	251	511	20	1118	1900
Lazio	411	5838	71	1416	7737
Central Italy	**1568**	**10098**	**236**	**3900**	**15802**
Abruzzo	1023	1503	270	755	3550
Molise	88	1113	376	178	1755
Campania	1348	2419	1743	878	6387
Puglia	4	7832	2643	2900	13379
Basilicata	134	210	1293	378	2016
Calabria	788	3752	1187	552	6280
Sicily	732	5661	1925	1487	9805
Sardinia	466	2386	1088	974	4914
Southern Italy and Islands	**4583**	**24876**	**10525**	**8101**	**48085**
ITALY	**23081**	**64783**	**10907**	**21650**	**120421**

Table 4.42 - Gross installed efficient power in electricity generating plants by Region in 2020 [Source: Terna]

Based on the latest data, electricity production countrywide in 2021 stood at 278 TWh. The increase in production in 2021 almost all took place in the 4th quarter, during which nationwide production exceeded the levels for the same period in 2020 by almost 6 TWh (+9%), because net imports took a decided downturn (-3 TWh compared to the 4th quarter of 2020, -25%), after the clearly positive result for the previous nine months. In the first nine months of 2021, production nationwide remained at the same levels as the previous years in overall terms. The production of electricity in 2021 is still below the pre-Covid levels in 2019 (about 2%): in 2020 the drop was more than 12 TWh. The primary sources used for generating electricity were up overall in 2021 by about 1 Mtep. After the sharp drop in 2020 (5% down on 2019), gas consumption for thermoelectric production was up compared to the previous year by more than 1.2 Mtep (+6%), going back to the pre-Covid 2019 levels. Especially in the 4th quarter, recourse to natural gas went up by almost 1 Mtep compared to the same period the previous year (+17% due to the drop in imported electricity and hydro), after growth in the first semester (+16% in the 2nd quarter alone), was downsized by the downturn in the 3rd quarter (-8%).

In terms of renewables, a negligible overall variation is estimated, compared to the previous year's levels. The modest upward trend of the first nine months of the year (about +1%) was offset by the negative result for the 4th quarter (-3%), due to the drop in hydroelectricity (-22%).

Generation using solid fuels was also up by 10% in 2021 compared to 2020, even though it is still below pre-Covid 2019 levels by almost one fifth. The 2021 result came about in the 3rd and 4th quarters of the year, for which a trend increase is estimated at above 15% on average, after the overall marginal variation in the 1st semester. Generating electricity using petroleum products is moving decisively downwards (about half 2020 levels), and is now producing marginal values, even more strongly that the drops in 2020 (more than 10% down compared to 2019).

In 2021 RES electricity production stood at about 116 TWh, which is practically the same as 2020.

The overall positive result of the first nine months of the year (+1% trend) was offset by the figures for the 4th quarter, when RES production stood at about 25,5 TWh, which is 4% down on the same quarter in 2020 (-1 TWh). The lower production in autumn is due to the negative hydroelectricity result of about 9 TWh, which was 20% less than the period in 2020. Also for the whole of 2021, hydroelectricity production of about 46 TWh was lower than the levels the previous year by about 2,6 TWh (-5,4%).

The hydroelectric downturn therefore rendered the increase in intermittent producers vain, which in 2021 exceeded 45 TWh, 2,5 TWh more than 2020 (+6%). Particular growth in intermittent sources is to be found in the positive result for wind, up by more than 10% compared to 2020 (+2 TWh), when production stopped at 18,5 TWh (-7% on 2019). Solar production was more modest in 2021, steady at 25 TWh, just 0,5 TWh more than 2020 (+2%), when it grew by more than 2 TWh compared to the previous year (+11%), in line with 2019 data (+10% compared to 2018).

During 2020 RES recorded an upward trend of about 1% compared to 2019, due to the positive hydroelectric result at the time (+1,3 TWh), while the contribution of intermittent sources is negligible in overall terms. After the early years of the decade saw a sharp rise, from 2014 on there was a great slowdown in the quota of RES electricity production in terms of electricity consumption. After the decided growth in 2020 (due more to the drop in demand than an actual increase in RES production), at the end of 2021 the SE

In terms of installed power of electricity generating plants, currently plants powered by renewable sources have reached about 57 GW power rating, while thermoelectric plants using fossil fuels have been stable for a few years at about 60 GW. Of the renewable source plants, after strong sustained growth in recent years, photovoltaic plants are the most widespread, in terms of both number (more than 930,000 plants in 2020) and installed power, standing at almost 22 GW. Excluding pumping, hydroelectricity is still the second renewable source in terms of installed power, which is rather stable at around 19 GW. Wind, which is growing constantly, has exceeded 10 GW, while for some years bioenergy has been stable at around 4 GW. Finally, overall geothermoelectricity is marginal and stable at a little over 800 MW.

It is worth noting that to date the only off-shore wind plant authorised and under construction, is located near to the port of Taranto, with an overall power of about 30 MW.

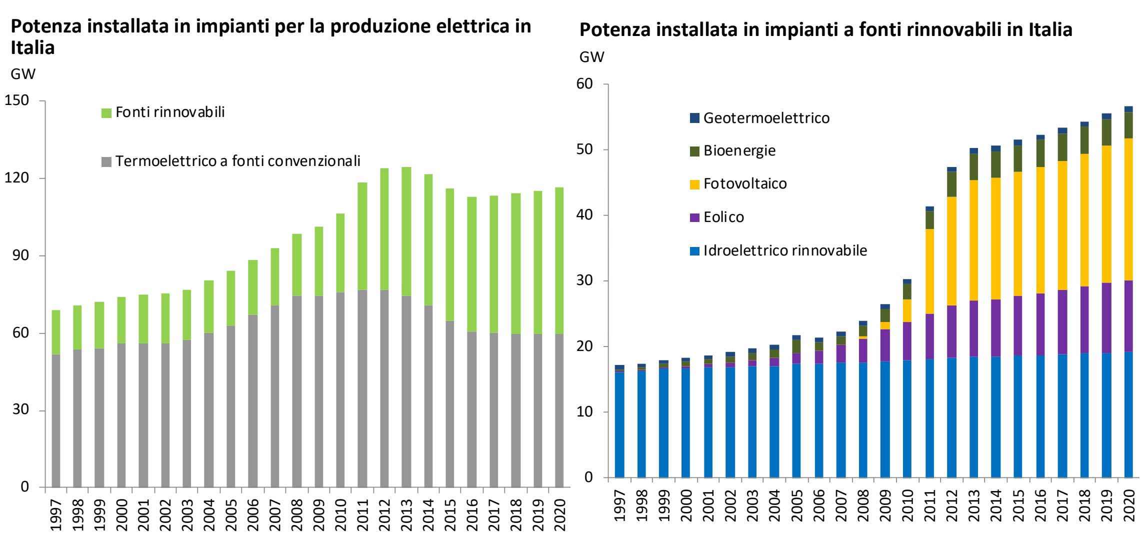


Figure 4.105 - Evolution of installed power for electricity generating plants in Italy [Source: Sogesid processing of Terna data]

4.2.8 Human health and socio-economic aspects

4.2.8.1 Food safety: fishing-related aspects

The quality of the environment and food products is one of the main aspects responsible for the health and wellbeing of the human population. Fishing and aquaculture are an important source of food with high value in terms of nutrition, income, and employment. The awareness of the importance of including ichthyic products in a varied nutritional regime has increased in recent decades in Italy and in Europe.

In studying the complex relationships between food and health, international scientific companies place ichthyic products among the functional food types that promote wellbeing and reduce the risk of illnesses arising. This is also because ichthyic products have nutritional profiles of particular value. On the other hand, pollutants in ichthyic products can pose a human health risk. While its chemical composition makes the ichthyic products peculiar compared to other protein foods, at the same time there are risks connected with consuming ichthyic products, in the form of biological contaminants (bacteria, viruses, algae toxins for bivalve molluscs, parasites, etc.), or chemicals (heavy metals, mercury, lead, cadmium, polychlorobyphenyls, PCB, dioxin, etc.). The presence of harmful substances is mainly due to the influence of the aquatic environment. The degree of contamination also depends on the age of the animal, its type of food, the species' lipid content (e.g. dioxin and PCB build up in the fats).

Food safety for all products including ichthyic products, is still one of the priority objectives of European Community policies. With the issuing of the “Hygiene Package”, a range of four regulations (reg. (CE) 852/2004, reg. (CE) 853/2004, reg. (CE) 854/2004, and reg. (CE) 882/2004), the European Commission updated and reorganised the fragmented, diversified community norms on food hygiene matters, in order to ensure an overall and integrated approach when it comes to food safety, based on risk analysis. As indicated in the preceding paragraphs, the concentration of contaminants in ichthyic products intended for human consumption (D9) is estimated taking into account the provisions of Directive 2008/56/CE (implemented in Italy by D.Lgs. 190/10), or the threshold values laid down by Regulation 1881/2006 and s.m.i. The main environmental milestone for descriptor 9, by means of specific action and monitoring programmes, consists of diminishing the concentration of contaminants in samples of fishing products from national waters, that do not conform to the limits laid down by current legislation (Reg. 1881/2006 and s.m.i.).

The MSP and environmental report on *Sustainable Development Goals, SDGs* n° 3 “Health and wellbeing” of the 2030 Agenda, deal with the question of human health in various paragraphs, such as in the case of the environmental quality of the body of water, and possible negative repercussions for human health as well. As regards the coastal marine environment, and especially swimming waters, we have already pointed out the criticality represented ever more frequently of blooms from the *Ostreopsis ovata* micro-alga. Another problem dealt with briefly before is the increase in the quantities of fuels for maritime use, with a high sulphur content, that are produced and imported.

As has been highlighted above, the risk of SOx pollution posed by these fuels is high. However, these substances are mainly released far from land, and so they are less visible and have less impact on human health. As stated before, the risks to human health associated with consuming ichthyic products relate mainly to the heavy metal content in fish and biological contamination in bivalve molluscs. Specifically, there are three types dangers that the consumer can face when consuming ichthyic products:

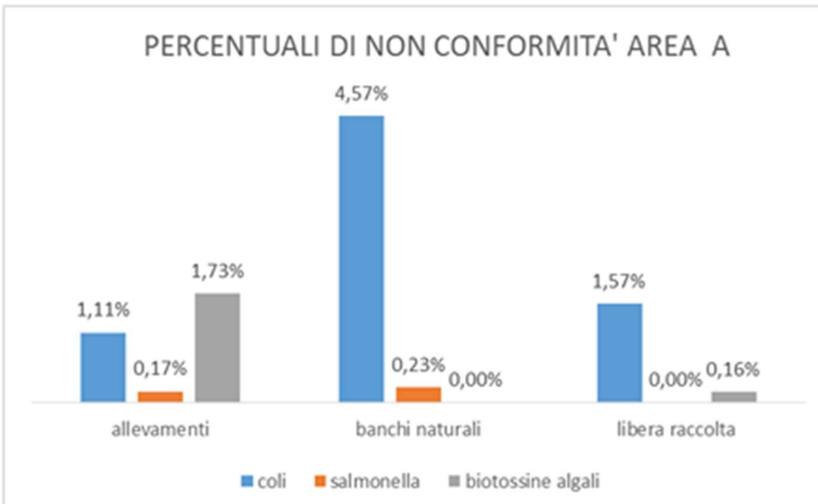
- Biological (especially viruses, bacteria, and parasites).
- Chemical (mainly environmental pollutants).
- Physical (presence of foreign bodies in the ichthyic product, such as fragments of plastic).

The data below covers all the maritime areas, as it is not available by individual areas or sub-areas. As can be seen from the Annual Report to the PNI 2019 of the Health Ministry, in 2019 there were 7,119 checks carried out on bivalve molluscs, 3% of which did not conform due to the presence of *Escherichia coli*, in 0.3% of the cases Salmonella was present, and in 0.4% of the cases algae toxins were present. Most of the non conformities were found in natural managed banks, whereas the lowest number (with the exception of the algae mycotoxins) in hatcheries.

Tab. 4.43 Live bivalve molluscs - production and checks: checks done and non conformities in the type A zones (2019)
Source: Annual Report to the PNI 2019 - Health Ministry

	Controlli effettuati	Non conformità *Coli*	Non conformità' *Salmonella*	Non conformità biotossine algali	% non conformità *Coli*	% non conformità *Salmonella*	% non conformità biotossine algali
ALLEVAMENTI	2.891	32	5	50	1,11%	0,17%	1,73%
BANCHI NATURALI GESTITI	1.707	78	4	0	4,57%	0,23%	0,00%
LIBERA RACCOLTA	637	10	0	1	1,57%	0,00%	0,16%

Fig.4.106 Live bivalve molluscs – percentages of non conformities in type A zones (2019)
Source: Annual Report to the PNI 2019 - Health Ministry



In the 680 checks carried out on ichthyic hatcheries in 2017, no irregularities were found for the presence of forbidden anabolic substances or residue from medicines or other contaminants.

In 2019 there were 7,119 checks carried out on bivalve molluscs, 3% of which did not conform due to the presence of Escherichia coli, in 0.3% of the cases Salmonella was present, and in 0,4% of the cases algae toxins were present. Most of the non conformities were found in natural managed banks, whereas the lowest number (with the exception of the algae mycotoxins) in hatcheries (Health Ministry 2019). As stated in paragraph 4.2.1.9, as regards metals, organochlorines and APH, the fish samples produced did not show any exceeding of the threshold values, which showed an improvement in quality compared to the past (ISPRA 2018).

As regards nano-plastic pollution, a report was published in June 2016 by a group of EFSA scientific experts in contaminants in the food chain (CONTAM), on the presence of microplastic and nanoplastic particles in food, especially in relation to ichthyic products.

The CONTAM reviewed the scientific literature currently available on this matter, and assessed the risk of man being exposed by consuming contaminated foods.

EFSA defines particles between 0,1 and 5,000 micrometres (μm) in size, which corresponds to 5 millimetres, as microplastic, and particles between 0,001 and 0,1 μm (that is, 1 to 100 nanometres) as nanoplastic. These can be in the form of pellets, flakes, fibres, spheroids, and grains. They represent an emerging problem, especially in the marine environment.

At a marine level, microplastics have been found in a large variety of zooplanktonic organisms, and also at higher trophic levels in both invertebrates and vertebrates, exposed directly or via lower trophic levels. It has been estimated that the total quantity of secondary emission of microplastic into the marine environment stands at 68,500 to 275,000 tonnes per year (EU, 2016). EFSA highlighted the current state of a great lack of useful information for a complete risk assessment. Extremely little data is currently available in concentrations, toxicity, and toxicokinetics, dealing exclusively with microplastics, while the scientific community does not have information available yet relating to nanoplastics. Of the foods for which information is available in terms of concentrations, there are some ichthyic products including fish, shrimps, and bivalve molluscs.

In ichthyic products the highest concentration of microplastics is found in the gastrointestinal tract. In fish the average number of particles found is between 1 and 7, in shrimps an average of 0.75 particles / g was found, whereas in bivalve molluscs the average number of particles is 0.2-4/g.

Since in most cases the stomach and intestine of fish are fish are eliminated, the risk of exposure of man to microplastics as a result of consuming fish, is low.

On the other hand, the risk may be greater for bivalve molluscs, as they are consumed whole. It is also known that only microplastic smaller than 150 µm can pass through the intestinal epithelial cells, giving rise to systemic exposure, even if absorption is limited anyway ($\leq$0.3%). Another risk posed by the microplastics relates to the capacity of these compounds to accumulate pollutants such as polychlorobiphenyls (PCB) and aromatic polycyclic hydrocarbons (APH), or residue of compounds used in packaging like bisphenol A (BPA). Concentrations of up to 2,750 ng/g of PCB and 24,000 ng/g of APH have been found in microplastics deposited on beaches. It has also been documented that plastic debris can act as a substrate for the development of various microbic populations. It has been calculated the a 225 g portion of mussels could, at the maximum levels, contain 7 micrograms and microplastic. Based on the estimate above and taking the worst case, a portion of mussels would increase the level of exposure to PCB and APH by less than 0.01% and to bisphenol A by less than 2%. In Conclusion, EFSA recommends further implementation and standardisation of analytical methods for detecting micro and nano plastics, in order to evaluate their presence and quantify the levels at which they are present in foods. Further studies are also necessary, in order to find out more about the toxicokinetics and toxicity of these compounds, both in marine organisms and in man.

4.2.8.2 Socio-economic aspects associated with fishing and aquaculture

The sea economy includes all the types of production in which companies and people work, with the production process based on the "sea" resource. This means transporting cargo and passengers via waterways, the ichthyic chain (which includes fishing and aquaculture), coastal tourism, shipyards, water sports and recreation activities, the sea-derived energy industry, research activities, regulation and environmental safeguarding of the waters.

These activities do not only involve companies located on the coast, but also those who work in order parts of the Country, but that are functionally part of these sectors. In 2017 the European Commission identified the Blue Economy as "*A well-managed, sustainable marine and maritime economy that aims to reconcile sustainable economic growth associated with the sea with the best means of subsistence and social fairness for current and future generations, and reinforcing of transparent food systems that are reliable and safer, based on conservation of the marine ecosystems and biodiversity, and on sustainable use of the resources*". Promoting sustainable growth of maritime economies is one of the priority goals of the PSM and MSFD Directives. This context is part of that for sustainable development, dealt with in the "2030 Sustainable Development Agenda" of the United Nations (2015) and in the 17 Sustainable Development Goals - SDGs to be attained by 2030, in line with the principles and objectives of the National Sustainable Development Strategy. It is also connected to the environmental and socio-economic strategies contained in the European New Green Deal, the National Strategy for Biodiversity, and the Blue Economy policies.

The National Sustainable Development Strategy (SNSvS), approved by Decision 108/2017, outlines a vision of the future and development, centred on sustainability as the shared and essential value, for tackling our Country's global challenges. It constitutes a key element in implementing the durable growth policy in Italy, starting with positioning in relation to the United Nations' SDGs, of which it takes the 4 guiding principles as its own: integration, universality, inclusion, and transformation.

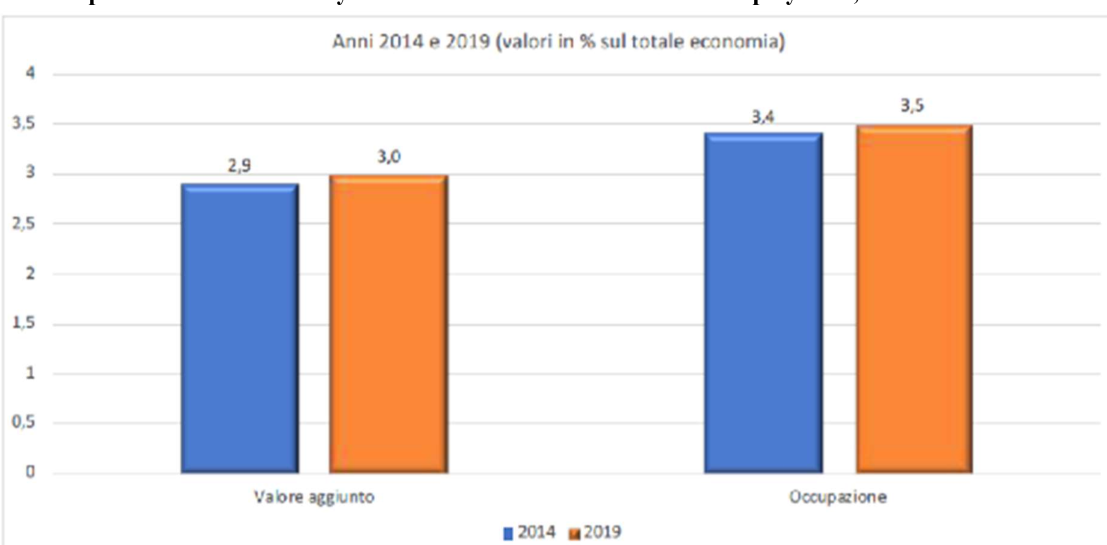
The SNSvS is broken down into five areas that correspond to the "5P" of sustainable development, proposed by the 2030 Agenda: people, planet, prosperity, peace, and partnership. These are added to by a sixth area dedicated to the so-called sustainability vectors, to be seen as essential elements for attaining the National strategic goals. Each area contains Strategic Choice and Strategic Goals for Italy, correlated with the Agenda 2030 SDGs. The Programme will play a role in contributing to some of the Strategy's objectives, in line with the financial dimension and resources that will be assigned to the tasks directly correlated with the objectives they will affect (see diagram below).

The Primary objective is to improve the socio-economic wellbeing conditions that characterise our Country, while the individual objectives are:

- To reduce poverty, inequality, discrimination, and unemployment (especially among females and the youth).
- To ensure environmental sustainability.
- To regain trust in the institutions.
- To increase opportunities for professional growth, study, and training.
- To restore competitiveness to Countries, by means of a fourth industrial revolution based on innovative, sustainable technologies.

Italy accounts for 6% of the European Coastline, and the Italian coasts are in 7 of the 30 Geographical Sub-Areas (GSA) into which the General Fishing Commission for the Mediterranean (GFCM) has sub-divided the Mediterranean Sea. The GSA were set up to allow geographical referencing of fishing monitoring data and the evaluation of ichthyic resources, but they have also become functional for drawing up plans to manage fishing that revolve around the characteristics of the seas. According to the latest Report on the Sea Economy published by the Latina Chamber of Commerce with UnionCamere, with the technical-scientific contribution of Si.camera (2021), in 2019 the sea economy generated added value of € 47.4 billion, equal to 3% of the national GDP, and gave work to 893,600 people, equal to 3.5% of those employed in the country. Both of these indicators went up by 0.1% between 2014 and 2019.

Graph. 4.1 The sea economy's contribution to added value and employment, of the total for the economy



Categoria DPSIR: non pertinente
Fonte: Unioncamere-Si.Camera

Tab. 4.44 Sea economy added value and employment by sector (year 2019)

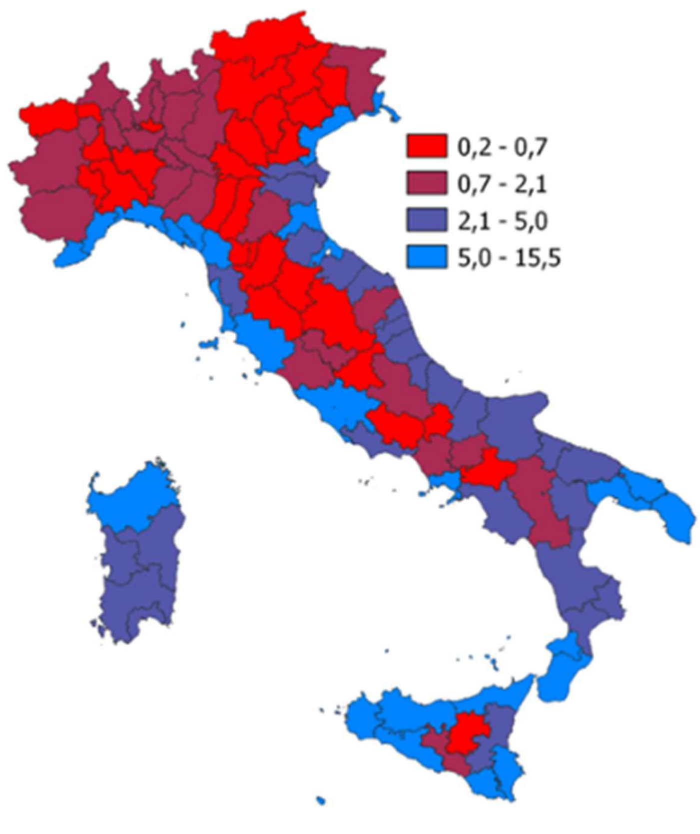
Settori economici	Valore aggiunto		Occupati	
	M€	%	N° (migliaia)	%
Filiera ittica	3.397,00	7,2%	103,40	11,6%
Turismo (Servizi di alloggio e ristorazione)	14.746,60	31,1%	342,10	38,3%
Industria delle estrazioni marine	2.584,20	5,4%	6,20	0,7%
Cantieristica navale	7.406,00	15,6%	137,20	15,4%
Trasporti via mare	8.307,40	17,5%	103,60	11,6%
Ricerca regolamentazione e tutela ambientale	8.250,00	17,4%	128,10	14,3%
Attività sportive e ricreative	2.732,80	5,8%	73,00	8,2%
TOTALE	**47.424,00**	***100,0%***	**893,60**	***100,0%***

Categoria DPSIR: non pertinente
Fonte: Unioncamere-Si.Camera

The most important sector in terms of added value and employment is tourism, while mining and recreational activities are the most marginal sectors. The ichthyic chain, which includes fishing and aquaculture, generates more than 7% of the added value, and employs almost 12% of the people.

At a territorial level, the sea economy's contribution to the provincial GDP is particularly significant in Liguria, Southern Tuscany, Sicily (especially Trapani and Messina), the Rimini Province, Veneto and the Province of Trieste, where it reaches its highest value of 15.4%. This sector is characterised by a positive evolutionary dynamic. In 2019 there were 208,606 companies in business, and the number increased by 14.7% in 2014-2019, compared to an overall growth in the number of companies in Italy over the same period of 0.6%. The level of sea economy companies nationwide stands at 3%, but approaches 12% in Liguria, and stands at between 4.5 and 5.6% in Sardinia, Friuli-Venezia-Giulia, Lazio, and Sicily.

Graph. 4.2 Quota in % of the sea economy's added value compared to the province's total economy Year 2019 Percentage values



Source: Unioncamere-Si.Camera

Tab.4.45 Sea economy companies by sector (year 2019)

Settori economici	Numero	Di cui nei Comuni costieri	Quota nell'economia del mare
Filiera ittica	33.178	72,11%	15,90%
Turismo (Servizi di alloggio e ristorazione)	95.933	99,99%	45,99%
Industria delle estrazioni marine	471	94,69%	0,23%
Cantieristica navale	27.342	61,57%	13,11%
Trasporti via mare	11.750	91,98%	5,63%
Ricerca regolamentazione e tutela ambientale	8.601	51,77%	4,12%
Attività sportive e ricreative	31.332	100,00%	15,02%
TOTALE	**208.607**	**88,07%**	**100,00%**

Categoria DPSIR: non pertinente
Fonte: Unioncamere-Si.Camera

Most of the companies work in the tourism sector, followed by the ichthyic sector, and sporting and recreation activities. In total, these companies account for almost 77% of companies, but only generate 44% of the added value. Clearly this sector is characterised by extensive fragmentation of activity.

Almost 90% of the activities are based in coastal municipalities, but this quota drops significantly in the research sector (almost half), shipbuilding (a little over 60%), and the ichthyic chain (a little over 70%). The dynamism of this sector is shown by the presence of numerous companies managed by young people (in 2019: 9,3% of all companies in the sea economy). One should also note that between 2014 and 2020 companies run by young people in the sea economy remained substantially steady.

However, substantial differences are found in the various segments: companies run by youth are more numerous in tourism and the ichthyic chain, whereas there are few of them in research, environmental regulation and protection, and the transport segment. Italy plays its part in the effort to contain the impact of fishing on fishery resources and the marine ecosystems, pursued by the EU, acting in reducing the number of fishing vessels and engaging in fishing. The trend in reducing the number of boats, engine power used, and tonnage of fishing vessels went on, albeit slowly, in 2018 as well. In recent years the reduction in volume of catches landed has reduced, after have gone at a good pace up to the early 2000s.

In this situation the number of people employed in the sector continues to decline slowly and inexorably, showing signs of ageing that seem to be in line with ageing of the population.

Finally, one must record that the system of regulating fishing is going along its course, providing operators with an ever more certain situation in which they work. Despite the slowdown recorded in 2019 (and early 2020, in which case also due to the Covid pandemic), the Coast Guard's activity of controlling fishing continues.

Production by Italy aquaculture sector remains stable, while one would hope for growth to reduce dependence on importation of ichthyic products, and limit pressure applied by fishing on the ichthyic stock.

The goal aimed for in Italy for 2025 in terms of growth and development of the sector seems to be unattainable, given the unchanging number of plants and substantially stable production trend.

Employment in the sector follows a positive trend in the leading segment (mussel farming), but is negative when it comes to fresh water production.

The impacts associated with emitting nitrogen, phosphorus, and antibiotic substances into the environment are marginal compared to those generated by other zootechnic production processes, but must be given particular attention as the pollutants are put directly into the bodies of water. In this regard defining areas in which sea farming and systems for filtering and decanting waters downstream of the fresh water plants, are of crucial importance.

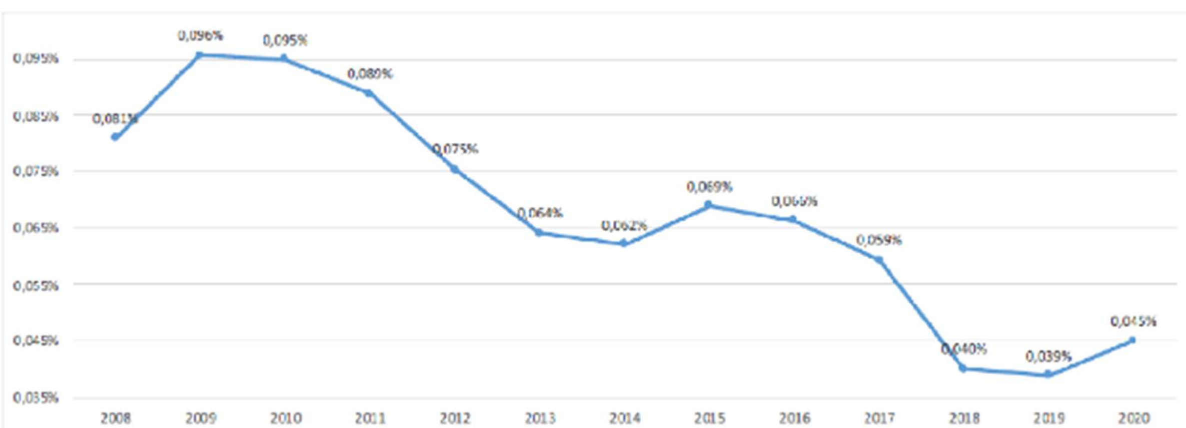
Finally, it is important to point out that many aquaculture companies provide environmental services by maintaining some brackish water environments (e.g. valleys), or by guaranteeing the run-off of spring waters. Consumption of ichthyic products in Italy continues to grow and, to meet the demand, ever greater quantities are imported. In terms of the value chain, small artisanal fishing offers the best results. The consumption of hatchery products is concentrated within some species, salmon, trout and mussels, which are available on the market almost exclusively in the form of imported products.

Only the latter two are produced in significant quantities in Italy. The added value generated by fishing and aquaculture accounts for a marginal quota of the national GDP, and has been stable in terms of value and quota of the national total since 2013. In 2020, fishing and aquaculture contributed € 843 billion to the Italian GDP, which relates to a percentage quota of 0,045%. The sector's contribution to the national GDP reduced constantly from 2010 to 2020 in terms of both absolute value and percentage.

Graph. 4.3 Fishing / aquaculture sector value (millions of Euro, years 2008-2020)

Categoria DPSIR: D
Fonte: ISTAT, Conti Territoriali

Graph. 4.4 Fishing / aquaculture contribution to the total GDP (%, years 2008-2020)



Categoria DPSIR: D
Fonte: ISTAT, Conti Territoriali

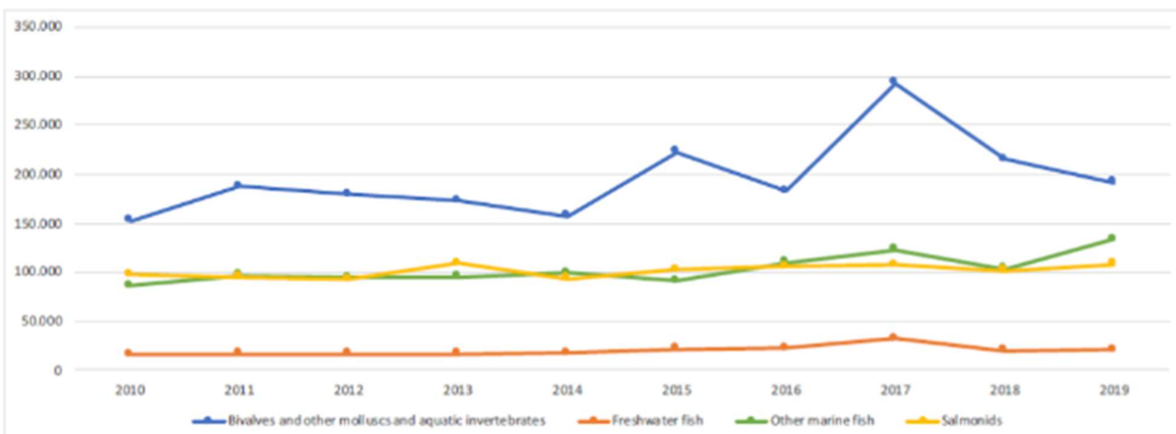
In 2016 the value generated by small artisanal fishing reached 24% of the total for the sector, compared to 14% of the volume landed. This quota has remained relatively stable in recent years of observation, but reached a peak of 27% in 2011, coinciding with the peak in the catching quota.

The factors that make it possible to achieve this result are the types of target species for small fishing, and the different capacity to valorise the products. In terms of aquaculture, production levels and value generated stayed essentially stable in recent years (2010-2020). In terms of the value of the main produces, in 2014 and 2017 there was an increase for bivalve molluscs, which must be associated with a general price increase (EUMOFA data - https://www.eumofa.eu/data).

However, this data seems anomalous both in terms of its dimensions (+90%), and because ITTICO (https://ittico.bmti.it/), the ichthyic products market's website, does not indicate market trends in its periodic bulletins (weekly, with summaries quarterly and annually), for mussels and clams, that is, the main molluscs farmed, or such significant price changes, even associated with seasonal production trends.

Therefore, the value of aquaculture production can also be taken as being essentially stable over time.

Graph. 4.5 Trend in the value of the main aquaculture products (million Euro, years 2010-2019)



Categoria DPSIR: D
Fonte: EUMOFA

4.2.9 Landscape and cultural heritage

4.2.9.1 Introduction and analysis methodology

The landscape and cultural heritage are structural elements of the living setting for the population and the identity of a territory. They represent a key element in individual and social wellbeing, as recognised in the European Landscape

[46] Convention (Florence 2000). D.Lgs 63/2008, integrating the provisions of D.Lgs 42/2004, interprets (art. 2, co. 1) landscape as "*the territory expressing identity, the character of which derives from the action of natural and human factors, and their interrelations*" and establishes that "*valorisation of the landscape goes towards promoting the development of culture*" and "*is implemented in accordance with the needs for safeguarding*", and so "*the State, Regions, and other territorial public bodies, as well as all those who, in exercising public functions, act on the national territory, base their activities on the principles of knowledgeable use of the*

[46] In art 1, the European Landscape Convention defines Landscape as "*a specific part of the territory, as perceived by the populations, in which the character derives from the action of natural and/or human factors, and their interrelations*".

territory and safeguarding of the landscape characteristics, as well as realising new integrated and coherent landscape values that meet the quality and sustainability criteria".

Given the elements of physical and anthropic characterisation of the landscape and its components, it would be difficult to represent the Adriatic coastal belt system in a few pages. Therefore, in the pages that follow, an analysis is laid out that will make it possible to arrive at:

1. A definition of the particular characteristics of the **Landscape Settings** as these are identified in[47] the Regional Landscape Plans, based on elements of the hydrogeomorphological set-up, the environmental and ecosystemic characters, the types of settlements (towns/cities, infrastructures, farming structures), a combination of the morphotypological characters of the landscapes and preceptive identities.
2. Evaluation of the **Concentration of historical-architectural assets and landscape areas of interest** protected in terms of articles 136, 142 and 157 of the Cultural Heritage and Landscape Code (D.Lgs. 42/2004 and s.m.i.), on the coast or immediately adjacent to it (a belt within 300 m of the shoreline was taken as a reference[48], subject by law to landscape protection pursuant to article 142, comma 1, lett. a) of D. Lgs 42/2004[49]). In particular, the following were taken into consideration:
   - Assets, at a point or extending over an area, of historical interest ("*Properties and areas of significant public interest*") protected in terms of art. 136 of D.Lgs. 42/2004 and s.m.i.
   - Sites recognised as UNESCO World Heritage Sites.
   - Assets of landscape interest, protected[50] in terms of art. 134 and 142 of D.Lgs. 42/2004 and s.m.i.
   - Submerged assets (relics of archaeological or historical interest, wrecks, etc.)[51].

   To do this analysis a database was built up, containing all assets in the UP for Sub-areas A/1-A/7, starting with checking those registered in the MiC (SITAP) platform, and comparison with those registered in the PTPR. In the Table below, the numbers of protected assets / areas are provided for each Sub-Area and each Planning Unit (UP): cases of historical / architectural interest (characterised by a specific extension) were used to make up an index that classifies the UPs based on the quantity of assets within the reference coastal belt (300 m from the coastline). For assets of historical / archaeological and landscape interest (characterised by an areal extension) an index was calculated that measures the area protected compared to that of the reference coastal belt. A brief index was obtained based on these values, broken down into 5

47 In terms of art. 135, comma 2 of the Cultural Heritage and Landscape Code (D.Lgs. 42/2004 and s.m.i.).

48 Reference is made to projection within 300 m of the section of coastline that demarcates the UP.

49 This analysis comes with scale drawings of the Sub-area, with greater detail that the maps provided with the Plan, and are prepared at a Maritime Area level.

50 The following are subject to landscape protection, in terms of art. 142 of D.Lgs. 42/2004 and s.m.i.: "*a) Coastal territories within a belt extending 300 metres from the shoreline, as well as for land raised above the sea. b) Territories around lakes included in a belt 300 m wide from the coastline, also for territories raised above the lakes. c) Rivers, streams, watercourses, registered in the lists.., and their banks or edges, for a 150 metre belt each. d) The part of mountains above an altitude of 1,600 metres for the Alpine chain and 1,200 metres above sea level for the Appenine chain and islands. e) Glaciers and glacial circles. f) National or regional parks or reserves, as well as protection territories outside the parks. g) Territories covered by forests or woods, even if passed through or damaged by fire, and those subject to reforestation protection. h) Areas assigned to agricultural universities and zones subject to civic use. i) Wetlands included in the list laid down by D.P.R. n° 448 of 13 March 1976. l) Volcanoes; m) Zones of archaeological interest*".

51 For characteristics of submerged heritage see the drawings provided with the Plan (Map 09 "*landscape and cultural heritage*", which indicates the wrecks, archaeological and architectural assets. The assets indicated are those georeferenced for the MIBACT project called "Archeomar",that covered the Regions of Campania, Calabria, Basilicata and Puglia, and "Archeomar 2" for Lazio and Tuscany. Also, in par. 3.6.7 of Chapter 3 of the Plan, it states that "*for safety reasons and given the lack of homogeneity of data at a national level, while waiting to be able to access georeferenced data for the submerged heritage sites in all Regions of Italy, it was deemed best to proceed with characterisation by zone, of the Alert submerged cultural heritage data*"

classes,[52] which made it possible to identify: The most sensitive settings, which will be analysed in paragraph 4.3.

This methodology was used to try to obtain an index that is not intended to be an absolute reference value, but rather to provide support for evaluation as part of this RA.

3. Evaluation of the *Consumed land* (ISPRA 2020 data) and *Land Consumption*[53] (ISPRA 2019-2020 data) in the areas subject to landscape protection, in order to characterise the level of anthropic pressure and transformations in progress in the areas subject to protection in terms of D.Lgs. 42/2004.

Substantially, the references sources for the analyses in the previous points are:

- WebGis RAPTOR – geodatabase that registers the national archaeological sites www.raptor.beniculturali.it;
- Websites of Regional Landscape Plans and Regional Territorial Plans that apply to the landscape.
- Territorial Environmental and Landscape Information System – SITAP: http://sitap.beniculturali.it/
- Risk Map – ICR: http://vincoliinrete.beniculturali.it/vir/vir/vir.html
- ISPRA Environmental Data Yearbook: https://annuario.isprambiente.it.

52 The 5 classes cover: <5%, 5-20%, 20-50%, 50-75%, >75%

53 See https://annuario.isprambiente.it/sys_ind/364. According to ISPRA "*The indicator is derived from a mix of the chart showing changes in land consumption, with the protected assets, only for areal ones*" (Source: SITAP). The aim of the indicator is "*to evaluate changes in land consumption in the areas subject to protection in terms of D.Lgs. 42/2004 (Urban Code) in two consecutive years.*" In order to provide "*a representative view of the environmental conditions, pressures on the environment, or responses by society, also in relation to the objectives of specific norms*".

Sub-Area	UP Code	N° of underwater specific assets in the UP	N° of cultural / architectural specific assets in the 300 m coastal belt	N° of architectural specific assets in the 300 m coastal belt	Overall total	Area of landscape / cultural / architectural assets in the 300 m coastal belt (sq.km)	Area under archaeological protection in the 300 m coastal belt (sq.km)	% area of landscape and architectural assets in the 300 m coastal belt (sq.km)	% area of archaeological protected sites in the 300 m coastal belt (sq.km)	Total % area covered by areal protections	Area of the entire 300 m coastal belt included in the planning unit (sq.km)	AREAL ASSETS Areal proportion index (% of total)	SPECIFIC ASSETS Proportion index (% of total assets registered by sub-area)	SENSITIVITY INDEX
A/1	A/1_01	2	54	0	54	4,07	0	23,14	0,00	23,14	17,59	4	3	**12**
	A/1_02	0	18	0	18	5,45	0,15	78,53	2,16	80,69	6,94	2	5	**10**
	A/1_03	0	2	0	2	0,98	0	100,00	0,00	100,00	0,98	1	5	**5**
	A/1_04	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/1_05	0	85	0	85	1,92	0,02	18,37	0,19	18,56	10,45	5	2	**10**
	A/1_06	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
A/2	A/2_01	1	17	0	17	15,21		68,82	0,00	68,82	22,1	2	4	**8**
	A/2_02	0	0	0	0	18,63	0	94,42	0,00	94,42	19,73	1	5	**5**
	A/2_03	0	13	0	13	6,43	0	100,00	0,00	100,00	6,43	2	5	**10**
	A/2_04	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/2_05	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
A/3	A/3_01	0	0	0	0	0	0	0,00	0,00	0,00	7,81	0	0	**0**
	A/3_02	0	0	0	0	0	0	0,00	0,00	0,00	5,27	0	0	**0**
	A/3_03	0	0	0	0	4,93	0	94,26	0,00	94,26	5,23	1	5	**5**
	A/3_04	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/3_05	1	18	0	18	6,79	0	18,41	0,00	18,41	36,88	2	2	**4**
	A/3_06	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/3_07	1	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/3_08	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/3_09	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/3_10	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
A/4	A/4_01	0	16	0	16	3,38	0	16,34	0,00	16,34	20,69	2	2	**4**
	A/4_02	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**

	A/4_03	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/4_04	0	18	15	33	7,003	0	23,91	0,00	23,91	29,29	3	3	**9**
	A/4_05	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/4_06	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/4_07	0	1	0	1	6,07	0	97,43	0,00	97,43	6,23	1	5	**5**
	A/4_08	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/4_09	0	0	0	0	6,3	0	97,37	0,00	97,37	6,47	1	5	**5**
	A/4_10	2	49	11	60	0,622	0	6,77	0,00	6,77	9,19	4	2	**8**
	A/4_11	0	0	1	1	0,061	0	2,88	0,00	2,88	2,12	1	1	**1**
	A/4_12	1	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
A/5	A/5_01	0	8	0	8	1,48	0	51,21	0,00	51,21	2,89	2	4	**8**
	A/5_02	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/5_03	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/5_04	0	4	0	4	5,603	0	38,83	0,00	38,83	14,43	1	3	**3**
	A/5_05	0	27	0	27	18,93	0	52,06	0,00	52,06	36,36	3	4	**12**
	A/5_06	0	11	0	11	15,11	0	100,00	0,00	100,00	15,11	2	5	**10**
	A/5_07	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
A/6	A/6_01	1	3	0	3	17,61	0	100,00	0,00	100,00	17,61	1	5	**5**
	A/6_02	5	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/6_03	2	9	2	11	22,5	0,119	89,46	0,47	89,94	25,15	2	5	**10**
	A/6_04	3	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/6_05	0	10	0	10	0,77	0	38,69	0,00	38,69	1,99	2	3	**6**
	A/6_06	10	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/6_07	6	2	0	2	0,303	0,44	2,33	3,38	5,72	13	1	2	**2**
	A/6_08	0	0	0	0	0	0	0,00	0,00	0,00	1,06	0	0	**0**
	A/6_09	3	98	5	103	5,902	0,04	32,81	0,22	33,03	17,99	5	3	**15**
	A/6_10	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/6_11	0	5	0	5	0,441	0	83,21	0,00	83,21	0,53	2	5	**10**
	A/6_12	1	29	0	29	0,38	0	52,78	0,00	52,78	0,72	3	4	**12**
	A/6_13	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/6_14	1	4	0	4	2,43	0	100,00	0,00	100,00	2,43	1	5	**5**
	A/6_15	5	256	18	274	25,42	1,4	80,75	4,45	85,20	31,48	5	5	**25**
	A/6_16	1	2	0	2	0,15	0	100,00	0,00	100,00	0,15	1	5	**5**
	A/6_17	1	0	0	0	2,3	0,038	78,50	1,30	79,80	2,93	1	5	**5**
	A/6_18	1	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/6_19	1	0	0	0	0,13	0,04	2,10	0,65	2,74	6,2	1	1	**1**

	A/6_20	1	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/6_21	3	0	0	0	6,57	0	60,11	0,00	60,11	10,93	1	4	**4**
	A/6_22	1	0	0	0	1,89	0	100,00	0,00	100,00	1,89	1	5	**5**
	A/6_23	3	2	7	9	11,46	0,364	96,87	3,08	99,95	11,83	2	5	**10**
	A/6_24	1	0	0	0	0,47	0	100,00	0,00	100,00	0,47	1	5	**5**
	A/6_25	3	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/6_26	1	4	1	5	15,01	0,11	99,27	0,73	100,00	15,12	2	5	**10**
A/7	A/7_01	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_02	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_03	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_04	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_05	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_06	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_07	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_08	1	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_09	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_10	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/7_11	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
A/8	A/8_01	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/8_02	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/8_03	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/8_04	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
A/9	A/9_01	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/9_02	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/9_03	2	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/9_04	1	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**
	A/9_05	2	0	0	0	0	0	0,00	0,00	0,00	0	0	0	**0**

Areal proportion index	Weight
<5%	**1**
5-20%	**2**
20-50%	**3**
50-75%	**4**
>75%	**5**

Specific proportion index	Weight
<5	**1**
5-20	**2**
20-50	**3**
50-75	**4**
>75	**5**

Total proportion weight = Areal proportion weight + Specific proportion weight	
<1	*null*
1-5	*very low*
5-10	*low*
10-15	*medium-low*
15-20	*medium*
20-25	*high*

4.2.9.2 Characteristics of the Adriatic Coastal Belt's Landscape System

- **Sub Area A/1 – (Territorial waters) Friuli-Venezia-Giulia**[26]

Reference: Landscape Plan

[55] of the Autonomous Friuli-Venezia-Giulia Region, approved by Decree of the President of the Region n° 0111/Pres of 24 April 2018, and published in Ordinary Supplement n° 25 of 9 May 2018, at BUR [Official Regional Bulletin] n° 19 of 9 May 2018. It is effective from 10 May 2018.

WebGIS: http://webgis.simfvg.it/it/map/bozza-ricognizione-ppr/qdjango/13/

The Friuli-Venezia-Giulia Region prepared the PPR-FVG via a gradual procedure that was participated in, considering both the spirit of the European Landscape Convention and the contents of the Cultural Heritage and Landscape Code. The FVG Region's Landscape Plan combines an approach that looks at all "protection" and "safeguard" aspects, with those for "valorisation" and "management", with actions aimed at governing possible landscape transformations. The Plan covers the entire territory and expresses cogent prescriptive content only for those portions of the territory recognised as expressing "notable" values that identify the region's landscape. The region's territory was classified in 12 Landscape Settings (AP) beginning, among other things, from the following identification criteria:

a) Hydrogeomorphological.
b) Environmental - ecological.
c) Identifying - historical - cultural.
d) Administrative - managerial.
e) Permanence of historical territorialisation.
f) Coherence with settlement - territorial aggregated systems.

As explained in the General Report on the Plan, “*these criteria take on board those laid down in the PPR scheme, perfecting them based on further analysis and evaluation, while taking into account the results of in-depth socio-economic surveys and territorialisation processes*”.

Of the 12 **Landscape Settings** identified by FVG's Landscape Plan, those affected by the MSP are:

- **AP 11** - Karst Region and Western Coastline; as highlighted in the Descriptive Schedule for the AP (Annex 20 to the Plan), “*this setting is characterised by some components that undoubtedly motivate its configuration: on the one side there are the Karst highlands, and on the other the coastline that stretches from Sistiana to Muggia. The setting includes the actual Karst region, as linked to the great roadways and port front.*

  The Karst highlands are characterised by typical rural settlements, marked by low density and spontaneous architecture, the fruit of the places and the original historical and cultural aspects. The coast is characterised by a fragmentary limestone nature profile, with arenaceous marl formations, dropping precipitously into the sea, in th form of cliffs. Along with these important aspects there are the ecological and environmental features that make up five Regional nature reserves, and the vast Special Conservation Zone of the Karst of Trieste and Goriziano, and in the Special Protection Zone of the Karst Areas of Venezia Giulia. These are lands of ancient colonisation, full of historical settlements that are identified here for the conspicuous presence of fortified towns that, in some cases, gave rise to the current settlements. The settlement - territorial system is closely tied to the presence of Trieste that is identified as the only polar settlement system on a metropolitan and transnational scale in the Region, and has both monumental historical centres and contemporary settlement structures based on typically centred urban elements, and others of a linear nature linked to the great roadways and the port front”. It also highlights (see par. 1.1.1 of the Schedule) the AP's environmental vulnerabilities, associated with the physical / geomorphological aspects related to hydraulic instability in the coastal zone, especially in terms of storms. These are often triggered by a combination of various climatic factors (precipitation, high tides, southern winds) that result in flooding of urban centres (Trieste and Muggia), in part due to excessive waterproofing

[26] Carta dei beni culturali e paesaggistici nella Sub-Area A/1 - MSP_ADR_AMBD009_BeniCulturali_A1

[55] See www.regione.fvg.it/rafvg/cms/RAFVG/ambiente-territorio/pianificazione-gestione-territorio/FOGLIA21/#id4

of the land, and difficulty with disposing of the storm waters in the case of storm events coinciding with the run-off from the water grid. This is added to the vulnerabilities of geostatic instability, especially in territories characterised by the karst-carbonate domain (karst crest, especially on the steepest coastal slopes).

In terms of the aspects more closely tied to the eco-systemic and environmental characteristics, the vulnerabilities are linked (see par. 1.2.1 of the Schedule) to pressures due to expansion of building and/or specialist agricultural crops, with the growth of small residential centres the expansions if which break up the territory. Then there's the intrinsic geographic position that forces extensive transport and energy infrastructures (gas pipeline, oil pipeline, motorway, railway, regional roads, forestry roads, electrical power lines), the risk of bush fires in the newly formed Karst bush. There is also widespread anthropic disturbance associated with using the territory for recreational purposes, including non-tourist caves and crags. It then identifies (see par. 2.1.1 of the Schedule) the areas that have homogeneous ecological functions ("ecotopes")[56] and are the basic element of the regional ecological network. They are characterised by very high value due to their particular geomorphology, linked to the karst phenomena, and for their geographical position at the crossroads of the Mediterranean, Continental, and Balkan Illyrian biogeographical regions. Finally, the Schedule identifies (see Chap. 3) the quality goals for the ecological network, the cultural heritage network, and the slow mobility network (see Chap. 4) as well as the Protection and Valorisation Norms.

- **AP 12** – Lagoon and coast: as highlighted in the Description Schedule for the AP (Annex 21 to the Plan), "*This setting includes the Marano and Grado lagoon, a peri-lagoon strip and the coast up to the mouths of the Timavo, and is homogeneous in both geomorphological and environmental - ecological terms. The presence in this area of 4 Regional nature reserves as well as important, extensive areas within the Natura 2000 network, as both Special Protection Zones (ZPS) and Special Conservation Zones (ZSC), give the entire setting great environmental importance*". In this case too it highlights (see par. 1.1.1 of the Schedule) the environmental vulnerabilities of the AP, associated with the phenomena of marine flooding of the coastal zones, mostly caused by violent storms, generally associated with exceptionally high tides and relative subsidence phenomena, especially in the lagoon area of the low-lying Lignano plain (with 4 mm/year) and in Grado (with 7 mm/year) or complete depression. The reduction in lagoon areas, especially Barenicole, other factors that contribute to triggering erosion processes, such as the increase in the tidal range, exceptional weather and sea events and the migration of canals, and the increase in lagoon salinity and rising of the saline wedge.

  These pressures are behind the vulnerabilities of the ecosystemic and environmental vulnerabilities (see par. 1.2.1 of the Schedule): Progressive erosion of the morphologies and bathymetric levelling of the lagoon beds, overall loss of sediment with a trend towards marginalisation of the lagoon environment, water drawn for industrial and irrigation purposes, lowering of the water table and entry of the saline wedge, historical polluting of the lagoon sediments, spillage of pollutant substances from vessel traffic inside the protected areas as well, expansion of tourism centres (Lignano, Grado), and the presence of vegetal species and invasive animals, etc. It then identifies (see par. 2.1.1 of the Schedule) the areas that fulfil homogeneous ecological functions ("ecotopesi") and that are the basic element of the regional ecological network[57]. Finally, the Schedule identifies (see Chap. 3) the quality goals for the ecological

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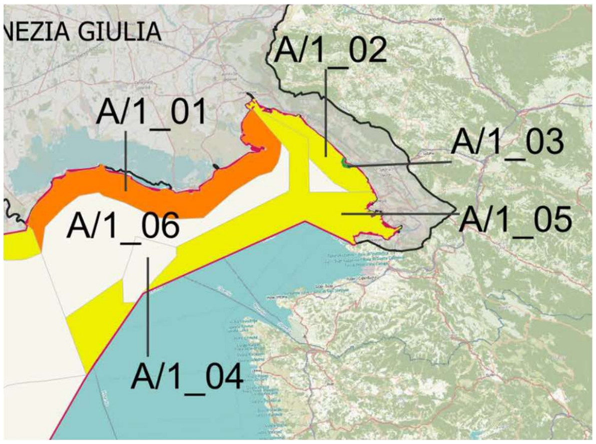
[56] Of these settings those of particular importance are: Nature 2000 area of the Karst areas in Venezia Giulia (11001); the Studenec Marsh in Malchina (11003); the connective fabric of the Karst of Gorizia (11101); the connective fabric of the Karst of Trieste (11102); connective fabric of the Trieste coast (11103); connective fabric of Muggia and San Dorligo della Valle (11104); then this list is added to with poorly connected ecotopes, including the urbanised area of Trieste, Opicina and Muggia (11201), and the towns of Fogliano-Redipuglia and Sagrado (11202).

[57] These include: Lignano pine forest (12002); Marano and Grado lagoon (12001), Valle Cavanata and the Mula di Muggia bank (12004), mouth of the Isonzo and Cona island (12005), Cavana di Monfalcone (12006), karst areas of Venezia Giulia (12007), loops in the Stella river (12003), linear connection of the Tagliamento river (12109), linear connection of the Turgnano river (12102), linear connection of the Zellina canal (12103), linear connection of the Ausa and Como rivers (12104), linear connection of the Comor stream (12105), area of the Villaggio del Pescatore (12107), Lisert area (12106), bush areas in Alberoni (12108). The poorly connected ecotopes include the urbanised area of Lignano (12201), urbanised area of Grado (12202), urbanised area of Monfalcone (12203), industrial area

network, the cultural heritage network, and the slow mobility network (see Chap. 4) as well as the Protection and Valorisation Norms.

- Sensitivity Index (based on the concentration of cultural assets and areas of landscape interest)



In **A/1** (within the reference belt) a total of 159 assets of historical / architectural interest were censused. The highest concentration is in A/1_05 with 85 units (which puts it in class 5 in terms of the specific asset proportion index) and in A/1_01 with 54 assets censused (index value: 4). The greatest density of areas subject to landscape protection in **A/1** lies in A/1_03 in which 100% of this reference belt has assets of landscape / architectural interest (which puts the PU in class 5 in terms of areal proportion. One finds that usage of this UP is laid down as being for "*Protection of the environment and natural resources*"). It is followed by A/1_02 at 80,69% (class 5 in the areal proportion index, to be used for "*Protection of the environment and natural resources, Coastal and maritime tourism, and Aquaculture*"). To a lesser extent there's A/1_01 at 23.14% (areal proportion index, class 3). However, in combining the specific and areal index values the **highest sensitivity indices** in **A/1** are assigned to **A/1_01** (value: 12), A/1_02 (value: 10) and A/1_05 (value: 10).

- **Sub-Area A/2 – (Territorial Waters) Veneto[58]**

Reference: Regional Territorial Coordination Plan[59] (PTRC), which is not a landscape plan in terms of D.Lgs 42/2004 and that was approved by means of DG n° 62 of 30/06/2020 (BUR n° 107 of 17 July 2020. A specific Regional Setting Plan (PPRA) was drawn up for each Landscape Setting, along with the MiC, coordinated by the Technical Landscape Committee. The regional territory was divided up into fourteen Landscape Settings.

WebGIS: https://idt2.regione.veneto.it/idt/webgis/viewer?webgisId=191

Of the 14 APs identified in Annex B3 to DGR 427 of 10/04/2013, those affected by the MSP are settings 11) Eastern Remediations - Piave to Tagliamento, and 14) Adriatic coastal arc, Venice Lagoon, and Po Delta.

- **AP 11** Eastern remediations Piave to Tagliamento: This area lies between the strip of coastline to the south and the infrastructural arterial routes that run along the line that divides the historically consolidated territory from that remediated more recently to the north. It therefore extends from the Tagliamento Rive to the East as far as the Sile River in the West. It is crossed by the Livenza, Piave and Lemene Rivers. As is highlighted in Annex B3 referred to above *"in the coastal belt there are multiple areas that have a certain nature-environmental value, made up of various types of habitat. Of these, those worthy of note for their ecological importance, are the coastal, delta, lagoon and agricultural settings … there are some fragments of the remainder of or recently formed dune systems on which pine forests are normally found, with the Pinus pinea and Pinus pinaster, as well as Mediterranean flora elements. These settings are mainly found along the Laguna del Mort, the Pineta di Eraclea, the coast in Valle Vecchia, and the Bibione pine forest. The latter is a forestry area located between the Vallegrande and Vallesina fish-farming valleys and the strip of residential buildings. The pine forest is small in extent and has almost only one species (pinus nigra austriaca) added to by a thick undergrowth of shrubs, interrupted by low-lying*

Aussa Corno (12204), farming areas in the remediations of San Canzian 12205 farming areas in the remediations of Palazzolo (12207) farming areas in the remediations of Marano d'Isonzo, Grado, Aquileia, Terzo d'Aquileia, and Torviscosa (12209), farming areas of Staranzano and San Canzian d'Isonzo (12206), farming areas south of Latisana (12208), farming areas in the remediations of Palazzolo della Stella (12207), etc.

[58] Carta dei beni culturali e paesaggistici nella Sub-Area A/2 - MSP_ADR_AMBD010_ BeniCulturali _A2

[59] https://www.regione.veneto.it/web/ptrc/ptrc-2020

wetlands. In the peat bog and wetland settings one also finds species of great natural value, as they are rare and/or endemic. The Valle Vecchia coast, the site of landscape reconstruction and environmental refurbishing work, is a good example of a growth of ecodiversity, in terms of associating with production and conservation. … Generally, the valley setting is made up of successive bodies of water, earmarked for extensive fish farming, differing in salinity and extent, with cane thicket or other halophyte formations, banks with tree and shrub vegetation, typical of brackish wetlands, isolated bush areas and, to a lesser extent, cultivated areas, like in Valle Zignago …. The presence of the lagoons and fish-farming valleys are of fundamental importance in designing the territory, not only in environmental but also in historical - cultural terms. These settings have an absolute unique value that testifies to the perfect balance between human production activities and natural environments and values, which are behind the culture based on lagoon fishing, an exemplary expression of which is in the "cason da pesca".

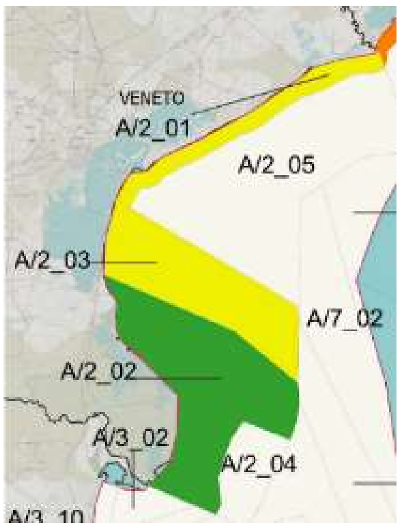
- **AP 14** Adriatic Coastal Arc, Venice Lagoon, and Po Delta: this setting includes the entire Lagoon of Venice and recent remediations of the lagoon drainage that from the Sile River in the East to the Mestre hinterland (Tessera) skirt the northern lagoon, and from Fusina (south of the industrial zone of Porto Marghera) to Chioggia look out over the southern lagoon. From a natural-environmental point of view, it is of exception value, guaranteed by the large variety of settings found within the territory. *The Venice Lagoon is a site of extraordinary importance for enervation and migration of the bird life associated with the wet zones, especially ardeidae, anatidae, and waders, nest making of numerous species of birds including sternides and charadriforms, as well as the presence of endemic types and syntypes, as well as species of animals and plants that are rare and threatened at both regional and national level. The presence of the fish farming valleys contributes to maintaining these environments. The fish farming valleys include various habitats: bodies of stagnant brackish water in the shallows, valley lakes that vary in depth, salt marshes, cane thickets, bushy banks and tree hedgerows. This allows a certain diversity of ecosystem that facilitates accommodating vegetal and animal species of some value. The traditional fish farming valleys, one of the main activities carried out in the Venice Lagoon, not only plays an important role in the ichthyic economy, but is also a type of compatible farming in both ecological and water terms, as it is based on the lagoon's natural hydrodynamic characteristics. Currently, there are two large valley complexes: one adjacent to the lagoon's northern run-off, between Caposile abd Cavalling-Treporti, and on the lagoon's southern run-off, between the Giare peninsula and the Conche remediated area.*

  The Venetian beaches, dune reefs that separate the open sea from the lagoon, and the Cavallino peninsula boast a great variety of habitats, especially in the Cavallino, Alberoni, and Ca' Roman area.

  Within the main forestry formation, which is of a coastal pine type, there are main micro environments, such as wet lowlands behind the dunes, swaps, and antique dune reefs with stretches of xerophile vegetation. In addition, some artificial typical pine forests on the coast

  are giving way, on the Cavallino and Alberoni coasts, to the more natural formation of holm oaks and manna ashes and, in the Ca' Roman area, to communities typical of the toposequence behind the dunes, such as Tortulo-Scabiosetum, and Eriantho-Schioenetum Nigricantis. The high water tanks also now contribute to the natural-environmental value of the area surveyed. They were set up in the 1960s to house the Porto Marghera industrial zone (subsequently, never built) using material from excavation of the Canale dei Petroli, which allows the ships to enter the industrial port. These high water tanks are located south of the Naviglio Brenta mouth, between the Canale dei Petroli and the lagoon run-off. These are spacious areas, first hemmed in but then partially opened to the flow of the tides again, in which a natural environment of specific value has come about, with alternating fresh and brackish waters, influenced by the tides, and settings with spontaneous regrowth of the bush. The historical - cultural value of the setting relates to the presence of "Venice and its Lagoon", which is a UNESCO world heritage site, the extraordinary value of which must be preserved for humanity. A city of art par excellence, built on an archipelago of one hundred and eighty islands, cut through by canals, thanks to the richness of its architecture, the particularity of the city, and the number and importance of the artists who have left their works there, Venice is deemed to be one of the most beautiful cities in the world. Also worthy of consideration is the Chioggia territory, where the historical - artistic heritage, landscape, and specific cultural nature of places are significant, not only as added value, but as important driving forces that strengthen and direct tourism and economic resources of a place full of opportunities, with food that ranges from ichthyic to agricultural products, important not only due to their kinds, but also to the value of the products. The Cavallino area is also interesting, and worthy of note is the presence of a unique coastal defence system, made up of a cluster of decommissioned military properties (forts, batteries, barracks, etc.), built at the time of the first world war. In the area north of the swimming beach coastal zone, on the northern lagoon, of the characteristic settings of the coastal vegetable gardens, one should also note some places and buildings of significant historical - architectural interest, testimony to the ancient valley settlements of the Venice Lagoon: Treporti, Saccagnana, Lio Piccolo, and Le Mesole. In the lagoon valleys you can fund the traditional Large Hunting and Fishing Houses, historically linked to the lagoon areas, of which those worthy of mention are Casone di Valle Zappa, in the town of Campagna Lupia, with its eccentric architecture influenced by Northern European culture. The Adriatic Coastal Arc, Venice Lagoon and Po Delta PPRA is a territorial landscaping planning tool, that continues on from the previous regional experience in the form of the Plans for the Lagoon Area, Venetian Area (PALAV) and the Po Delta. Besides taking in a significant number of landscape protection areas, this Setting also has interesting cases of significant transformation dynamics.

- Sensitivity Index (based on the concentration of cultural assets and areas of landscape interest)



In **A/2** (within the reference belt) a total of 30 assets of historical / architectural interest were censused. The highest concentration is in A/2_01 with 17 units (which puts it in class 2 in terms of the specific asset proportion index) and in A/2_03 with 13 assets censused (index value: 2). The greatest density of areas subject to landscape protection in **A/2** lies in A/2_03 in which 100% of this reference belt has assets of landscape / architectural interest (which puts the PU in class 5 in terms of the areal proportion index). It is followed by A/2_02 at 94,42% (class 5 in the areal proportion index). To a lesser extent there's A/2_01 at 68.82% (areal proportion index, class 4). However, in combining the specific and areal index values the **highest sensitivity indices** in **A/2** are assigned to **A/2_03** (value: 10), A/2_01 (value: 8) and A/2_02 (value: 5).

- **Sub-Area A/3- (Territorial Waters) Emilia-Romagna**[60]

Reference: The Region, along with the MiBAC is currently involved in adapting the PTPR to the current Cultural and Landscape Heritage Code (D.Lgs. 42/2004). The PTP currently in force is still that according to DCR 1338 of 28/01/1993.

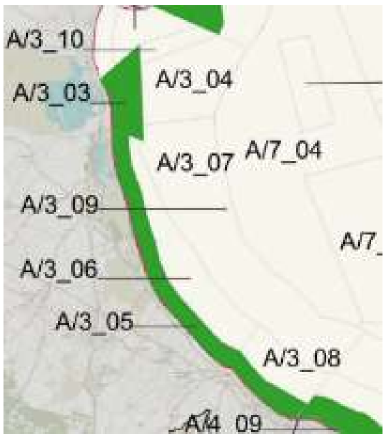
WebGIS: https://servizimoka.regione.emilia-romagna.it/mokaApp/apps/PTPR93/index.html

If considered along its general lines, the regional landscape appears to be simplified in physical terms into easily identifiable strips, albeit certainly not uniform: the Appenine ridge, Alpine in nature at times, with significant slopes and irregularities, a great wealth of waters and very vast forest areas. The mountainous mean, which in Emilia has a great variety of jutting styles, is homogeneous yet impervious in Romagna, with narrow, deep valleys and sharp ridges, often bare. The hills, similar almost everywhere, with gentle slopes and soft ridges, suddenly break up into the gulleys or into rocky opposing isolated places, the signs of a very complex geological evolution. The plains are no longer in their natural state, excepting for minute remnants that have escaped the hydraulic remediations and deforestation. The more aquatic settings are on the region's northern and eastern borders: along the tortuous Po valley, which runs between high banks and, near the northern part of the Adriatic coast, where there is still a good representation of the extraordinary environmental variety. Looking at anthropic landscapes the picture is incredibly more complex. These differences are to be found to some extent in all aspects of regional life, even though in recent years, as in the whole of Italy, one finds a quick lessening of local peculiarity and the loss of distinctive signs. Art 6 of the Norms for Implementing the

[60] Carta dei beni culturali e paesaggistici nella Sub-Area A/3 - MSP_ADR_AMBD011_ BeniCulturali _A3

Plan identify the Landscape Units that "*constitute an essential reference for the methodologies for forming planning tool, and other regulatory instruments, in order to maintain management that is in line with the protection objectives*". In relation to the coastal system, the Plan identifies 3 different zones with different protection regimes (zones for safeguarding the coastal morphology; zones for upgrading the coast and the sandy shores; and zones for protecting the coast and sandy beaches). Especially art. 12 of the Norms states that "*conservation of the natural conformation of the territories least affected by anthropic settlement processes must be pursued, while for those in which these processes are taking place, reconstitution of the natural elements must be facilitated, also by means of experimental works*".

- Sensitivity Index (based on the concentration of cultural assets and areas of landscape interest)



In **A/3** (within the reference belt) 18 assets of historical / architectural interest were censused overall, all concentrated in A/3_05 (A/3 is a sub-area that lies mainly in territorial waters). The highest concentration is, as stated, A/3_05 with 18 units (putting it in class 2 in terms of its specific assets proportion index). The greatest density of areas subject to landscape protection in **A/3** lies in A/3_03 in which 94.26% of the area is subject to areal restrictions within the reference area (which puts the PU in class 5 in terms of the areal proportion index). It is followed by A/3_05 at 18.41% (class 2 in the areal proportion index).

However, in combining the specific and areal index values the **highest sensitivity indices** in **A/3** are assigned to **A/3_03** (value: 5), and A/3_05 (value: 4).

- **Sub-Area A/4- (Territorial Waters) Marche[61]**

Reference: Marche PPAR[62], approved by means of D.A.C.R. n° 197 of 3 November 1989.

WebGIS: https://giscartografia.regione.marche.it/BeniPaesaggistici/

The PPAR Report highlights the fact that the Region is divided into three sub-areas:

- Coastal sub-area. Made of the territories of the municipalities on the Adriatic coast.
- Mountain sub-area. Made up of territories of municipalities that are part of the Mountain Communities.
- Hill sub-area. Made up of territories of municipalities not included in either of the previous sub-areas.

As indicated in art 25 of the Technical Norms Implementing the current Plan: *the Plan defines provisional protection settings, based on geometric parameters or specific cartographic indications, in order to determine the areas to which the basic requirements apply, and to indicate the sensitive areas, in which the problems of protection must be resolved and the necessary valorisation processes must be activated. Demarcation of the final protection settings is the responsibility of the general town planning instruments.* Art 48 of the Technical Norms Implementing the Plan, lays down the guidelines for river, maritime, coastal, and port works. Drawing 6 identifies the areas of significance for their landscape values. For characterisation of the coastal landscape in Marche, it is interesting to read the Integrated Management Plan for Coastal Zones (GIZC Plan), outlined to favour an increase in "coastal resilience", that is, an increase in the coast's intrinsic capacity to react to changes brought about by changes in sea level, extreme events, or sporadic impacts. And so, starting from the "National Guidelines for Defending the Coast against Erosion and the effects of Climate Change"[63], the Marche Region's coastline has been divided up into 11 Secondary Physiographic Units (UFs), in turn broken down into n° 64 Coastal Management Units (UGC). The Plan highlights some significant point in relation to connotation of the coastal landscape systems: "*The coastal zone is "the mostly densely urbanised portion of the Marche Region: it is where the major road and rail infrastructures are located, as well as important*

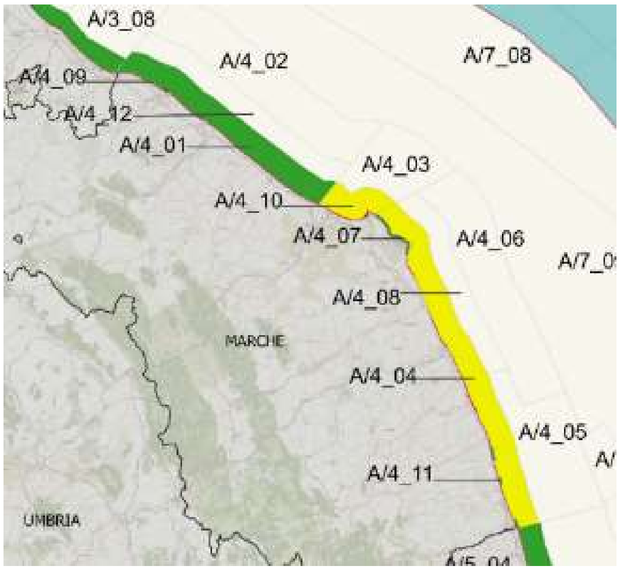
[61] Carta dei beni culturali e paesaggistici nella Sub-Area A/4 - MSP_ADR_AMBD012_ BeniCulturali _A4

[62] https://www.regione.marche.it/Regione-Utile/Paesaggio-Territorio-Urbanistica-Genio-Civile/Paesaggio#PPAR---Piano-paesistico-ambientale-vigente

[63] http://www.erosionecostiera.isprambiente.it

production and industrial plants, including tourism associated with swimming, and especially most of the Region's population. The coastal towns and cities at the sea found their main source of sustenance and a resource for development first in fishing and then in tourism. A recent study by ISPRA that analyses territorial distribution of land use, shows that the coastal provinces in Marche have percentages of land use that are generally above the national average. The percentages of land used increase as one moves towards the coast: almost a quarter of the 300 metre coastal belt is now taken up and, along with Liguria, Marche is not one of the regions with the highest values with almost 50% of the land used".

- Sensitivity Index (based on the concentration of cultural assets and areas of landscape interest)



In **A/4** (within the reference belt) a total of 84 assets of historical / architectural interest and 27 archaeological assets, giving a total of 111 units were censused (besides the 3 under water). The highest concentration is in A/4_10 with 60 units overall (which puts it in class 4 in terms of the specific asset proportion index) and in A/4_04 with 33 assets censused (index value: 3). The greatest density of areas subject to landscape protection in **A/4** lies in A/4_07 in which 97.43% of the area involves is covered by landscape / architectural assets within the reference area (which puts the PU in class 5 in terms of the areal proportion index). It is followed by A/4_04 at 23.91% (class 3 in the areal proportion index). However, combining the specific and areal index values the **highest sensitivity indices** in **A/4** are assigned to **A/4_04** (value: 9), A/4_10 (value: 8) and A/4_07 (value: 5).

- **Sub-Area A/5- (Territorial Waters) Abruzzo and Molise**[64]

Reference: Regional Landscape Plan[65] (PRP) of the **Abruzzo** Region, approved by the Regional Council on 21/3/1990 by means of deed 141/21 (drawing up of the new landscape plan is in progress).

WebGIS: http://geoportale.regione.abruzzo.it/Cartanet/viewer

The Regional Landscape Plan identified the following landscape settings:

Mountain Settings

- Monti della Laga
- Salinello River
- Gran Sasso Maiella – Morrone Monti Simbruini, Velino Sirente, Abruzzo National Park.

Coastal Settings

- Teramo Coast
- Pescara Coast
- Testino Coast.

River Settings

- Vomano - Tordino Rivers
- Tavo - Fino Rivers
- Pescara - Tirino – Sagittario Rivers

[64] Carta dei beni culturali e paesaggistici nella Sub-Area A/5 - MSP_ADR_AMBD013_ BeniCulturali _A5

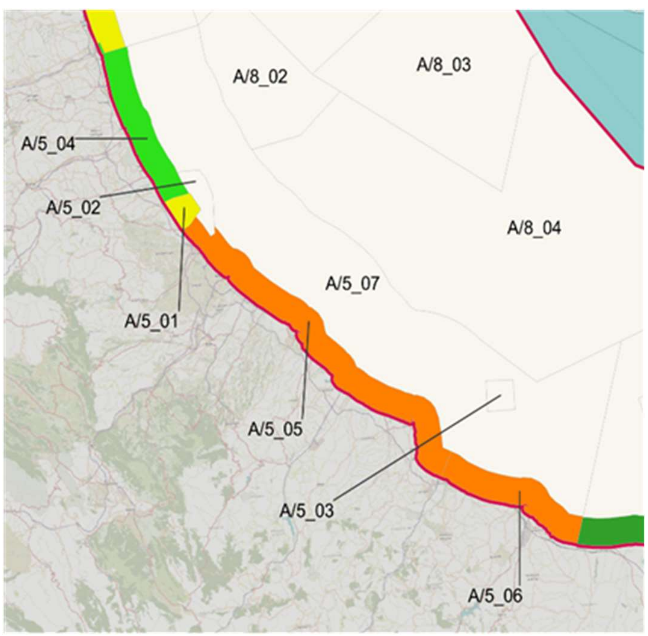
[65] https://www.regione.abruzzo.it/content/piano-regionale-paesistico-prp

– Sangro - Aventino Rivers.

In turn, these settings are broken down into Protection and Valorisation Categories, specifically: - A) Conservation, in the form of A1 (Full conservation) and A2 (Partial conservation); - B) Targeted transformability; - C) Conditioned transformation; - D) Ordinary transformation. Landscapes located in the coastal and hill geography have different geomorphological matrices and, based on this initial distinction, can be broken down into "coastal landscapes", "river landscapes", and "hill landscapes".

The coastal landscapes are broken down into two large "sections", the north, called the "Teramo and Pescara coast", and the south, called the "Teatino coast". This distinction is based on analysing the morphological characteristics of the coast (mainly low and sandy in the north; steep and rocky or gravelly in the south), and the forms of settlement that have developed there over time, as well as the intensity of anthropisation and degree of remaining naturalness. The north coast landscapes have a greater degree of urbanisation, and the figure that dominates the landscape if that of the linear coastal city that ideally goes from Emilia without continuity. The sections that still have residual natural characteristics (taking as given that here "nature" means a sort of "second nature" envisaged and imposed by man, such as the maritime pine forests) are minimal and subject to continuous pressure from built-up areas. On the other hand, the coastal landscapes in the south have more natural relevance, besides a greater capacity to evoke Abruzzo's identity, as can be seen from the recurrent use of images of the Trabocchi Coast in the various marketing and tourism promotion campaigns on the part of the Region and the bodies tasked with this activity. The greater relevance of the south coast when it comes to nature and the capacity to evoke the region's identity, is testified to by the "*Teatino Coastal Part*" proposal.

Reference: The Regional landscape-environmental plan of[66] the **Molise** Region is made up of a number of Landscape-environmental territorial plans covering a Vast Area (PTPAAV) put together by the Molise Region for the individual parts of their territory[67]. The coastal setting is covered by the Landscape - Environmental Territorial Plan for Vast Area n° 1 in which "*anthropic activity has led to the almost complete destruction of the territory's original natural vegetation*".



This is a setting in which the settlement logic took advantage of the seasonal migration routes for cattle as the prime element of territorial organisation, at least "*up to the beginning of this century. Subsequently, with the building of the railways, state roads, and freeways along the valley floors, the primary territorial organisation structures are being moved orthogonally from the old seasonal migration routes which now no longer fulfil any major function in terms of territorial development*".

- Sensitivity Index (based on the concentration of cultural assets and areas of landscape interest)

In **A5** (within the reference belt) a total of 50 assets of cultural / architectural interest were censused in the 300 m coastal belt. The highest concentration is in A/5_05 with 27 units (which puts it in class 3 in terms of the specific asset proportion index) and in A/5_06 with 11 assets censused (index value: 2).

[66] https://www.regione.molise.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/4818

[67] 8 Vast Area Setting PTP: Lower Molise DCR n° 253 of 1/10/97; Molise Guardalfiera-Fortore Lake DCR n° 92 of 16/04/98; Massiccio del Matese DCR n° 254 of 01/10/97; Della Montagnola-Colle dell'Orso DCR n° 94 of 16/04/98; Northern Matese DCR n° 106 of 07/04/99; Medio Volturno molisano DCR n° 93 of 16/04/98; Mainarde and Valle dell'Alto Volturno DCR n° 107 of 07/04/99; Upper Molise DCR n° 255 of 01/10/97

The greatest density of areas subject to landscape protection in **A/5** lies in A/5_06 in which 10.00% of the area is subject to areal restrictions within the reference area (which puts the PU in class 5 in terms of the areal proportion index). It is followed by A/5_05 at 52.06% (class 4 in the areal proportion index), and A/5_01 at 51,21% (class 4). Combining the specific and areal index values the **highest sensitivity indices** in **A/5** are assigned to **A/5_05** (value: 12), A/5_06 (value: 10) and A/5_01 (value: 8).

No underwater assets were surveyed.

- **Sub-Area A/6- (Territorial Waters) Puglia**[68]

Reference: Regional Territorial Landscape Plan for the **Puglia**[69] Region, approved by means of DGR n° 176/2015 and subsequent updating to the latest version by means of Decision n° 1801 of 15 November 2021.

WebGIS: http://webapps.sit.puglia.it/freewebapps/PPTRApprovato/index.html

As indicated in the General Report, the Plan identifies 11 landscape settings (drawing 5: Landscape setting schedules) identified by integrated evaluation of a number of factors:

- ✓ The historical conformation of the geographical regions.
- ✓ The characteristics of the hydrogeomorphological set-up.
- ✓ The environmental and eco-system characteristics.
- ✓ The types of settlement: towns/cities, city infrastructure networks, agricultural structures.
- ✓ The combination of territorial aspects that make up the morphotypological characteristics of the landscapes.
- ✓ The structure of the landscapes' perceptive identities.

The layout of the setting schedules refers to article 135, comma 3 of the Cultural and Landscape Heritage Code. Their role is to provide brief descriptions, identifying and statutory interpretation, and the strategic scenario for each individual setting identified. As detailed in paragraph 4.2 of the Plan's General Report, 5 regional level projects were drawn up, which go together to provide a strategic vision of future territorial organisation, aimed at increasing the quality and social usability of the region's landscapes, providing responses to the main problems raised by the general objectives:

- ✓ *Raising the quality of the environmental systems and the hydrogeomorphological set-up.*
- ✓ *Raising the quality of living in the urban settlement systems and the rural world.*
- ✓ *Extending the opportunities to make use of the landscapes in Puglia and the economies related to them, especially in terms of integrated valorisation of the coastal system.*
- ✓ *Extending the opportunities to make use of Puglia's cultural heritage in their landscape contexts.*

The approximately 940 kilometres of Puglia coastline (according to the latest measurements) led to the PPTR dedicating a specific project to valorising and upgrading the coastal system, looking at it in enough detail to form integrated coastal and inland policies, involving the urban, infrastructural, agricultural and natural systems *(Territorial project: Integrated valorisation and upgrading of Puglia's coastal landscapes)*. In this regard, the analysis of the coastal system heritage (urban fronts, agricultural areas, areas with high natural importance, dune systems, peripheral areas, tourism platforms, urban-rural and inland infrastructural systems, etc.) which was done in a 1:25000 scale, breaking down the system into coastal units with homogeneous landscapes, highlighted the particular nature of this heritage that, if subjected to abuse and urbanisation related to the start of a recent historical cycle of seaside tourism, still retains significant existential value in terms of nature, landscape, and urban and rural features, compared to the saturation and decay of the heritage in coastal systems in other regions.

Compared to the Regional Coastal Plan, which refers to a narrow strip of state land areas, the project takes on an in-depth dimension of the coastal territory as a planning and normative reference, based on the system of areas protected in various forms, to be able to activate functional decongestion and settlement plans that fully valorise the urban, infrastructural, rural, and natural heritage of the coastal hinterlands. For this coastal

[68] Carta dei beni culturali e paesaggistici nella Sub-Area A/6 - MSP_ADR_AMBD014_ BeniCulturali _A6

[69] http://www.sit.puglia.it/portal/portale_pianificazione_regionale/Piano%20Paesaggistico%20Territoriale

belt, the project integrates all the territorial landscape projects, by means of extensive works on the urban waterfronts, dune systems, wetlands, agriculture, peripheral urbanisation, landscape with high natural value, infrastructural links with the coastal hinterland, and fresh water navigability.

In relation to the setting covered by the MSP we wish to point out:

- **AP 1** Gargano includes the stretch of coast that goes from Marina di Lesina to Manfredonia. Despite being a unit, this setting in Puglia has varied local coastal morphologies and settlement characteristics, to the extent of justifying the identification of two distinct coastal sub-units: PC 1.1 - The region of the Lesina and Varano lagoons and the Tremiti Islands, and PC 1.2 - the Gargano coast. The landscape on the upper Gangano coast is characterised by a series of deep valleys that reach the coast and end up in the sea in a number of tight sandy shores or more extensive flood plains, interspersed with large or small promontories, covered by stretches of pine forest. Starting from the North, the area starts with the large Vico Valley with citrus groves and Aleppo pine forests on the slopes, contained by the Rodi Promontory on which the city stands, These are followed by the San Mennaio and Valazzo valleys, with their olive trees and Mediterranean scrub. Continuing along rhe coastal belt, heading East, the Calinella flood plain opens, nestled between Coppa Marzini and Monte Pucci, with stretches of bush and pine forest. An olive grove ridge stretches put from the Gargano promontory, dividing it from Calena Valley, that centres on the settlement of Peschici. This is followed by a series of wider flood plains, characterised by olive farming and bushy scrub landscape that flow together onto the beach at Scialmarino, closed inland by the bushy ridge of Gargano, broken up by slight internal ridges. Finally, the flood plain behind the coast between the Torre Porticello and Torre Gattarella promontories, closed a ridge that runs parallel to the coast, and dominated by the Vieste promontory, at which two arched coastlines converge. The agricultural territory has a tight web of terraced citrus groves, vegetable gardens, vineyards, and olive groves, some of which are very extensive, which counterpose the Mediterranean scrub and rocky pine forests on the ridges. The settlement is characterised by a system of coastal centres that surround Gargano, spread out along the road that runs parallel to the coast and at the promontories over the sea. Another characterising system is that of the coastal towers that are strategically positioned at natural outposts. The highland landscape of Manfredonia to the south, and the extensive karst highlands of Gargano, are interrupted by a long, imposing, steep mountainside, cut into deeply by erosion and valleys, which give it a greatly undulating morphology. At the foot there is another triangular shaped terrace that gets longer in the centre, as far as Monte Aquilone, with the two sides sloping down, one towards Candelaro and the other to the Gulf of Manfredonia. The landscape on this last Gargano terrace has an extensive strip of olive and almond groves on the slope at the foot of the mountainside, and a fragmented mosaic of the pedegarganiche steppe, permanent arable and prickly pear pastures, in the south. The web of traditional agricultural countryside and water / agricultural arrangements (terraces, dry walls, collection pits, etc.) are still widely present, as are the system of farmhouses and historical rural buildings. The settlements lie in a raised position along the Carbonara fault, dominating Tavoliere and the Gulf. The only settlement on the plain is Manfredonia, that runs parallel to the coast with a chequerboard urban layout. The visual - perceptive values of this setting are the privileged places for enjoying the countryside (panoramic and landscape points and roads), and great views and the main visual references that characterise it (see "The perceptive and visibility structure" map, drawing n° 3.2.12.1).
- **AP 3** Tavoliere *Schedule: Setting A3.4 I Coastal landscapes:* This runs from the south-western periphery of Manfredonia to "Il Focione di Cannapesca" and falls within the municipal areas of Manfredonia, Zapponeta, Trinitapoli and Margherita di Savoia, as well as including parts of the Cerignola municipality. At the two ends the coastline is marked by the mouths of two water courses - the Candelaro stream to the north and the Ofanto river to the south. It forms an open arc towards the Adriatic, characterised by low, sandy beaches, pebbly in places, bounded on the inland side by wetlands. Continuing along the coast from Siponto towards Margherita di Savoia, in sequence, one comes across: the remediation area of Siponto, the Frattarolo swamps, the mouth of the Candelaro river, the Daunia Risi wetlands, the Scalo dei Saraceni and Ippocampo swamps, the mouth of the Cervaro, the Posta Berardi and S. Floriano pools, the mouth of the Carapelle stream, and the Alma Dannata lakes that belong to the Salina di Margherita di Savoia Nature Reserve. Continuing on towards Zapponeta, you come to the vast S.FLoriano - Carapelle wetland system

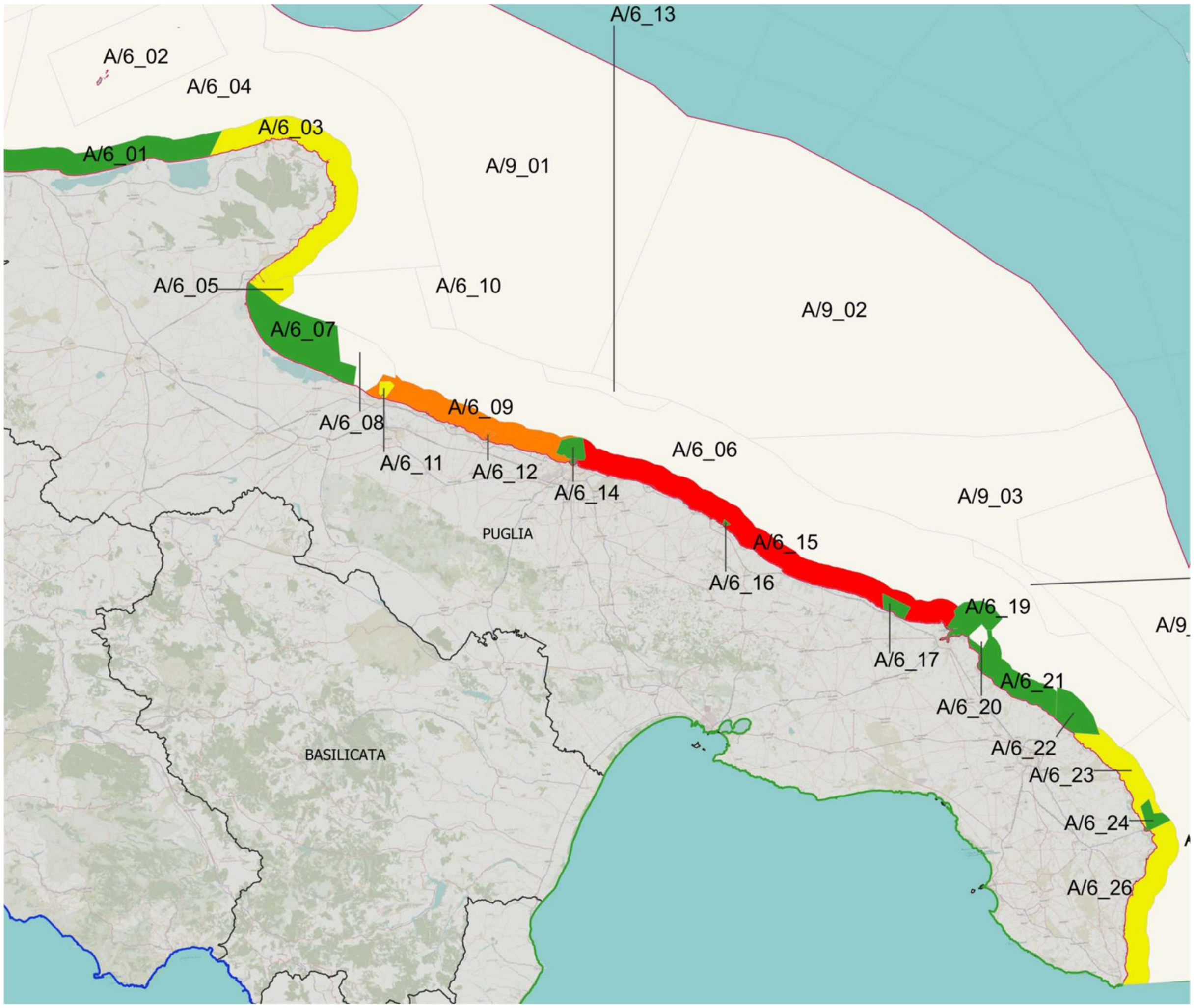
(approx 500 ha). This area has been subject to numerous remediation works what, in this case too, have almost completely deleted any traces of the rice paddies that once lay adjacent to the town. From Margherita di Savoia to the outskirts of Zapponata, for about 20 km along the SS 159, there are the largest salt pans in Europe (3871 ha), formed from remediation of Lake Salpi, of which some trace has been left of the place names in the vast salt and evaporating basins (Salpi I, Salpi Vecchio, Salpi Nuovo, Salpi V). Known since Roman times, this site was enormously important for its local economy up to the last century, and in the 18th century it employed more than 1000 workers as simple operators and "salt pan masters". In 1754 Charles III Bourbon, aware of the economic importance of the Salt Pans, tasked architect Luigi Vanvitelli with redeveloping and extending them. Today the salt production plant is still in business - albeit at a lesser level - and produces 5-6 million quintals of salt per year, heaped up in large mounds clearly visible from the road. The possibility of gathering salt led to man continually remodelling the natural characteristics of the landscape for productive purposes, by colmatage, remediation, and water channelling works, giving rise to signs and plots in the territory that show a strong will to dominate and control. From a perceptive point of view, the scenery is also highly impactful, dominated by a wide range of colours generated by the water, the salt, and reflections of the sun at different times of the day. Margherita di Savoia and Zapponata, the only towns built on the coastal road, on the sandy edge that separates the salt pans from the sea, were small centres with an economy closely connected with exploiting local natural resources. The only coastal towns of a certain size, Barletta and Manfredonia, stood at the ends of the gulf, at a safe distance from the marshy fields. Even though it did not have significant centres, this stretch of the coast was not without its functions, brought to life by a crowd of fishermen, hunters, and salt gatherers, etc. who made minute and intense use of the same. The coastal landscape that extends from the Carapelle mouth to Barletta was historically home to a rhythmic series of irrigated vegetable gardens in long narrow plots, known as "arenili", the fruit of the work of the Saline area inhabitants who, from the 18th century, set about breaking up and levelling the coastal lands to allow them to be cultivated. The "arenili" formed a vast stretch of perfectly levelled fields, with scattered homes and sheds, and intense cultivation. From a pedologic point of view, these are sandy lands, grey in colour and easy to work, with a low capacity for retaining water, and poor in nutritive elements. The coastal landscape is marked by irrigated vegetable gardens on the coast between Zapponeta and the Calendaro river as well, where the farming pattern gradually spreads out, before being interrupted by the farming grid of the Siponto remediation. Currently the coastal landscape has alternating open and built-up spaces. Various tourism - hospitality centres have sprung up on the coast between Zapponeta and Manfredonia, with mainly seasonal residential areas and equipped seaside sites. The entire settlement system of this linear coastline is now laid out along the coastal road and connected with the hinterland by a system of crossings, normally in the form of roads that run along the banks of rivers and canals.

- **AP 4 Ofanto** this runs from the village of “Il Focione di Cannapesca” to the north.western periphery of Barletta, and is included in the administrative territory of the coastal towns of Margherita di Savoia and Barletta, as well as including part of the Trinitapoli municipality. The historical river mouth landscape is the result of significant planning characterised by an approach that respect the evolutionary dynamics of the environmental systems. This early period (from the early years of the 19th century to after the second world war) was subject to the plans and works by Afan de Rivera, the integral remediation of the Opera Nazionale Combattenti (with works around the hamlet of Santa Chiara di Trinitapoli and the Margherita railway station), through to the irrigation systems and compact settlements, as well as the scattered rural hamlets of the Riforma Fondiaria (1950). The latter take the form of a road system that runs parallel to the river (on both the left and right banks), from the river mouth to Madonna di Ripalta. The entire coastal belt that stretches from the Carapelle river mouth to Barletta was historically characterised by the rhythmic series of irrigated vegetable gardens, on long narrow plots, known as "arenili", the result of the works of the Saline inhabitants, who took to breaking up and levelling the coastal lands from the 18th century, to allow them to be cultivated. The Olfanta coast was also home to a very large number of businesses associated with exploiting the marine resources. In particular, behind the beach on a rented piece of land, the fishermen would build temporary "pagliai" for fishing for squid. The entire end portion (from Candela to the river mouth) was systematically subjected to works to make it safe from water, with a double series of banks (low and full plain) used to form floodplain areas, exposed by events of flooding that occur approximately every thirty years. Along with the anthropic events that reduced the river's capacity, the small farmers of Ofanto started planting vegetable gardens and vineyards in the river's floodplains as well, to the clear detriment of the pre-existing river vegetation.

- **AP 5** Central Puglia: this extends from the north-western periphery of Barletta to Cozze (at the border between the Mola and Polignano municipalities), and lies in the administrative territories of the towns of Barletta, Trani, Bisceglie, Molfetta, Giovinazzo, Bari e Mola, includendo anche parte dei territori dei comuni di Andria, Corato, Ruvo di Puglia, Terlizzi, Bitonto, Palo del Colle, Bitetto, Modugno, Bitritto, Valenzano, Capurso, Triggiano, and Casamassima. In line with the morphological and structural characteristics of the Murge plateau, here the coastal edge is rocky with limestone or calcarenite, rather than low and sandy as is the case with most of the Adriatic coast. The rocky face is divided up by coves and inlets, near which the early cores of the seven large towns along the coast sprang up: Barletta, Trani, Bisceglie, Molfetta, Giovinazzo Bari and, further south, Mola. The Bari coastline is historically deep, and the character of the coastline has a strong influence inland, with well organised local roads radiating out, linking the intensely cultivated and inhabited countrysides (with dense homesteads and structures outside the walls) and sub-coastal towns that reach out in an orderly manner towards the sea. Over example for all is the Port of Barletta, strongly linked to inland by straight routes that head straight for the countryside. This coastal territory, full of uses and activity, was counterposed by two great settlement voids of Tavoliere to the north, characterised by lands suitable for cereal farming but historically used as pastures, and Murge to the west, with a cereal farming - pastoral calling. The compact, historical coastal centres near Bari are generally located on promontories and near natural coves used as landings. They were defended by a series of walls and castles, which provide the monumental cores of the urban space; Romanesque cathedrals, mother churches, municipal buildings, and convents. A long sequence of defensive towers breaks up the coastal space rhythmically, as it separated the cities (Torre di Pilato and Torre Olivieri on the Trani coast, Torre Calderino, Torre S. Giacomo, Torre Grillo, Torre Panunzio, Torre Ciciriello, Torre Palumbo in Molfetta, Torre Rotonda, Torre Pietre Rosse, Torre di San Matteo, Torre di S. Agostino in Giovinazzo, Torre D'Amelle, Torre Montrone and Torre a Mare in Bari). The first ring around the historical coastal towns and the coastal belt from Barletta to Polignano were once marked by the cultivation of irrigated vegetable gardens that supplied the cities' markets, fed with karstic or more or less brackish water with their final stretches almost reaching the sea, and brought to the surface by scooping waterwheels (known locally as "ngegne"). The vegetable gardens bordered on the olive groves of the outer strip, marked by the large isolated production centres (masserie - farmsteads). The multi-centred settlement and compact nature of the city - port remained both during the urban expansion stages between the 17th and 19th centuries, and during the urban additions phase of the early 20th century, in the form of hamlets laid out in a chequerboard pattern, enlivened by tree-lined avenues, piazzas, and gardens (e.g. Trani and Molfetta). The capital city's growth phenomenon fitted in with the ancient coastal settlement system, made up of a multi-centred city-port system of a certain size, without any hierarchies. Today, the metropolitan city of Bari emerges in the context described mainly due to its size, and only partly due to its role.
- **AP 7** Murgia Dei Trulli
- **AP 9** The Brindisi Plain
- **AP 10** Tavoliere Salentino
- **AP 11** Salento Delle Serre

Of relevance for the purposes of this analysis, is also the content of the Environmental Report for the Regional Coastal Plan that states: "*in many cases Puglia's coastal landscape has been greatly altered in its morphological and environmental characteristics, due to the significant anthropic transformations that have come about with at an exponential rate in recent decades. The clear manifestation of local and widespread erosion of the sandy coastlines, resulting in the retraction of the coastline, can be deemed to be the result of anthropic actions almost everywhere in the regional coastal territory*".

- Sensitivity Index (based on the concentration of cultural assets and areas of landscape interest)



A/6 is the area with the greatest richness and sensibility of landscape on the Adriatic Coast.

In **A/6**, within the reference belt, 457 assets of historical and architectural interest were censused. The greatest concentration is in A/6_15 with 274 units (256 specific cultural / architectural assets, 18 archaeological assets, and 5 underwater assets), putting it in class 5 in terms of the specific asset proportion index. In A/6_09 there were 103 assets (98 cultural / architectural assets and 5 archaeological assets) with an index value of 5. The greatest density of areas subject to landscape protection in **A/6** lie in A/6_01, A/6_14, A/6_16, A/6_22, A/6_24 and A/6_26 with 100% of their area covered by landscape / architectural assets in the reference belt (which puts this UP in class 5 in terms of areal proportion), followed by A/6_23 with 99.95%. Combining the specific and areal index values the **highest sensitivity indices** in **A/6** are assigned to **A/6_15** (value: 25), A/6_09 (value: 15) and A/6_12 (value: 12).

4.2.9.3 Land use in the belt subject to landscape protection

Reference is made to the indicator developed by ISPRA to monitor land used in the coastal belt[70] and annual land use (2019-2020) in areas bound by landscape protection[71] (ex D.Lgs. 42/2004 - art. 136). In the first case the table shows how of the Adriatic regions setting, Marche is the region with the highest value for land use in the 300 m coastal belt, with an upward trend for 2018-2020, followed by Abruzzo and Emilia-Romagna. In the second case the table shows how of the Adriatic regions setting, Veneto is the territory that has seem land

[70] https://annuario.isprambiente.it/sys_ind/697

[71] https://annuario.isprambiente.it/sys_ind/696

use in absolute terms more than any other, even though Puglia is the region with the largest percentage of land used.

Region	**Annual land use within 300 m of the coastline (2019-2020)**		**Annual land use within 300 m of the coastline (2018-2019)**	
	%	*Var % 2019/2020*	*%*	*Var % 2018/2019*
Veneto	10.8	-0.1	10.8	0.2
Friuli-Venezia-Giulia	12.6	0.1	12.6	0.3
Emilia-Romagna	35.6	0.1	35.5	0.0
Marche	46.1	0.2	46.0	0.2
Abruzzo	36.8	0.2	36.7	0.3
Molise	20.2	0.3	20.0	0.0
Puglia	29.5	0.0	29.4	0.2
Italy	**22.8**	**0.1**	**22.7**	**0.1**

Region	**Land use in areas bound by landscape protection (2019-2020)**			**Land used (%)**
	Increase (hectares)	*Increase %*	*Density m^2/ha*	
Veneto	122	0.2	1.8	8.4
Friuli-Venezia-Giulia	11	0.1	0.5	8.2
Emilia-Romagna	64	0.2	1.2	7.4
Marche	46	0.2	1.3	5.8
Abruzzo	86	0.5	1.4	2.9
Molise	34	0.4	1.4	3.7
Puglia	65	0.3	2.2	8.7
Italy	**1037**	**0.2**	**1**	**5.4**

4.3 Identification of the areas of environmental criticality and sensitivity within the territory covered by the MSP

Beginning with characterisation of the environmental context of the territory covered by the Adriatic Plan laid down in the previous pages, we will now proceed to identify the areas that, due to their intrinsic characteristics and levels of associated environmental protection, stand out as settings of particular environmental sensitivity and criticality. In addition, reference is made to the indicators presented in par. 4.2.1 in relation to the various environmental questions (biodiversity and marine environment, land, landscape, etc.).

4.3.1 Areas worthy of environmental protection within the reference territory

4.3.1.1 Marine environment and biodiversity: settings of greater sensitivity

On the topic of the marine environment and biodiversity, to define the areas of greater environmental sensitivity in the MSP Adriatic setting, reference was made first of all to the indicator that looks at the proportion in terms of percentage of the areas that fall within Protected Marine Areas, Biological Safeguarding Zones (ZTB), and Fishing and Fisheries Restricted Areas (FRAs), compared to that for the Sub-areas and the

Planning Units. For some biological safeguarding (ZTB) and Fishing Restriction Areas (FRA) that fall within the "Adriatic" Maritime Area, the non-availability of data did not allow us to demarcate these areas in the related cartography. The subject of this indicator is the waters that fall within the Protected Marine Areas (set up in terms of Laws 979/1982 and 394/1991 and s.m.i.) , and in the other types of protected areas included in the Official List of Protected Areas (EUAP), in the Biological safeguarding Zones in terms of the Decree of 22 January 2009 by MIPAAF (Official Gazette, General Series n° 37 of 14-02-2009, and in the Fisheries Restricted Area in terms of the recommendations by the GFCM-FAO (*General Fisheries Commission for the Mediterranean-Recommendation*: GFCM/41/2017/3). Sub-area A/3 has a percentage of protected marine space of 22.2%, higher than the other Sub-Areas, due to the presence of the "Outside Ravenna and surrounding areas" ZTB, and the Rete Natura 2000 sites, while Sub-Area A/4 has a percentage of protected marine space of 0,3% due to the absence of both MPA and ZTB (see Annex...). Worthy of note are the 19,7% for Sub-Area A/8 for their Fishing Restriction Area (FRA) Jabuka/Pomo Pit, and the 19.6% for Sub-Area A/6 due to their "Tremiti Islands" MPA, and the MPA “Torre Guaceto” MPA, "Tremiti Area" ZTB, "Off the Puglia Coastline" ZTB, and the Rete Natura 2000 sites (Table 4.46)

Tab. 4.46 Percentages of the Protected Marine Areas, Biological Safeguarding Zones, and Fisheries Restricted Areas compared to the Sub-Areas and the Adriatic Maritime Area Planning Unit. (Source MITE-ISPRA-MIPAAF 2019)

SUB-AREA	N. UP	SUPERF.TOT. UP (Kmq) e SUB-AREA	SUPERF.TOT. PARCHI(Kmq)	SUPERF.TOT.AMP (Kmq)	SUPERF.TOT. FRAs (Kmq)	SUPERF. TOT. ZTB (Kmq)	SUPERF.TOT. NATURA2000 (Kmq)	TOTALE AREE TUTELATE (Kmq)	% DI SPAZIO MARINO PROTETTO E/O TUTELATO RISPETTO SUB-AREA	% DI SPAZIO MARINO PROTETTO E/O TUTELATO RISPETTO ALLA UP
A/1	A/1_01	173,89	0	0	0	0	20,1233878343	20,1233878343		11,6%
A/1	A/1_02	47,17	0	0	0	12,859602	9,75	12,859602		27,3%
A/1	A/1_03	1,22	0	0,286758	0	1,22	0,246539	1,22		100,0%
A/1	A/1_04	45,85	0	0	0	0	23,81	23,81		51,9%
A/1	A/1_05	271,12	0	0	0	0	0,0655132793	0,0655132793		0,0%
A/1	A/1_06	283,66	0	0	0	0	0,1229314615	0,1229314615		0,0%
Totali		**601,85**	0	0,286758	0	14,079602	24,2449837408	**58,2014345751**	9,7%	
A/2	A/2_01	256,58	0	0	0	6,198387	9,1038132415	9,1038132415		3,5%
A/2	A/2_02	970,3	0	0	0		32,9839129542	32,9839129542		3,4%
A/2	A/2_03	669,43	0	0	0	0	222,580532559	222,580532559		33,2%
A/2	A/2_04	226,64	0	0	0	0	26,4039973936	26,4039973936		11,7%
A/2	A/2_05	1354,57	0	0	0	0	2,30014804488E-005	2,30014804488E-005		0,0%
Totali		**2122,95**	0	0	0	6,198387	291,0722561483	**291,0722791497**	13,7%	
A/3	A/3_01	58,81	0	0	0	0	3,4604982283	3,4604982283		5,9%
A/3	A/3_02	115,63	0	0	0	0	4,0924189618	4,0924189618		3,5%
A/3	A/3_03	122,7	0	0	0	6,863068	3,4989291325	6,863068		5,6%
A/3	A/3_04	305,39	0	0	0	0	304,425696422	304,425696422		99,7%
A/3	A/3_05	294,42	0	0	0	0	4,8734352187	4,8734352187		1,7%
A/3	A/3_06	300,24	0	0	0	28,622385	0	28,622385		9,5%
A/3	A/3_07	836,27	0	0	0	142,96968	0,2817556313	142,96968		17,1%
A/3	A/3_08	142,88	0	0	0	0	0	0		0,0%
A/3	A/3_09	0,71	0	0	0	0	0,6590734062	0,6590734062		92,8%
A/3	A/3_10	59,22	0	0	0	0	0,3197139384	0,3197139384		0,5%
Totali		**2236,27**	0	0	0	178,45513	321,6115209392	**496,2859691754**	22,2%	
A/4	A/4_01	356,55	0	0	0	0	3,1127550753	3,1127550753		0,9%
A/4	A/4_02	680,66	0	0	0	0	0	0		0,0%
A/4	A/4_03	325,29	0	0	0	0	0	0		0,0%
A/4	A/4_04	513,79	0	0	0	0	0,1601442389	0,1601442389		0,0%
A/4	A/4_05	538,3	0	0	0	0	0	0		0,0%
A/4	A/4_06	690,43	0	0	0	0	0	0		0,0%
A/4	A/4_07	8,83	0	0	0	0	2,220159161	2,220159161		25,1%
A/4	A/4_08	276,01	0	0	0	0	0	0		0,0%
A/4	A/4_09	5,96	0	0	0	0	5,5755892754	5,5755892754		93,6%
A/4	A/4_10	102,86	0	0	0	0	0	0		0,0%
A/4	A/4_11	4,04	0	0	0	0	1,3235420939	1,3235420939		32,8%
A/4	A/4_12	334,35	0	0	0	0	0	0		0,0%
Totali		**3837,07**	0	0	0	0	12,3921898446	**12,3921898446**	0,3%	
A/5	A/5_01	34,13	0	34,096682	0	0	33,9638679817	34,096682		99,9%
A/5	A/5_02	53,66	0	0	0	0	0,000069813	0,000069813		0,0%
A/5	A/5_03	38,51	0	0	0	0	0	0		0,0%
A/5	A/5_04	187,89	0	0	0	0	0,0053595066	0,0053595066		0,0%
A/5	A/5_05	440,03	0	0	0	0	0,3334458388	0,3334458388		0,1%
A/5	A/5_06	193,6	0	0	0	0	1,5671165933	1,5671165933		0,8%
A/5	A/5_07	2496,42	0	0	0	0	18,6248615947	18,6248615947		0,7%
Totali		3444,24	0	34,096682	0	0	54,494721328	**54,6275353463**	1,6%	
A/6	A/6_01	330,070507787	0	0	0	0	5,259806	5,259806		1,6%
A/6	A/6_02	833,172156346	0	12,98205	0	121,3692	816,319788	816,319788		98,0%
A/6	A/6_03	432,643813048	0	0	0	0	0,478618	0,478618		0,1%
A/6	A/6_04	3315,1338726	0	0	0	0	1111,238648	1111,238648		33,5%
A/6	A/6_05	52,8760369451	0	0	0	0	0	0		0,0%
A/6	A/6_06	3674,4342145	0	0	0	1,480048	25,53183	25,53183		0,7%
A/6	A/6_07	318,401342596	0	0	0	0	2,317499	2,317499		0,7%
A/6	A/6_08	135,325916243	0	0	0	0	0,004722	0,004722		0,0%
A/6	A/6_09	300,322738327	0	0	0	0	35,218332	35,218332		11,7%
A/6	A/6_10	120,608837313	0	0	0	0	0	0		0,0%
A/6	A/6_11	35,9454373888	0	0	0	0	1,750818	1,750818		4,9%
A/6	A/6_12	588,17888696	0	0	0	0	219,854356	219,854356		37,4%
A/6	A/6_13	213,838020178	0	0	0	9,743977	0	9,743977		4,6%
A/6	A/6_14	65,1142592025	0	0	0	0	0	0		0,0%
A/6	A/6_15	23,9241867342	0	21,882116	0	0	18,969255	21,882116		91,5%
A/6	A/6_16	287,106307176	0	0	0	0	0	0		0,0%
A/6	A/6_17	86,3713915229	0	0	0	0	1,998284	1,998284		2,3%
A/6	A/6_18	17,1275774624	0	0	0	0	14,123869	14,123869		82,5%
A/6	A/6_19	157,800356831	0	0	0	0	101,813005	101,813005		64,5%
A/6	A/6_20	85,5768968582	0	0	0	0	34,884188	34,884188		40,8%
A/6	A/6_21	151,274917901	0	0	0	0	30,880035	30,880035		20,4%
A/6	A/6_22	28,7300876155	0	0	0	0	5,580645	5,580645		19,4%
A/6	A/6_23	1272,04029912	0	0	0	0	0	0		0,0%
A/6	A/6_24	249,242216316	0	0	0	0	40,044537	40,044537		16,1%
Totale		**12775,2602769716**	0	34,864166	0	132,59323	2466,268235	**2478,925073**	19,4%	
A/7	A/7_01	282,41	0	0	0	0	0	0		0,0%
A/7	A/7_02	684,26	0	0	0	0	0	0		0,0%
A/7	A/7_03	477,64	0	0	0	0	0	0		0,0%
A/7	A/7_04	1532,39	0	0	0	0	6,0806079831	6,0806079831		0,4%
A/7	A/7_05	142,94	0	0	0	0	0	0		0,0%
A/7	A/7_06	656,61	0	0	0	0	0	0		0,0%
A/7	A/7_07	707,82	0	0	0	0	0	0		0,0%
A/7	A/7_08	2404,03	0	0	0	159,73793	0	159,737932		6,6%
A/7	A/7_09	3425,83	0	0	0	0	0	0		0,0%
A/7	A/7_10	791,26	0	0	0	0	0	0		0,0%
A/7	A/7_11	143,32	0	0	0	0	0	0		0,0%
Totali		**10966,1**	0	0	0	159,73793	6,0806079831	**165,8185399831**	1,5%	
A/8	A/8_01	1151,79	0	0	0	0	0	0		0,0%
A/8	A/8_02	530,56	0	0	0	0	0	0		0,0%
A/8	A/8_03	1354,51	0	0	1351,455196	1328,725	0	1351,455196		99,8%
A/8	A/8_04	3814,81	0	0	0	0	0	0		0,0%
Totali		**6851,67**	0	0	1351,455196	1328,725	0	**1351,455196**	19,7%	
A/9	A/9_01	5397,48	0	0	0	0	0	0		0,0%
A/9	A/9_02	7079,21	0	0	0	107,39589	0	107,395886		1,5%
A/9	A/9_03	2309,58	0	0	0	0	0	0		0,0%
A/9	A/9_04	1989,97	0	0	0	0	0	0		0,0%
A/9	A/9_05	817,07	0	0	0	0	0	0		0,0%
Totali		**17593,31**	**0**	**0**	**0**	**107,39589**	**0**	**107,395886**	**0,6%**	

Sub-area A/3 has a percentage of potected marine space of 22.2%, higher than the other Sub-Areas[72], due to the presence of the "Outside Ravenna and surrounding areas" ZTB, and the Rete Natura 2000 sites, while Sub-Area A/4 has a percentage of protected marine space of 0.3% due to the absence of both MPA and ZTB.

Worthy of note are the 19.7% for Sub-Area A/8 for their Fishing Restriction Area (FRA) Jabuka/Pomo Pit, and the 19.6% for Sub-Area A/6 due to their "Tremiti Islands" MPA, and the MPA “Torre Guaceto” MPA, "Tremiti Area" ZTB, "Off the Puglia Coastline" ZTB, and the Rete Natura 2000 sites. Overall, the areas of greater sensitivity are represented by Sub-Areas A/3, A/8 and A/6. As regards the percentage of protected marine space in terms of the Planning Units[73], the areas with greater protection are Planning Units A1/03, A3/04, A4/09, A8/03, A5/01, A6/02, and A6/15 (in red) with a percentage of between 84% and 100%.

These are followed by Planning Units A1/02, A1/04, A2/03, A4/07, A4/011, A6/04, A6/12, A6/18, A6/19 and A6/20 (in orange) with a percentage of protected marine space that ranges from 22% to 83%. The Planning Units with the lowest level of protection of their marine space have values that range from 0,1% to 0,9%.

Overall, the Planning Units with greater sensitivity in the Adriatic Maritime Area are:

- A1/03 due to the Miramare MPA and the Miramare and Natura 2000 Sites ZTB.
- A3/04 due to the presence of Rete Natura 2000 sites.
- A3/09 due to the presence of Rete Natura 2000 sites
- A4/04 due to the presence of Rete Natura 2000 sites.
- A8/03 due to the presence of the Jabuka/Pomo Pit FRA.
- A5/01 due to the presence of the Torre del Cerrano MPA.
- A6/02 due to the presence of the Tremiti Islands MPA, the Tremiti Area ZTB, and the Rete Natura 2000 sites.
- A6/15 due to the presence of the Torre Guaceto MPA and the Rete Natura 2000 sites.

4.3.1.2 Land: settings of greater sensitivity

The coastal erosion phenomenon has always been the most clear result of a change in the balances that regulate coastal dynamics, and especially the delicate balance between sediments that come from land that has emerged, and those that are carried out to sea by the sea's currents. Therefore, this is an essential indicator of the state of the coastal environment, from both a geomorphological and sedimentological point of view and, obviously, in terms of evolution. The sub-areas in which this phenomenon manifests itself more frequently are A/2, A/3 and A/5. The stretches of coast most marked by coastal erosion and surveyed in MITE's Coastal Project are the Eastern beaches of Jesolo and Cavallino (sub-area A/2), the Reno River coast, the Ravenna and Cesenatico beaches (sub-area A/3), the Ofanto River coastline and the Margherita di Savoia beach (sub-area A/5). For decades, to limit the coastal erosion phenomenon and to protect structures from wave motion, many coastal defence works have been constructed, often in an uncoordinated manner (mainly attached reefs, longitudinal reefs, and transverse piers) that, in most situations, did not completely produce the desired effects.

Besides identifying the stretches of coastline in which erosion is more accentuated, these works have resulted in the loss of geomorphological and sedimentological naturalness of the beaches, thereby becoming a real indicator of environmental criticality. Extensive stretches of coastline, completely reinforced by anthropic works can be found in great numbers in sub-area A/1, followed by sub-areas A/4 and A/5 (ISPRA 2022 data). For example, there are tens of piers along the coastline in Lignano Sabbiadoro (sub-area A/1), as well as along the Marina di Cavallino, Lido di Venezia and in Rosolina Mare (sub-area A/2). Along the coastlines in sub-area A/5 cliff coastal defence works are most common, and there are a few hundred mainly protecting low, sandy coastlines. The lowering of the land, known as subsidence, which can be estimated to be of the order of a few mm per year, to be found in coastal areas and on the plains, is an indicator of environmental fragility and, specifically, geomorphological fragility. This phenomenon becomes a danger factor in densely populated

[72] Carta della sensibilità del Sistema delle Aree Protette, delle Zone di Tutela Biologica e delle Fisheries Restricted Areas a livello di Sub-Area - MSP_ADR_AMBD015_Sensibilità_AMP-ZTB-FRA_SubAree

[73] Carta della sensibilità del Sistema delle Aree Protette, delle Zone di Tutela Biologica e delle Fisheries Restricted Areas a livello di UP - MSP_ADR_AMBD016_Sensibilità_AMP-ZTB-FRA_UP

and morphologically lowered coastal areas, and becomes even more relevant where combined with rising of the mean sea level due to climate changes. Subsidence monitoring has shown that, in the coastal belts in sub-areas A/1, A/2, and A/3, almost all the municipalities are subject to this phenomenon. These are added to by some municipalities in Puglia like Manfredonia, Zapponeta, Margherita di Savoia, and Lecce.

4.3.1.3 Landscape and cultural heritage: Settings of greater sensitivity

With reference to the environmental sensitivity map for the landscape component of the territory covered by the Adriatic Plan and the related table in chapter 4.2.9.2, this paragraph analyses the brief sensitivity index in relation to the concentration of cultural assets and areas of landscape interest, broken down into 5 classes, for the purpose of identifying the areas that, due to their intrinsic characteristics and associated levels of protection. stand out as settings of particular sensitivity and environmental criticality, compared to the 300 m coastal belt, for the subject being examined. As already stated previously, the methodology adopted produced an index that is not intended to be an absolute reference value, but rather to provide support for evaluation as part of this RA. The more sensitive planning units are indicated in the table below, and they have been assigned mean sensitivity index values of between 15 and 20 and a high index of 20 to 25.

Sub-Area	UP	Total sensitivity weight
A/6	A/6_15	25
A/6	A/6_09	15

For the entire Adriatic Maritime Area a single planning unit has a high brief sensitivity index, and this lies within **sub-area A/6**, related to the Puglia Region. The most sensitive UP is **A/6_15**, which covers the maritime space that corresponds to the stretch of coastline from Bari to Brindisi via Polignano a Mare. Due to the wealth and historical value of the forms of settlements, this stretch of coastline has heritage and landscape assets of great value. Besides including historical centres of singular beauty like Bari and Polignano a Mare, this stretch of coastline is characterised by the concentration of archaeological sites and assets, located along the ancient Via Traiana (Egnazia), and the particular coastal morphology of bays and promontories of the Costa Merlata.

One element of great significance, from a settlement point of view, is the imposing multi-centred track system of north Bari, structured in relation to the specific geomorphology and hydrography of the territory, which touches on the Bari shell and extends to Monopoli along the coast.

Still in sub-area A/6, the UP with a mean brief sensitivity index that follow are A/6_9 from Barletta to Bari (value 15), A/1_01, A/5_05, and A/6_12 with a mean / low index (value 12).

Going back up the Adriatic coast, in sub-area **A/5,** the UP with a mean brief sensitivity index are A/5_0 and A/5_06 at 12 and 10. These cover the maritime space that corresponds to the stretch of coastline between Abruzzo and Molise, from Pescara to Termoli. Continuing with sub-area **A/2**, the UP with a mean brief sensitivity index is A/2_03 facing the Venice Lagoon and Pellestrina Island, with architectural assets that include the old Marco Polo Battery and the Fort of San Pietro in Volta, called Belvedere, the old St. Erasmus Battery, the ancient complex of the All Saints Parish, and the suffragan church of St. Vito.

Finally, in sub-area **A/1** the UP with a mean brief sensitivity index are A/1_1, at 12 and A/1_2, A/1_5 and 10. These cover the maritime space the corresponds to the stretch of the Friuli-Venezia-Giulia coast that goes from Lignano Sabbiadoro and the Marano Lagoon, through the Isonzo Mouth Regional Nature Reserve, and the entire Gulf of Trieste, with the Miramare Castle, old city centre of the Capital of Giulia, ending at Muggia that, like Trieste, is in the list of assets declared to be of public interest. The historical porticoes of Santa Croce, Grignano, Cedas in Barcola, and the presence of a section of the historical "Meridionale" railway line are of particular landscape value, while the vistas and dynamic visuals from the train of great panoramic and landscape value are also of particular landscape interest.

This context of great panoramic value is characterised by the great long-distance views, due to the sloping morphology adjacent to the coastline, which facilitates taking in the vistas with long stretches of the coastal belt, part of the city, the sea and, in general extensive portions from the coast and Istrian ridge to the Grado Lagoon, and in to the lagoons of Veneto and the Alpine circle. Then there's the uniqueness of the dynamic visuals of the Gulf of Trieste and large portions of the coast from Viale Miramare, all along the Barcola Promenade, and from the SR 14 "Coastal Road", through to the border with the town of Duino Aurisina.

4.3.2 Areas that are polluted or that require environmental remediation

This paragraph identifies the characteristics of the SIN (Sites of National Interest) in the Adriatic Maritime Area. As is known it involves areas in which, due to human activities in the past or still in progress, an alternation in the quality characteristics of lands, surface waters and underground waters was found. These therefore can include decommissioned or active industrial areas, port areas, ex mining quarries, and dumpsites that do not conform or are abusive, as well as areas that suffered accidents in the past that involved the release of pollutant substances. For some SIN the extent includes both land and sea areas (https://sindar.it). Very often these areas have particular environmental prestige and their level of pollution results in not only a high health and ecological risk in relation to the density of the population or the extent of the site itself, but they also have a significant socio-economic impact and pose a risk to assets of historical - cultural interest (MITE, 2022[74]).

Laws, norms, and regulations of various kinds have identified the SIN over the years, in some cases, changing the contents or boundaries: the DM (Environment Ministry) n° of 18/09/2001; Law n° 426 of 9/12/1998; Law n° 179 of 31/07/2002: Law n° 388 of 23/12/ 2000, as well as others (ISPRA, 2019).

The study of the SIN in the Adriatic Maritime Area did not only cover the sites at sea, bot also those that fall within the 10 km *Copernicus coastal zone*, used and described in this RA, as a geographical / spatial reference for the land side of the coastal environment. The table below lists the SIN in the Maritime Area being studied, with their ISPRA.MITE numbering: Trieste (n° 24); Caffaro di Torviscosa (n° 25); Venezia Porto Marghera (n° 1); Falconara Marittima (n° 44); Manfredonia (n° 5); Brindisi (n° 6); and Bari Fibronit (n° 33). Of these, 2 fall into Sub-area A/1, 1 each in A/2, A/4 and A/9, and 2 in A/6.

SIN name	ISPRA-MITE Numbering	Sub-Area	Region	Province
Trieste	24	A/1	Friuli-Venezia-Giulia	Trieste
Caffaro di Torviscosa	25	A/1	Friuli-Venezia-Giulia	Udine
Venice (Porto Marghera)	1	A/2	Veneto	Venice
Falconara Marittima	44	A/4	Marche	Ancona
Manfredonia	5	A/6	Puglia	Foggia
Brindisi	6	A/6	Puglia	Brindisi
Bari Fibronit	33	A/9	Puglia	Bari

Table 4.47 Sites of National Interest in the "Adriatic" Maritime Area, with their respective sub-areas, and the regions and provinces they fall under (ISPRA-MITE 2019/2021 data).

Administratively the fall within the Regions of: Friuli-Venezia-Giulia, Veneto, Marche and Puglia, and in the Provinces of Trieste, Udine, Venice, Ancona, Foggia, Brindisi and Bari. The SIN in the "Adriatic" Maritime Area that have the largest area, adding the landward and marine components indicated in hectares in the table below, are Brindisi with about 11,500 hectares, Trieste with about 1,400 hectares (after its boundaries were redefined in 2021), and Falconara Marittima with about 1,300 hectares.

The Brindisi site, which stands out for its coastline that is about 30 km long, was home to an important petrochemical plant in the 1950s and 60s, which gave rise to numerous environmental problems due to fast, widespread pollution of the land and the underground waters. The substances found include Mercury, C>12 and C<12 Hydrocarbons, Arsenic, Cadmium, Mercury, Copper, Vanadium, BTEXS, IPA, 1,2 dichloroethane,

[74] See https://bonifichesiticontaminati.mite.gov.it/sin/inquadramento

Chorobenzene and Toluene in the land, as well as Arsenic, Manganese, Iron, Selenium, Nickel, Aluminium, Lead, Fluorides, Nitrates, Cobalt, Selenium, Chrome VI, Boron, Phenols, Total hydrocarbons, BTEXS, IPA, PCB, Halogenated aliphatic hydrocarbons, Chlorobenzene, Thallium, Chlorinated Aliphatics, and Aniline in the underground water (https://bonifichesiticontaminati.mite.gov.it/sin-6/).

SIN name	Hectares on land	Hectares at sea	Institutive laws
Trieste	190	1,196	Decree of the Environment and Territory Protection Ministry n° 468 of 18 September 2001 (National environmental remediation and reinstatement programme)
Caffaro di Torviscosa	201	-	Decree of the Environment and Territory Protection Ministry n° 468 of 18 September 2001 (National environmental remediation and reinstatement programme)
Venice (Porto Marghera)	1,618	-	Law n° 426 of 9 December 1998 (New works in the environmental field)
Falconara Marittima	108	1,165	Law n° 179 of 31 July 2002 (Environmental provisions)
Manfredonia	216	855	Law n° 426 of 9 December 1998 (New works in the environmental field)
Brindisi	5,851	5,597	Law n° 426 of 9 December 1998 (New works in the environmental field)
			Decree of the Environment and Territory Protection Ministry n° 468 of

Table 4.48 Sites of National Interest in the "Adriatic" Maritime Area, with their respective extensions landwards and seawards, and the legislative reference behind them being set up (ISPRA-MITE 2019/2021

The Trieste SIN area includes the port and industrial area south-west of the city, the Baia di Muggia marine area, the Ferriera di Servola, and some dumpsites. The current boundaries of the SIN are dominated by the presence of the Ferriera di Servola and the Port. The Ferriera di Servola was an industrial complex built at the end of the 19th century, specialising in the production of cast iron, while the port and industrial area caused a marked increase in traffic volumes at the end of the 1960s with the opening of the transalpine oil pipeline, and at the beginning of the 1970s with completion of the container terminal and, still today, there is strong growth in the intermodal railway services sector. The main environmental criticalities are due to the land and underground water being contaminated by metals, hydrocarbons, and compounds, some of which are carcinogenic. These come from the activities of the Ferriera di Servola, port activities and the transportation of hydrocarbons, degrading the marine areas due to landfill materials of various kinds, and the presence of various and real uncontrolled dumpsites[75].

The borders of the Falconara Marittima SIN involve both a marine and a land area, smaller in extent, in which residential, services sector, and industrial activities live side by side, with a great impact on the environment. Production activities have always been linked to refining and storing petroleum products, most of which by the API Refinery in Ancona and, to a lesser extent, by an industrial plant that produced phosphate fertilisers, now known as "Ex Montedison". The most severe environmental criticalities are due to widespread excess of CSC, that is Contamination Threshold Concentrations, due to the industrial / commercial use of hydrocarbons products, in both the land and the underground water. Then there's the presence of waste in the form of pyrite ash and phosphate residue, widespread exceeding of the CSC due to the industrial / commercial use of heavy metals, and exceeding of the CSC in underground waters, due to chlorinated solvents, iron, and manganese.

[75] https://bonifichesiticontaminati.mite.gov.it/sin-24

In addition, within this SIN there are other areas with pollution of both the land and the underground waters, as well as areas not yet characterised[76].

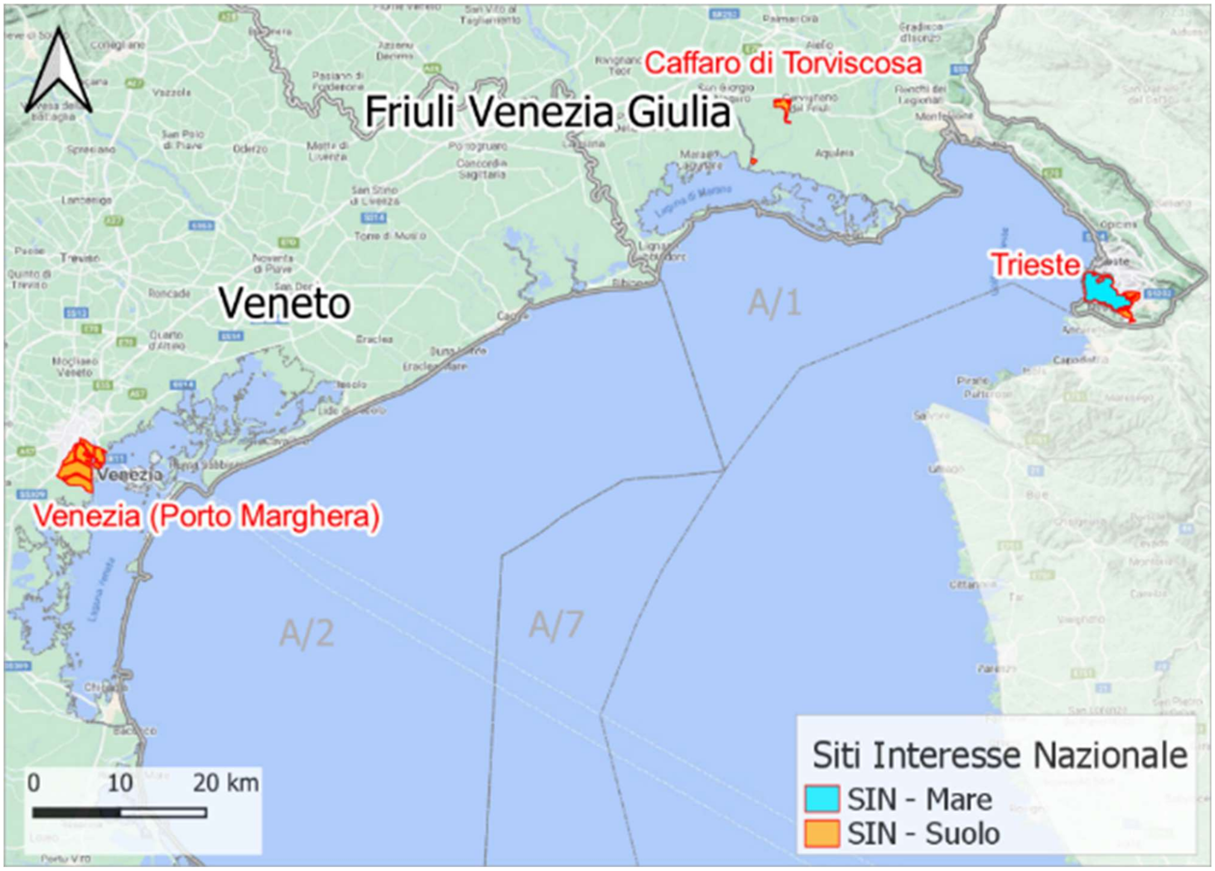


Figure 4.107 Map of the Sites of National Interest that fall within Adriatic Maritime Sub-Areas A/1 and A/2. ISPRA-MITE 2019/2021 Data – SOGESID 2022 Representation.

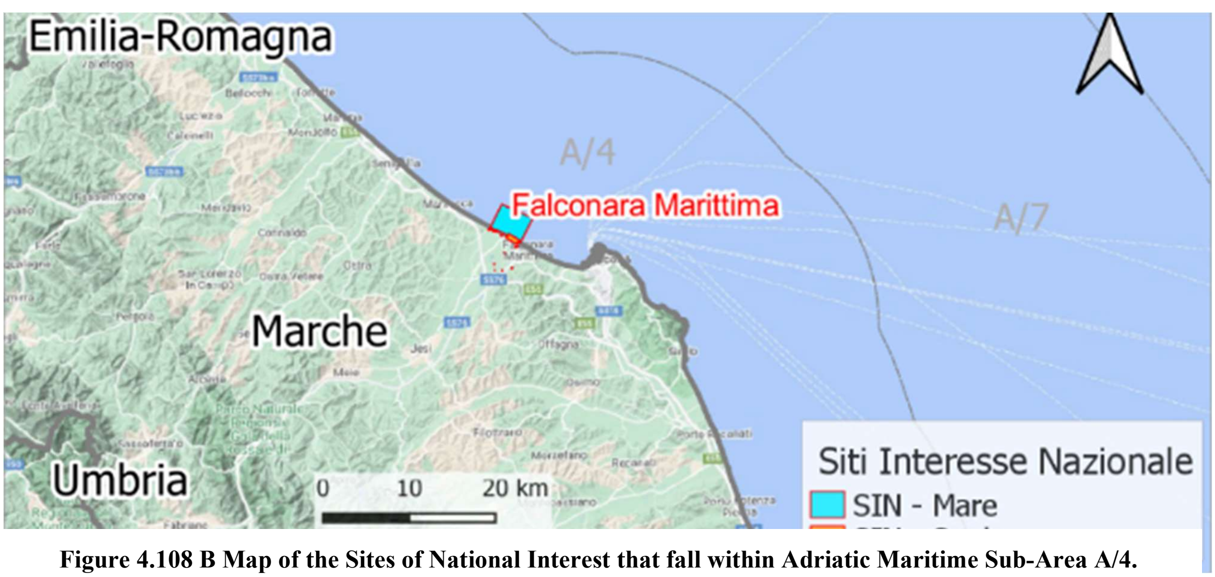


Figure 4.108 B Map of the Sites of National Interest that fall within Adriatic Maritime Sub-Area A/4. ISPRA-MITE 2019/2021 Data – SOGESID 2022 Representation.

[76] https://bonifichesiticontaminati.mite.gov.it/sin-44

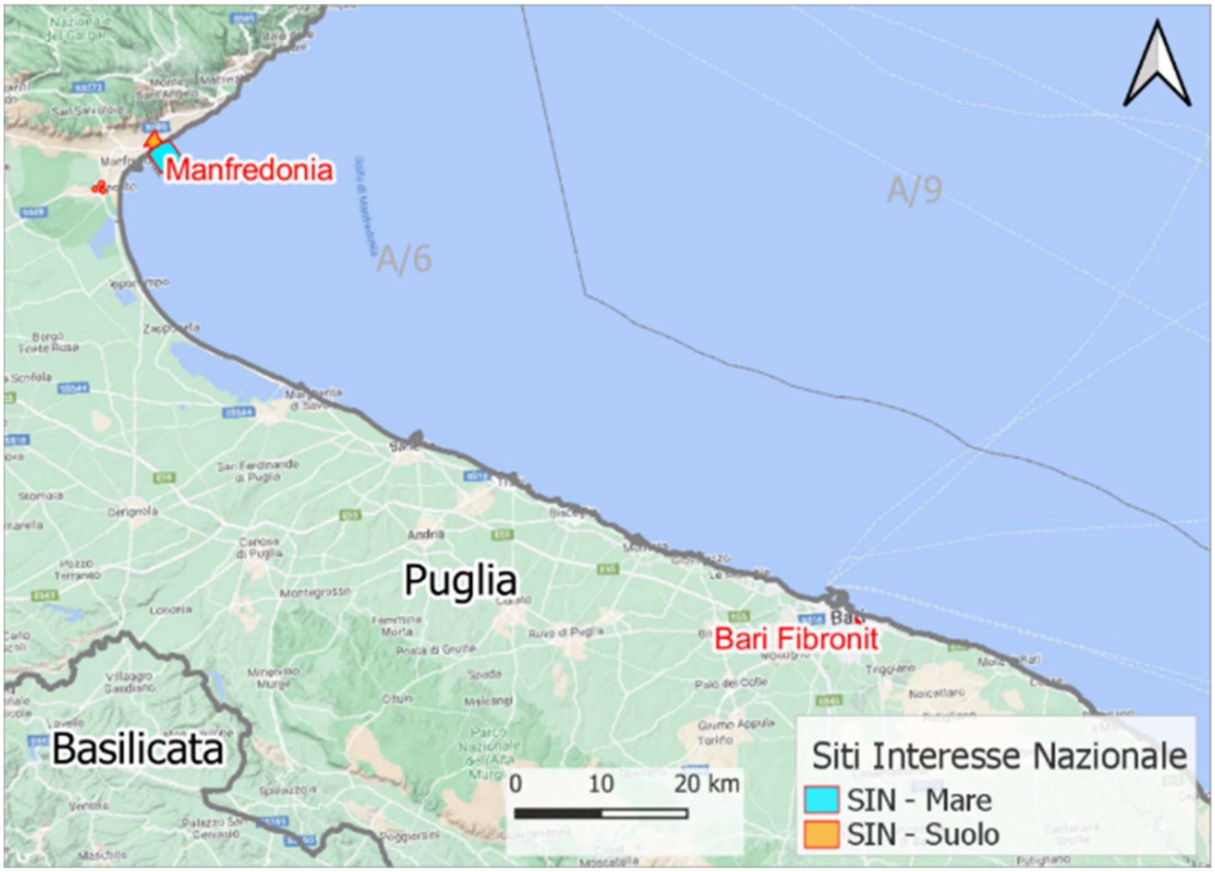


Figure 4.109 C Map of the Sites of National Interest that fall within Adriatic Maritime Sub-Area A/6. ISPRA-MITE 2019/2021 Data – SOGESID 2022 Representation.

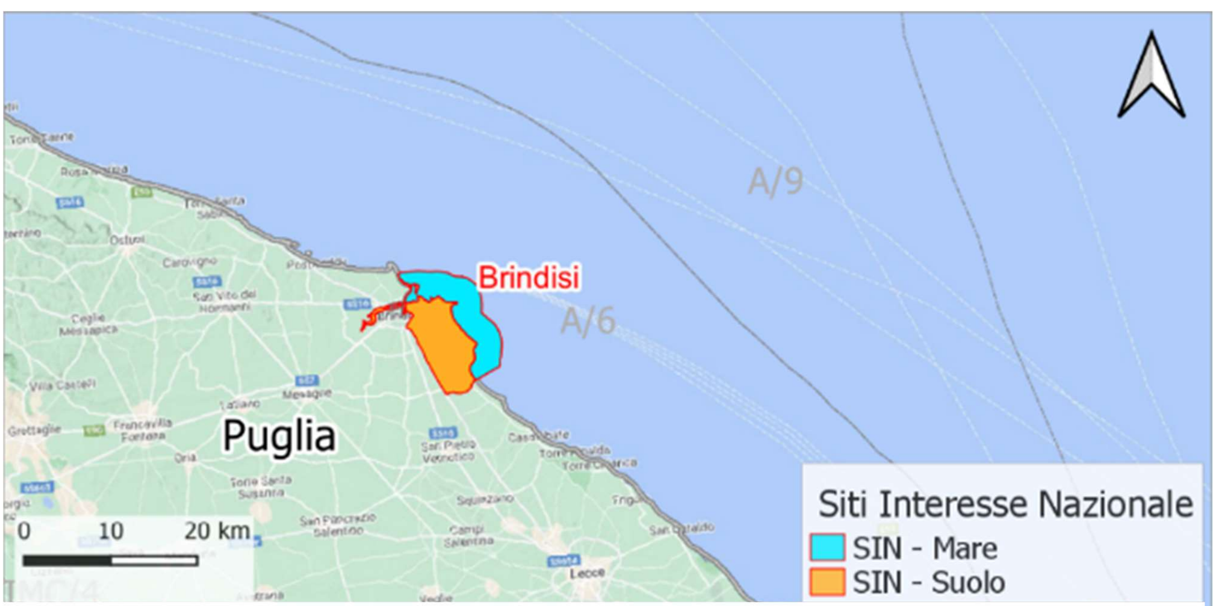


Figure 4.110 D Map of the Sites of National Interest that fall within Adriatic Maritime Sub-Areas A/6. ISPRA-MITE 2019/2021 Data – SOGESID 2022 Representation.

4.4 Possible evolution of the state of the environment in "Scenario 0"

4.4.1 Biodiversity and Protected Marine Areas

Our Country is characterised by biodiversity heritage that is among the most significant in Europe, both in terms of total number of animal and vegetal species, and for the high degree of endemism. Despite this richness, the biodiversity is diminishing rapidly as a direct or indirect consequence of human activities. In the Report in the Habitat (92/43/CEE) and Birds (2009/147/CE)11 Directives, published in July 2021, covering the six years from 2013 to 2018, critical conditions are being confirmed once again because as far as protected species and habitats in our Country are concerned, there is still a high number of unfavourable evaluations. Specifically, the scenario presents results pointing to an unfavourable conservation status for:

- ✓ 54% of the land and inland water flora (of which 13% are in a poor conservation state).
- ✓ 53% of the land and inland water fauna (of which 17% are in a poor conservation state).
- ✓ 22% of the marine species (of which 17% are in a poor conservation state).
- ✓ 89% of the land and inland water habitats (of which 40% are in a poor conservation state). However, marine habitats showed a favourable conservation state in 63% of cases, while the other 37% was unknown.

The main threats to biodiversity are the loss and fragmentation of habitats, climate changes, over exploitation of resources, such as the case with ichthyic resources, the introduction of invasive alien species, and pollution, which are causing this loss, while also damaging the natural ecosystems. Continuing in this direction would probably mean evolution of the state in the absence of a Plan, and therefore failure to apply Directive n° 2014/89/EU which sets up a framework for planning the maritime space, with the intent of promoting sustainable development of the maritime economies (so-called blue economy), sustainable development of marine zones, and sustainable use of marine resources (art. 1). In a status quo scenario, in which socio-economic activities continue unsustainability, without any change compared to today, the consequences would be a reduction in biodiversity over time, and worsening of the future of the human community.

The models put together by the Bending the Curve initiative, launched in 2018, indicate that with a radical change we have the possibility of inverting the biodiversity loss trend, already seen as being one of the most serious environmental threats worldwide. The various scenarios for bending the curve include increasing conservation efforts, which includes an increase in protected areas and integrated safeguard zones. The European Union has proposed ambitious, concrete goals for the Member States to slow climate change, in the form of the Next Generation EU, which grants was Country the resources to implement a national recovery and resilience plan, and to respect the Biodiversity and Forests Strategies, with European conservation goals to be implemented by 2030. The EU's 2030 strategy for biodiversity (SEB) aims to put Europe's biodiversity on the way to recovery by 2030, benefiting people, the planet, and the climate, and to encourage global action so that by 2050 all the world's ecosystems are reinstated, resilient, and adequately protected.

In line with the scientific and cultural world, the EU maintains that the loss of biodiversity and the climate crisis are interdependent and if one worsens the other follows the same trend. It also maintains that to attain the mitigation levels required by 2030, remediating the forests, land, and wetlands, and creating green spaces, especially in cities, are essential.

For this reason, Europe provides precise policy guidelines for implementing the SEB fir the 2020/2030 decade and, more specifically, the member states must attain the goal of:

- Create new protected areas in Europe and safeguard 30% of the Mediterranean by means of legally binding instruments, creating an efficient network of MPAs. These must be managed fairly and by applying other effective conservation measures, based on protecting the marine space (*Other Effective Area-Based Conservation Measures*, OECMs).
- Providing more rigorous protection of ecosystems, with 10% of the territory under integral protection.

- Remediate degraded ecosystems and increase the agricultural lands for biological use, to improve biodiversity. Restoration of the ecosystems has become a fundamental part of the 2050 vision of the strategy for Europe's biodiversity (*European Green Deal).*

Implementation of the Draft Directive on Marine Strategy (MSFD), which characterised the decade in question, gave a strong push forward to the marine environment. The MSFD is based on applying an Ecosystem Approach, an important tool that came out of the CDB and was adopted at the Nairobi COP in 2010, to guarantee environmental sustainability of all anthropic activities that affect the sea.

Directive 2008/56/CE, inserted in the *Acquis communitaire*, calls for an integrated approach that encompasses all the other tools and directives that, in some way, affect the marine environment, and constitute and constitute the environmental pillar of the European Union's maritime policy. The aim is that the Member States attain a Good Environmental Status (GES) for their marine waters. Originally this goal was set for 2020. Italy is one of the Countries with the greatest responsibility for attaining the Mediterranean 2030 Objectives, as its coasts fall within 3 of the 6 areas that, if protected effectively, are forecast to provide major conservation benefits: North.Western Mediterranean, Strait of Sicily, and the Adriatic Sea.

The MPAs designated to date cover 9.68% of the Mediterranean Sea, whereas those managed effectively by means of implemented management plans only cover 1.27%, and a lot still has to be done (Gomei et al. 2019). If adequately protected, the marine resources of the Mediterranean Sea could provide estimated assets of 450 billion Dollars per year. To fulfil the undertaking made, our Country must achieve the SMART (Specific, Measurable, Achievable, Relevant, Time-Bound) objectives for all the MPAs and Natura 2000 Sites, to be defined with the support of MITE and ISPRA or similar research centres. This is to increase the effectiveness of conservation of marine ecosystems and to contribute to attaining a Good Environmental Status. Effectively protecting the Mediterranean Sea means regenerating natural ecosystems, reinstating ichthyic stocks, mitigating the impact of climate changes, and ensuring a future for sustainable fishing and tourism, while at the same time ensuring the health and wellbeing of the local communities.

Marine ecosystems are ever more under pressure due to a variety of anthropogenic stress factors, which include anthropisation of the coastlines, pollutants added by rivers, over fishing, and difficulty in managing international waters, which continue to mar safeguarding of important natural resources. Effective measures are therefore required to reduce fishing pressure on the ichthyic stock levels, especially by eliminating illegal activity and valorising small artisanal fishing. This can also be taken as an opportunity to safeguard and manage protected areas and natural resources, often threatened by illicit actions that remove natural resources.

In accordance with the MSFD and SEB, the priority objectives of the Italian Maritime Space Plan (PSM) include safeguarding of biodiversity by means of effective implementation measures at both maritime area and sub-area level. Application of the plan could make it possible to run the studies necessary for monitoring marine - coastal species and habitats, not only at a maritime area level, but also for the sub-areas, for which data is still insufficient and lacking. In fact, the PSM represents an overall collective effort to promote essential actions in order to establish more rational organisation of the use of maritime space, and how its uses are interrelated, in order to balance the demand for growth with the need to protect the marine ecosystems, and to achieve social and economic goals in a transparent, planned manner.

The loss of biodiversity is one of the main environmental problems humanity is facing.

The anthropic impact has transformed 75% of natural environments on land and 66% of marine ecosystems, putting at least a million animal and vegetal species at risk, after having forced an unspecified number into extinction. *One World-One Health* sees health as one thing when it comes to comes to the connection between the human and the planetary dimensions. Human health and living well are closely tied to the vitality and resilience of the natural systems. There is only a little time left, less than a decade, to slow the decline in biodiversity. To attain this goal our Country must triple the percentage of protected land areas (we are currently at 11%) and increase the percentage of marine - coastal settings currently protected six-fold (only 5% of our seas and coastline are protected).

In the coming years we will be involved in attaining the goal of protecting 30% of our land ans sea by 2030. In this regard, application of the Maritime Space Plan could be a concrete tool for setting up the path, alliances, and strategies to achieve this goal.

4.4.2 Air and climate changes

4.4.2.1 Climatic factors

As indicated in the National Plan for Adaptation to Climate Changes (PNACC), to which you are referred for any in-depth study of the climatic scenario expected by the middle of the 21st century especially in terms of the temperature and sea level, the data from climatic simulations for the period 1981-2050 was considered, as obtained via the NEMO oceanic model (in this regard, also see Chapter 4.2.7.1.1) applied to the Mediterranean Sea (7 km resolution) and forced using atmospheric and hydrological data from the CMCC-CM climatic model at ~80 km horizontal resolution.

Configuration of the model used for these simulations, referred to as MEDSEA (see chapter 4.2.7.1.1), was developed by the CMCC Foundation and describes the evolution of the system for the RCP8.5 climatic scenario, which represents the most conservative condition, as it describes evolution of the climate for a "*business as usual*" emission scenario. Using this set-up, identified with MEDSEA, the surface temperature and sea level anomalies were characterised and analysed for the period 2021-2050 and 1981-2010, on a seasonal basis. The nomenclature used for the seasons is as follows: DJF (December-January-February) for winter, MAM (March-April-May) for spring, JJA (June-July-August) for summer, and SON (September-October-November) for autumn. The sea surface temperature anomalies indicate an increase of about 1,2°C per year for the Mediterranean basin, but the seasonal distribution provides a more detailed picture of the changes in Italy's seas (Figure). Specifically, for the reference period, the greatest increase in winter and spring temperatures in the Adriatic basin stand at values of between 1.5 and 2°C. In the summer period the anomalies are higher and widespread in the Tyrrhenian Sea (~1.5 °C), in the upper Adriatic and in the Ionian Seas. The variations in sea temperature for the spring and autumn seasons are very similar, although there are some minimal differences on a local level. The forecast sea level variations for the period 2021-2050 are presented on a seasonal basis in Figure 4.111, which clearly shows a different dynamic between the eastern and western basins of the Mediterranean, which is reflected in the forecast values for the Adriatic Sea (+6 cm) and the Tyrrhenian Sea (+8 cm). The greatest differences are found for the spring and autumn seasons, when the values for the levels of the Tyrrhenian and Adriatic Seas exceed 10 and 8 cm respectively.

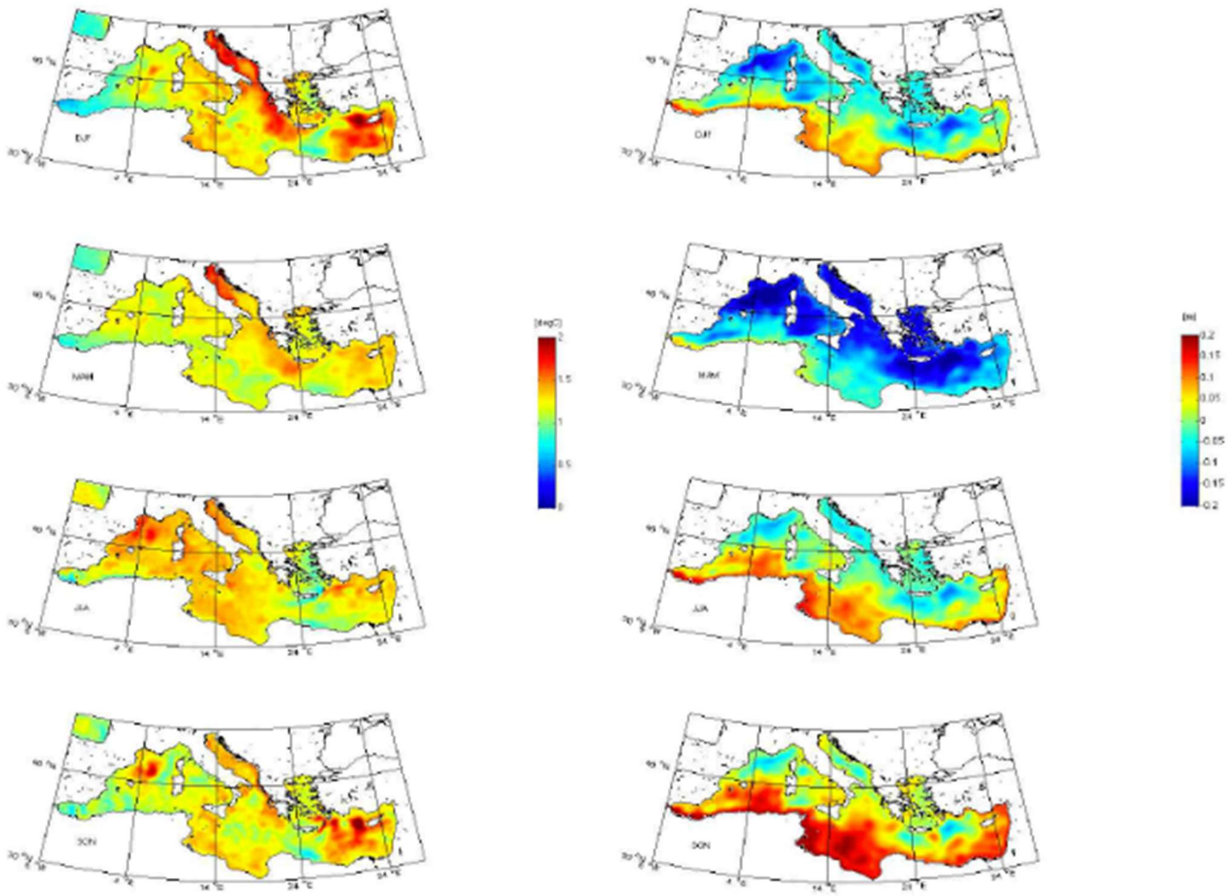


Figure 4.111 - Difference in the mean surface temperature (in °C on the left) and sea level (in metres on the right) for the 2021-2050 (scenario RCP8.5) and 1981-2010 periods, on a seasonal basis[77]
[Source: PNACC]

When the remixing indicator, calculated for the 2021-2050 period (Figure 4.112) is compared with the 1981-2010 historical trend, a substantially stationary state of the indicator emerges for the future scenario as well, despite the increase in temperature recorded. This conclusion is confirmed by the analysis of the depth of the remixing layer, which does not show significant changes in the future scenario when compared to the current climate.

[77] The panels from top to bottom represent the following seasonal sequence: DJF, MAM, JJA, SON

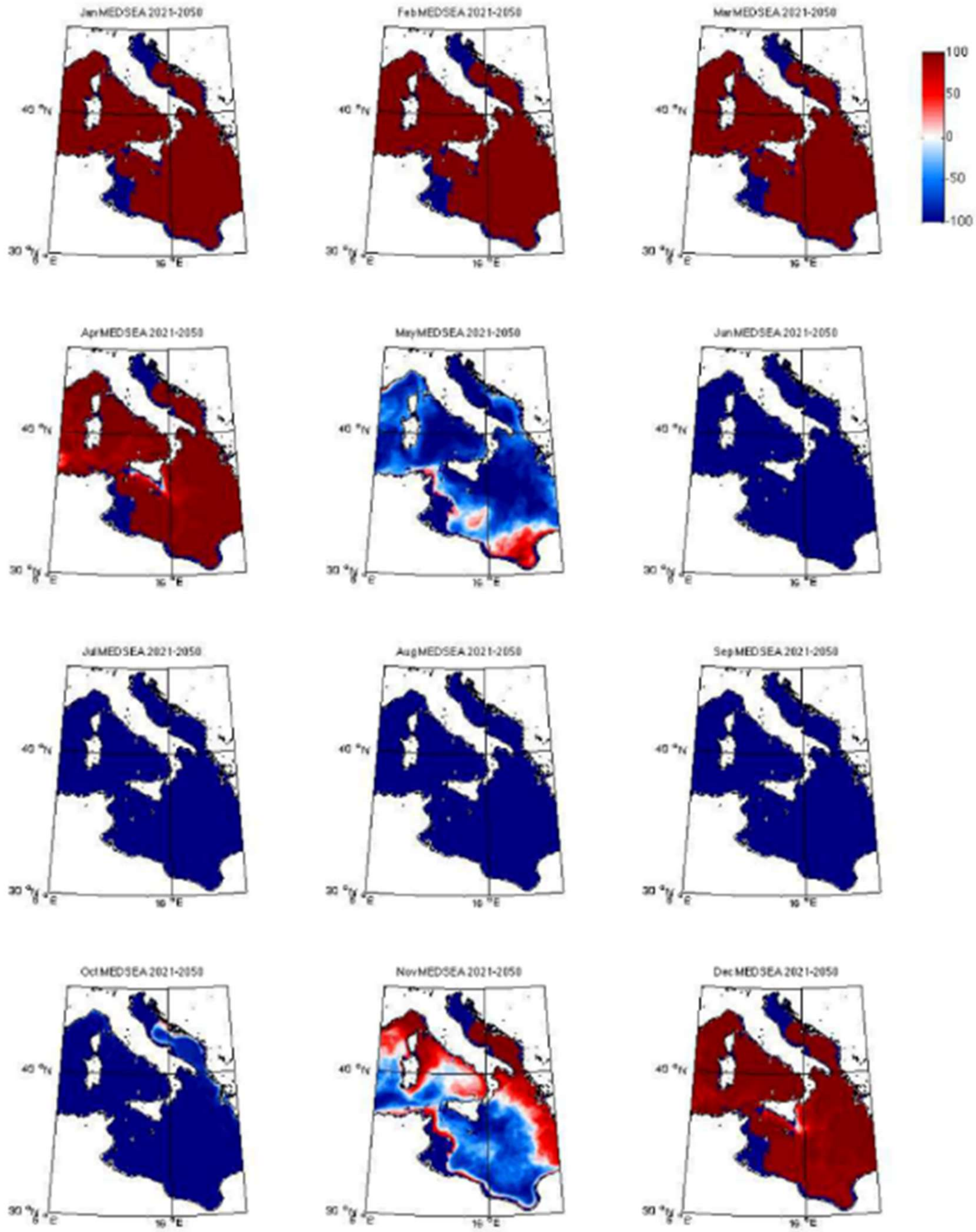


Figure 4.112 - Monthly maps of the remixing indicator
[Source: PNACC]

Comparing the sea surface water acidity scenarios, expressed in terms of pH against the full scale, for the 2041-2050 period with those for the 2001-2010 period (Figure 4.113) shows that the space-time pH variation is almost uniform in all of Italy's major seas, and the scenario shows a mean reduction of about 0.1 units. However, the northern Adriatic sub-basin is characterised by a seasonal variability, due mainly to the alkalinity added by the rivers, that reduces the pH variation for the winter period to 0.06 units.

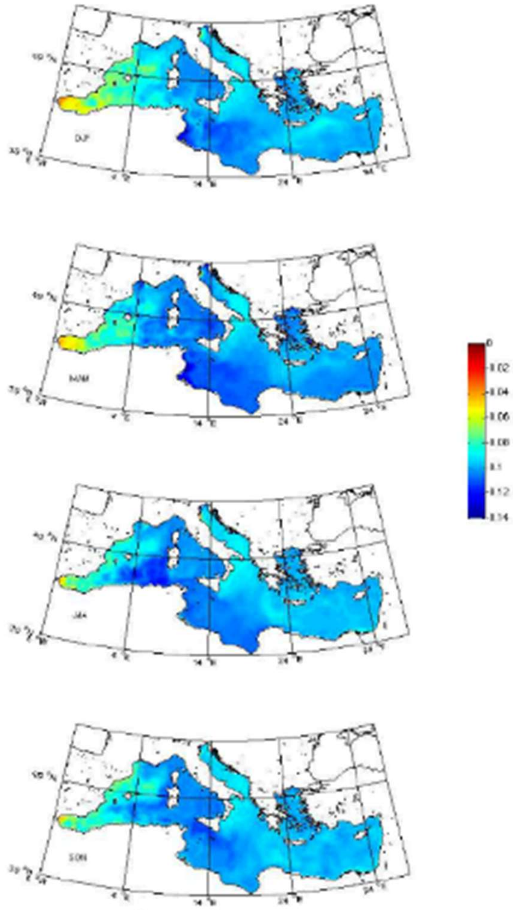


Figure 4.113 - Difference in the mean pH (full scale) value for the sea surface for the periods 2041-2050 (scenario RCP8.5) and 2001-2010 on a seasonal basis
[Source: PNACC]

For a detailed analysis of the future climatic projections for the marine areas in the coastal strip[78] one can look at the regional break down contained in the Marine Strategy Framework Directive (MSFD, Directive 2008/56/EC), which indicates five macro maritime regions for the Mediterranean: the Western Mediterranean, the Adriatic Sea, the Ionian Sea, the Central Mediterranean, and the Aegean-Levantine Sea.

The analysis that follows looks specifically at the sub-regions indicated in Figure 4.114, which correspond to the pertinent assessment areas for mixing, and are used by Italy in the MSFD 2012 Report[79] in the Central Data Repository (CDR) - EIONET.

[78] The coastal strip is taken to be the zone within twelve nautical miles from the coast, and corresponds to the territorial waters.

[79] Italy MSFD Report (2012), Assessment Areas – AA-8A01 – Physical features

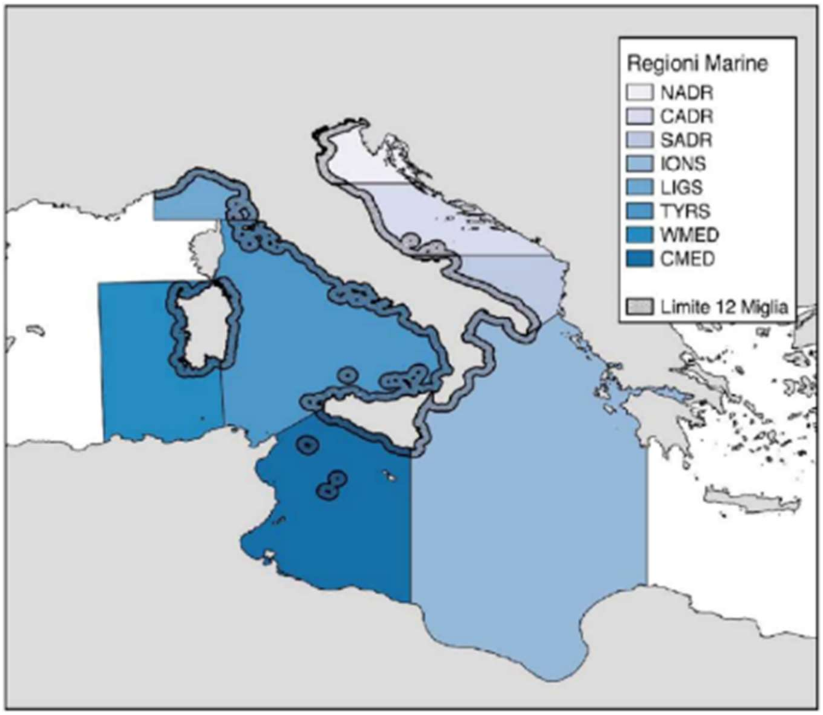


Figure 4.114 - Division of Italy's seas into specific maritime regions, for analysing future climatic projections for the maritime areas within the coastal strip
[Source: PNACC]

Figure 4.115 and Figure 4.116 respectively, illustrate the comparison between the monthly sea surface temperature (SST) and sea level (SSH) climatologies for the current climate (1981-2010) and the (2021-2050) scenario, for the coastal areas within 12 nautical miles defined in **Errore. L'origine riferimento non è stata trovata.** 4.114. For the RCP8.5 scenario, the monthly evolution of the SST shows that all of Italy's coastal areas will be characterised by an increase in temperature compared to the reference period 1981-2010. This increase ranges from a minimum of 1.3 °C in the Central and western Mediterranean and Ligurian Seas, to a maximum of 1.6 °C in the northern and central Adriatic. This increase is pretty much constant throughout the year, and so the seasonality does not change for each zone. Similarly to the surface water temperature, the increase in sea level for the RCP8.5 scenario for the 2021-2050 period characterises all the coastal areas. Compared to the 1981-2010 reference period, the values range from a minimum of 7 cm for the three sub-regions in the Adriatic basin and Ionian Sea, to a maximum of 9 cm in the Tyrrhenian and Central and Western Mediterranean Seas.

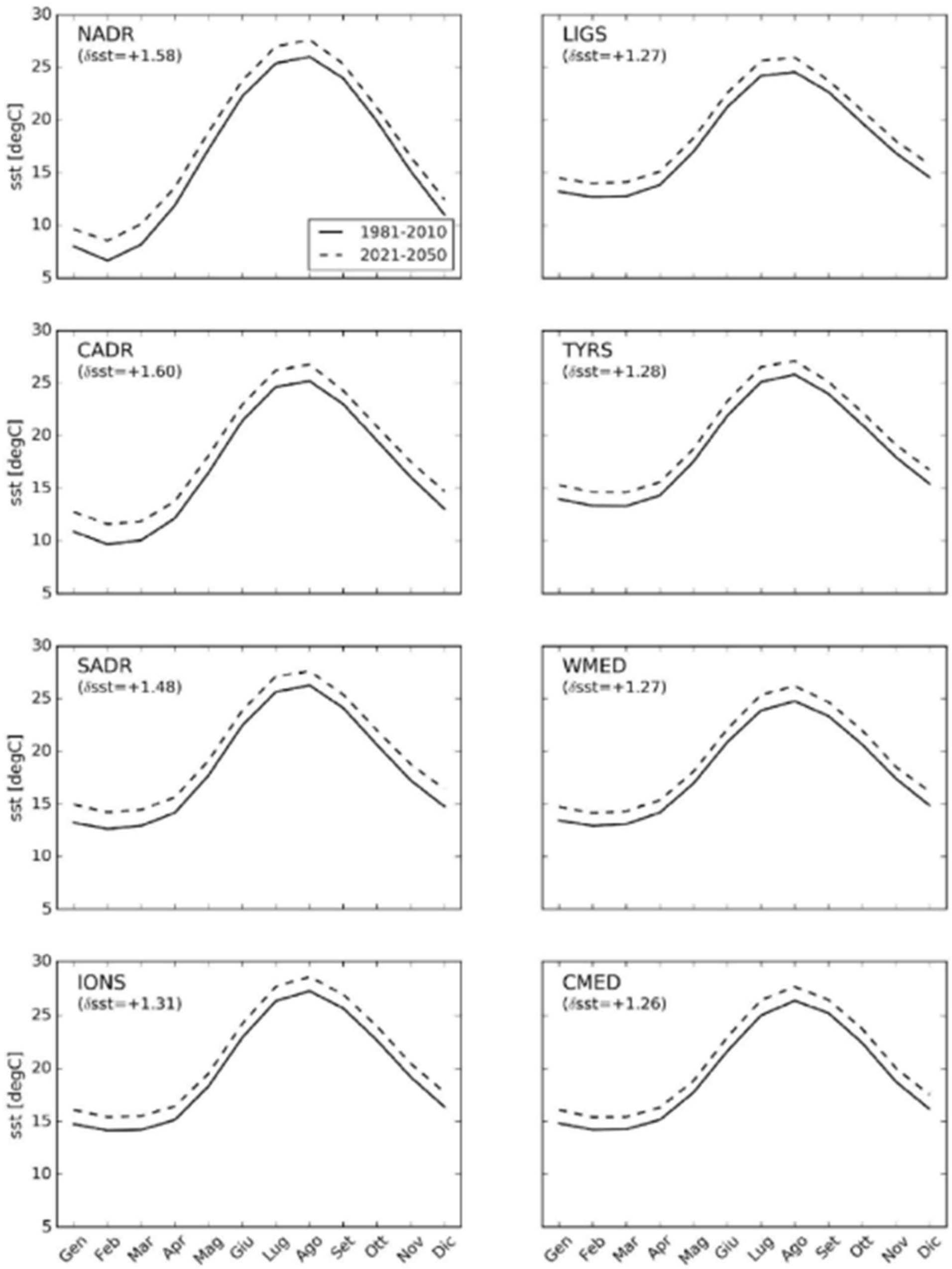


Figure 4.115 - Comparison of the monthly surface water temperature (SST, °C) climatologies between 1981-2010 (solid line) and the RCP8.5 scenario for the 2021-2050 period (dotted line) for the coastal strip within 12 nautical miles for the various maritime regions indicated in Errore. L'origine riferimento non è stata trovata. **[Source: PNACC]**

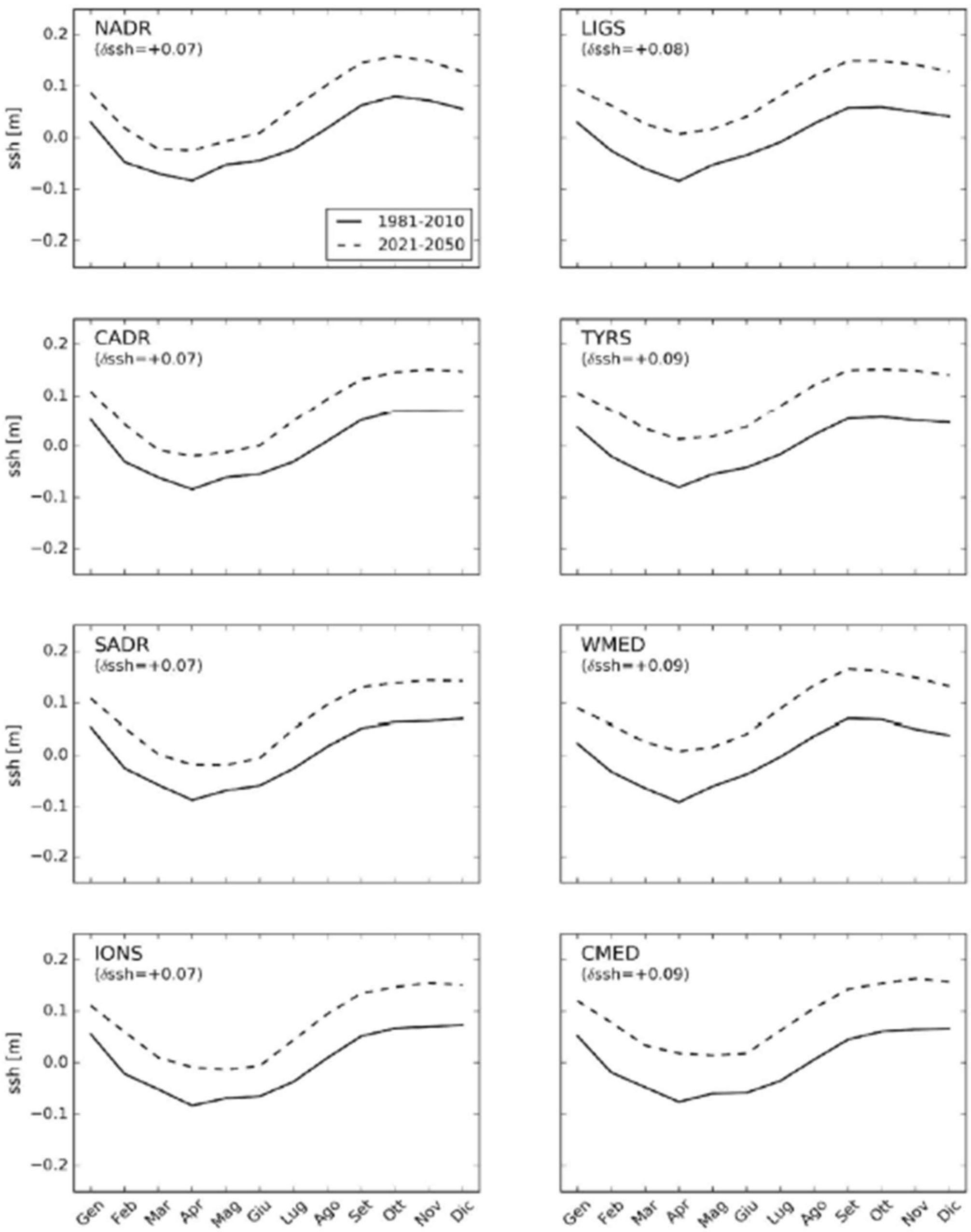


Figure 4.116 - Comparison of the monthly sea level (SSH, m) climatologies between 1981-2010 (solid line) and the RCP8.5 scenario for the 2021-2050 period (dotted line) for the coastal strip within 12 nautical miles for the various maritime regions indicated in Figure 4.114
[Source: PNACC]

A comparison of the monthly pH climatologies for the 2001-2010 and 2041-2050 periods, calculated for the coastal strip in the reference regions is shown in Figure 4.117. There is a clear uniform reduction of 0,1 units over the entire year, whereas the seasonal variability in the pH simulated for the future scenario is comparable with that for the current climate in all the coastal areas.

The remixing indicator calculated for the 2021-2050 period (Figure 4.112) is compared with the 1981-2010 period only for the coastal zones within 12 nautical miles of Italy's coast, and is analysed for the various regions identified for the MSFD (Figure 4.114). It seems that this indicator does not change for the future scenario, despite the temperature increase recorded. Only in the Central Mediterranean (CMED) sub-region does one see lengthening of the period with greater stratification (Figure 4.118 and Figure 4.119).

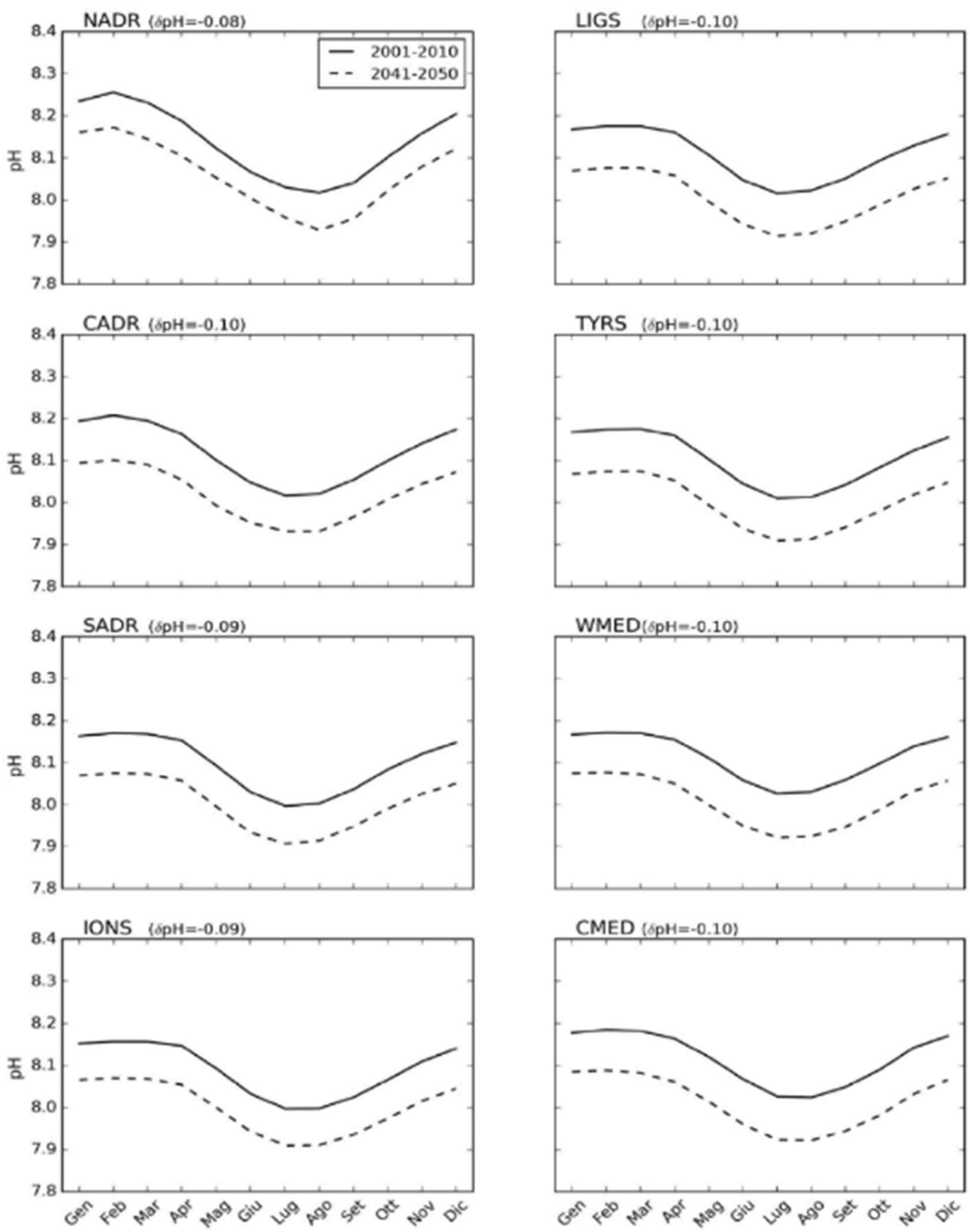


Figure 4.117 - Comparison of the monthly sea surface pH (full scale) climatologies between 2001-2010 (solid line) and the RCP8.5 scenario for the 2021-2050 period (dotted line) for the coastal strip within 12 nautical miles for the various maritime regions indicated in Errore. L'origine riferimento non è stata trovata. **[Source: PNACC]**

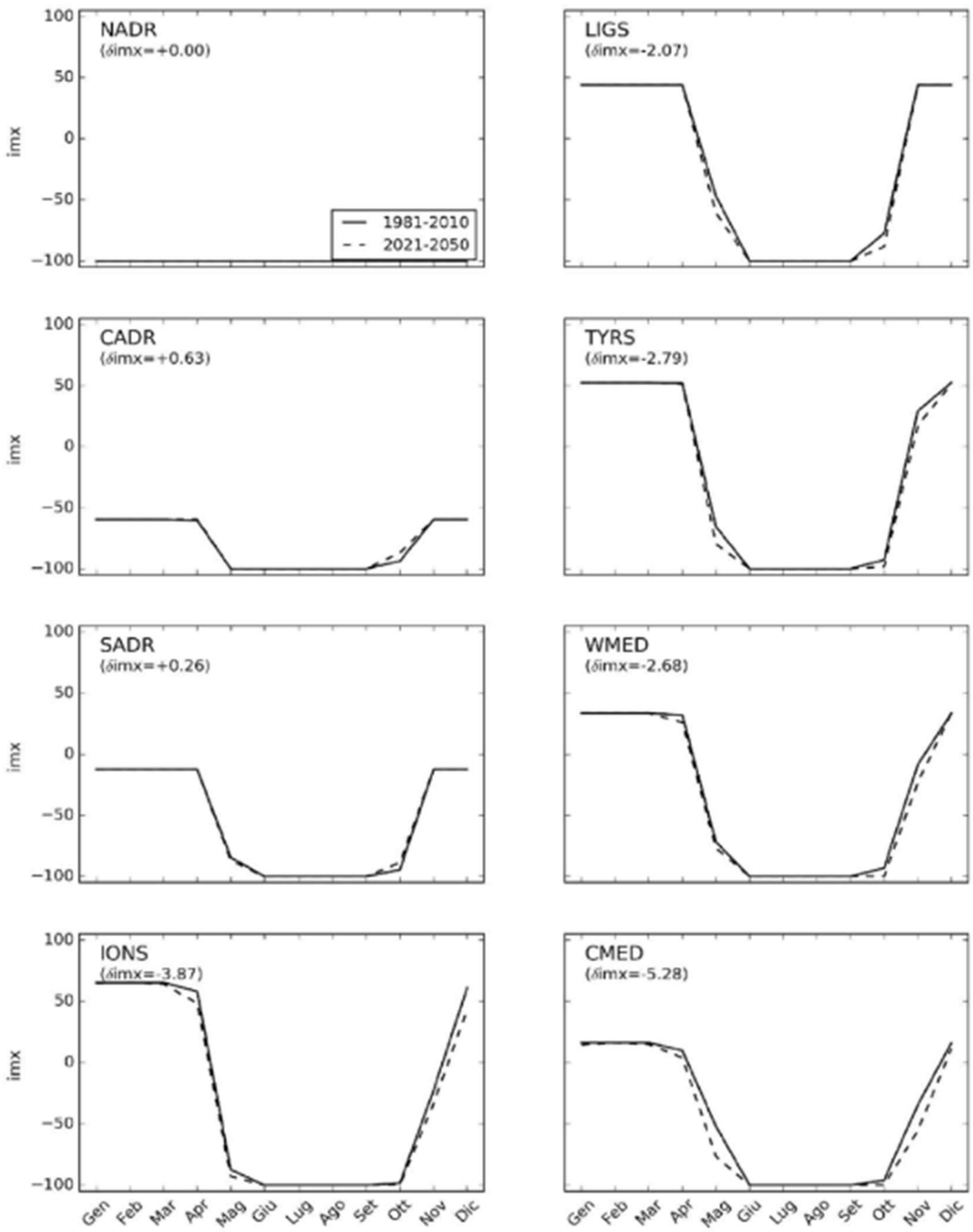


Figure 4.118 - Comparison of the monthly remixing indicator climatologies between 1981-2010 (solid line) and the RCP8.5 scenario for the 2021-2050 period (dotted line) for the coastal strip within 12 nautical miles for the various maritime regions indicated in Errore. L'origine riferimento non è stata trovata.
[Source: PNACC]

Based on what has been stated above, it is possible, as in Figure to represent the maritime climatic zoning of anomalies for the RCP8.5 scenario.

Cluster	SSTA (°C)	SSHA (m)
F	1.2	0.09
G	1.3	0.068
H	1.5	0.069

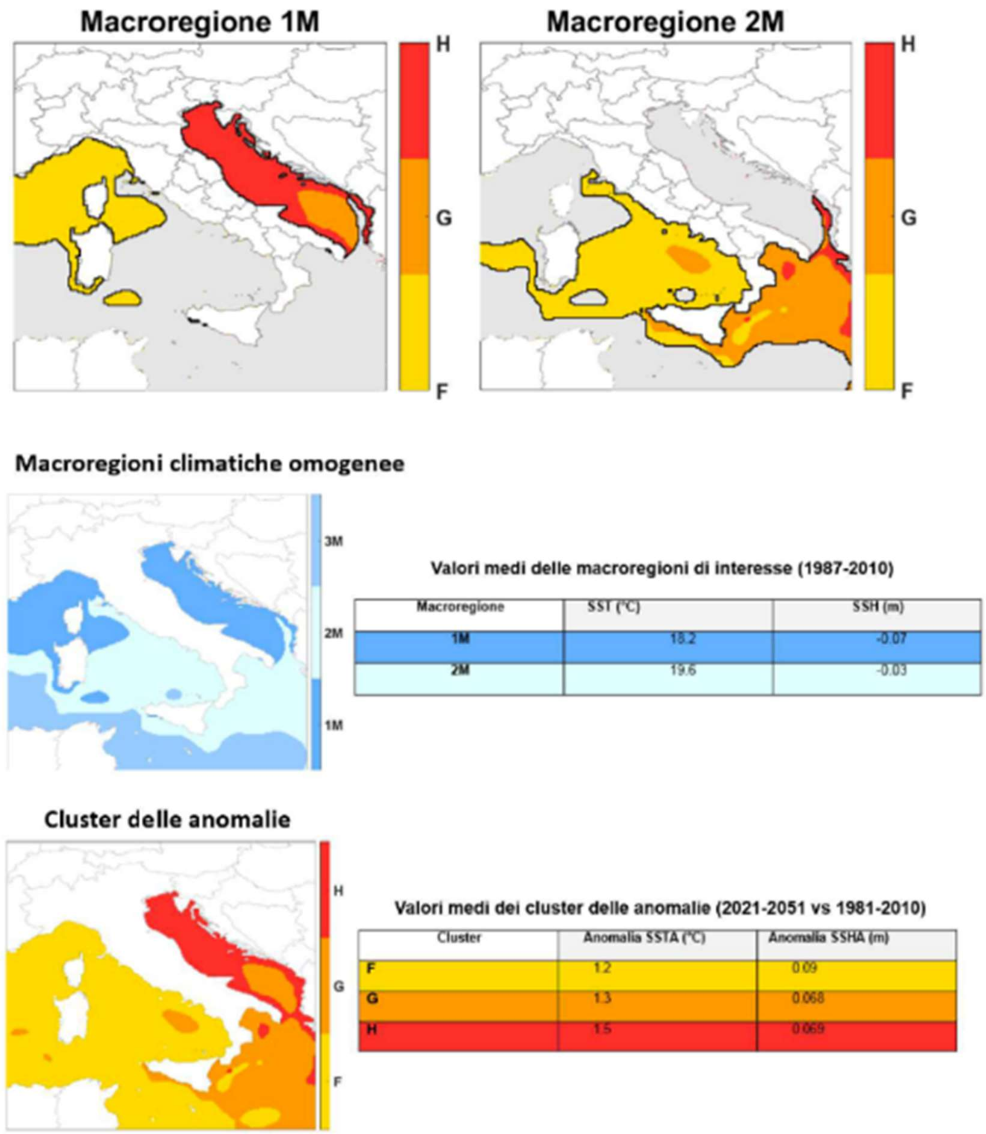
Figure 4.119 - Climatic zoning of the surface temperature (SSTA) and sea level (SSHA) anomalies for the RCP8.5 scenario (2021-2050 vs 1981-2010)
[Source: PNACC]

To facilitate identification of the prevalent anomalies for each homogeneous maritime climatic macro-region, the clusters of anomalies are shown separately below for each of the homogeneous climatic macro-regions (Figure 4.120). More specifically, zones that arise from overlaying the macro-regions (indicated by numbers) over the clusters of anomalies (indicated by letters), are defined as "homogeneous climatic areas". Table 4.49 provides a brief description of the climatic anomalies that characterise the two homogeneous climatic macro-regions that fall within the national territory (1M and 2M).

Briefly, the potential future climatic variations that affect the various Italian maritime areas are as follows:

- The **Adriatic Sea** shows the most significant change in mean temperature of +1.5 °C (cluster H), with variations for the winter and spring periods that can reach +2 °C. On the other hand, this basin shows a more limited increase in sea level of about 7 cm.
- Although they are separated into two different macro-regions, the **Ligurian and Tyrrhenian Seas** show the same characterisation of future anomalies, with an expected of an increase of 1.2 °C in temperature and of 9 cm for sea level.
- The **Ionian Sea** and **Strait of Sicily** belong to the same macro-region and show a medium increase in temperature and sea level (cluster G) of 1.3 °C and 7 cm respectively.

In addition, the future evolution of the pH of Italy's maritime areas shows a uniform reduction in the values of about 0,1 unit, that is, an increase in the acidity of the sea.



Valori medi delle macroregioni di interesse (1987-2010)

Macroregione	SST (°C)	SSH (m)
1M	18.2	-0.07
2M	19.6	-0.03

Valori medi dei cluster delle anomalie (2021-2051 vs 1981-2010)

Cluster	Anomalia SSTA (°C)	Anomalia SSHA (m)
F	1.2	0.09
G	1.3	0.068
H	1.5	0.069

Figure 4.120 - Maritime climatic zoning of anomalies (2021-2050 vs 1981-2010, scenario RCP8.5) for climatic macro-regions 1M and 2M
[Source: PNACC]

Macroregioni climatiche omogenee	Descrizione delle aree climatiche omogenee principali che ricadono nelle macroregioni considerando il Mediterraneo centrale
1M	*Cluster predominanti*: **1F, 1H** *Anomalie principali*: per la macroregione 1M si possono osservare due andamenti a seconda del bacino considerato; in particolare, l'area concentrata sull'Adriatico è caratterizzata da un aumento significativo dei valori di temperatura superficiale (1.5°C), invece la zona che individua il Mar Ligure e la parte settentrionale del Mare di Sardegna è soggetta ad un incremento significativo del livello del mare (9 cm).
2M	*Cluster predominanti*: **2F, 2G** *Anomalie principali:* per la macroregione 2M, si osserva, oltre ad un aumento generale della temperatura superficiale di circa 1.3°C, un aumento significativo del livello del mare (di circa 9 cm) che si concentra sul Mar Tirreno e sul Mare di Sardegna.

Table 4.49 - Description of the climatic anomalies for climatic macro-regions 1M and 2M [Source: PNACC]

4.4.2.2 Air and atmospheric pollution

At a national level, D.Lgs. 155/2010 that implements Directive 2008/50 on air quality and D.Lgs. 81/2018 that implements Directive 2016/2284 on reducing national emissions of certain atmospheric pollutants, calls for ISPRA to develop the energy and national production activity scenarios, while ENEA, based on these scenarios, is to calculate the projections related to polluting emissions, using the methodology used for this purpose at a European level, especially using the so-called GAINS-Italy model. The GAINS-Italy model processes scenarios for atmospheric pollutant and greenhouse gas emissions for 1990 to 2050 at 5-year intervals, and evaluates economically advantageous strategies to control multi-pollutant emissions, in order to arrive at the environmental goals related to improving the quality of the air. The emission scenarios dealt with in this chapter related to the "Baseline" scenario (also referred to as "with measures", WM_NECP) and the Policy scenario (with "additional measures", WAM_NECP), processed for the National Integrated Energy and Climate Plan (PNIEC), sent to the European Commission at the start of 2020.

The table below shows the codes for the NFR (Nomenclature For Reporting) sectors used in the scenarios.

NFR code	Description
1A1	Energy industries (Combustion in power plants & Energy Production)
1A2	Manufacturing Industries and Construction (Combustion in industry including Mobile)
1A3b	Road and Off-road Transport
1A4	Other sectors (Commercial, institutional, residential, agriculture and fishing stationary and mobile combustion)
1A5	Other
1B	Fugitive emissions (Fugitive emissions from fuels)
2	Industrial Processes and Solvent use
3	Agriculture
5	Waste
6A	Other (included in National Total for Entire Territory)

Table 4.50 – Codes for the NFR sectors considered in the emission scenarios

The results of the emission scenarios are shown in the figure below, in which the current emission trends are compared with those forecast for the "WM_NECP" and "WAM_NECP" scenarios, based on those used for the PNIEC as already stated. Details by NFR sector are also shown for the "WAM_NECP" scenario only.

In the case of sulphur oxides (Figure 4.121), the scenarios forecast a strong reduction in SO_2 emissions, driven by the energy and maritime sectors for the years 2020 and 2030, while the (1A2) industrial sector is the main emitting sector. Fishing will maintain a marginal role in terms of overall SO_2 emissions.

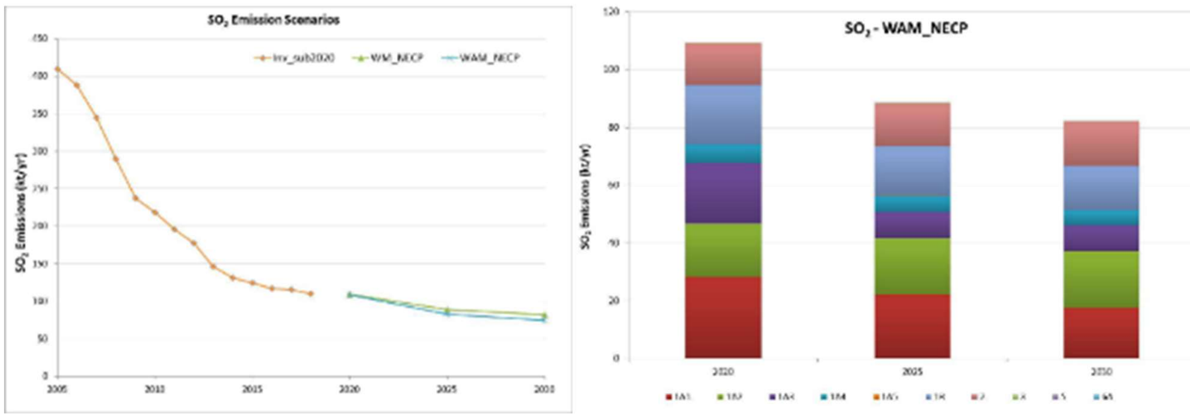


Figure 4.121 –Historical and 2030 scenario SO_2 emissions, processed using the GAINS-Italy model

For nitrogen oxides (NOx) too, a great decrease in the 2030 scenarios is estimated (Figure 4.122) due mainly to the diffusion of Euro 6 diesel and electric vehicles. In the future the road transport sector is still forecast to be the main source of NOx.

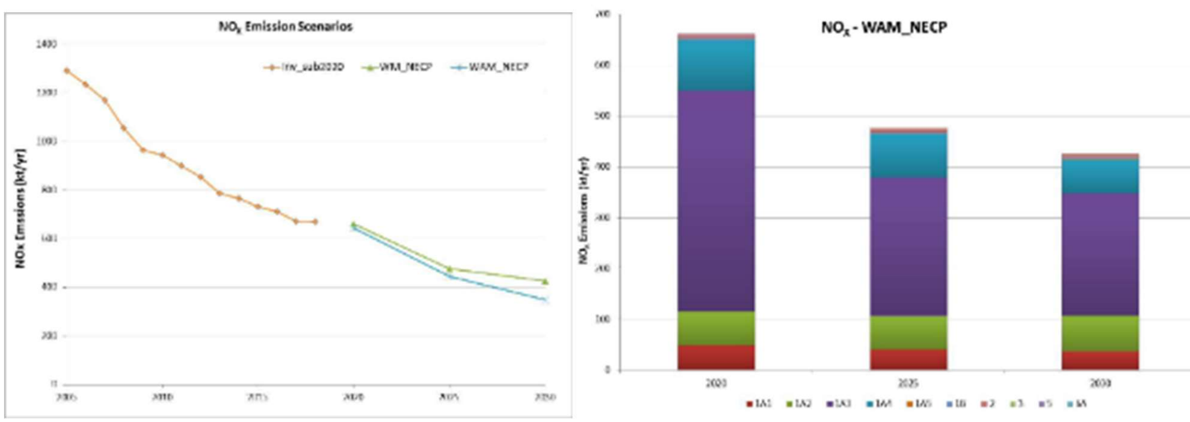


Figure 4.122 –Historical and 2030 scenario NOx emissions, processed using the GAINS-Italy model

In terms of dust ($PM_{2.5}$), the 2030 scenarios show a certain drop, even though the (1A4) civil sector will continue to make the main contribution (Figure 4.123).

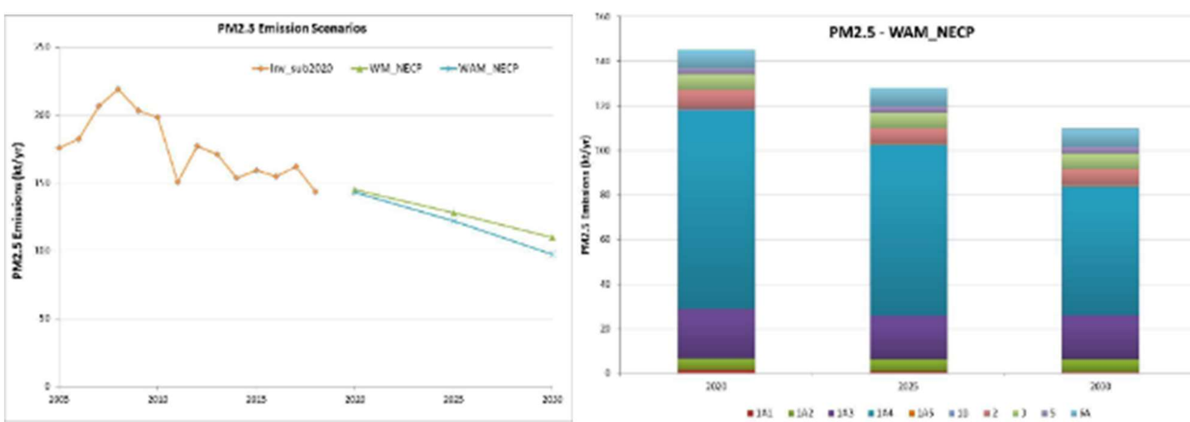


Figure 4.123 –Historical and 2030 scenario $PM_{2.5}$ emissions, processed using the GAINS-Italy model

For emissions of COVNM (Figure 4.124), there is currently a gap between historical emissions and those modelled in the scenarios (due to the estimate for sectors 3B and 3D), which will be resolved in the next updates of the emission inventories. Based on the latest estimates, the solvents sector will remain the main emitting sector anyway.

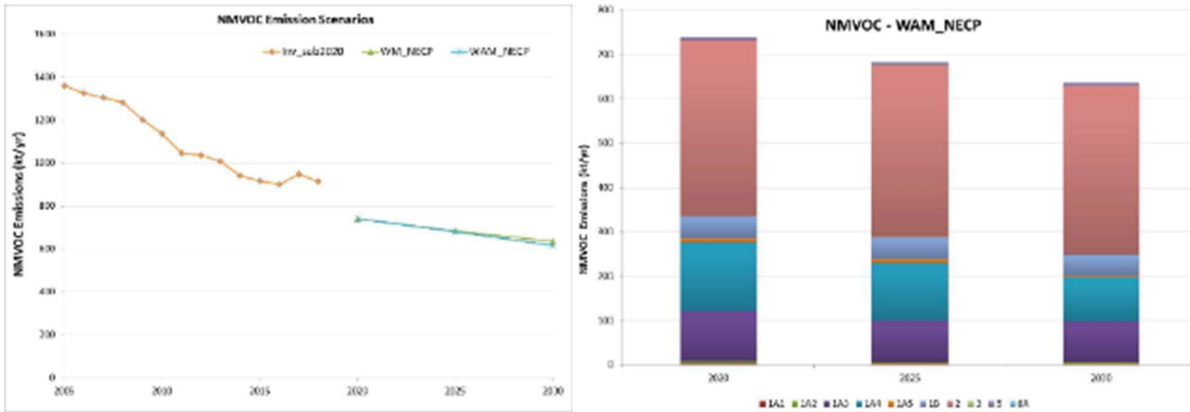


Figure 4.124 –Historical and 2030 scenario COVNM emissions, processed using the GAINS-Italy model

Finally, ammonia (NH_3) is the pollutant for which the smallest variations are forecast, originating mainly from the agricultural sector (Figure 4.125).

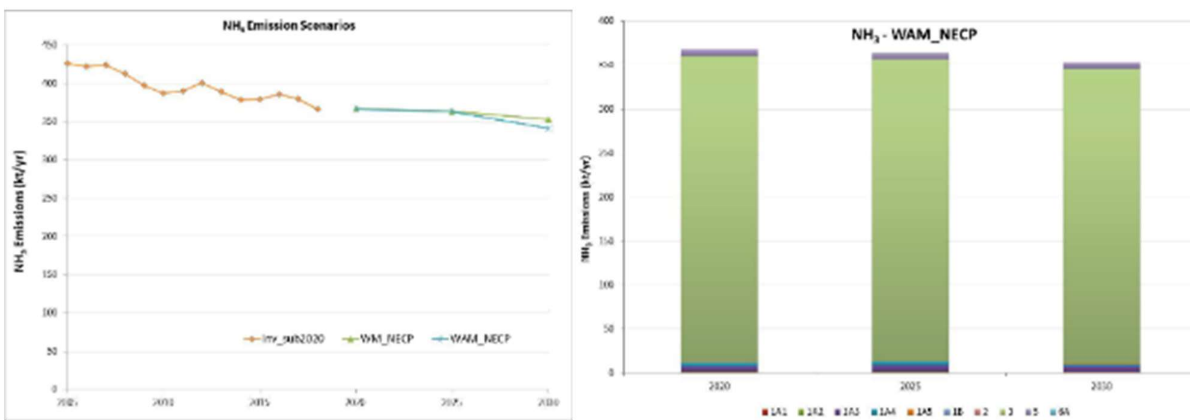


Figure 4.125 –Historical and 2030 scenario NH_3 emissions, processed using the GAINS-Italy model

As stated, Directive 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (NECD), implemented in the Italian standard by means of D.Lgs. 81/2018, sets the emission reduction goals for 2020 and 2030 for each Country, compared to the baseline year 2005, for anthropic emissions of SO_2, NOx, $PM_{2.5}$, NMVOC and NH_3. In this regard, the tables below indicate attainment of the national emission reduction goals by the years 2020 and 2030, called for by the NECD Directive, for each of the scenarios considered ("WM_NECP" and "WAM_NECP"). According to current emission projections, all the goals should be reached in 2020 as per the "WM_NECP"scenario, whereas additional measures should be adopted for the 2030 target.

	2020 EMISSION REDUCTIONS			2030 EMISSION REDUCTIONS		
	NECD targets	WM_NECP	WAM_NECP	NECD targets	WM_NECP	WAM_NECP
SO_2	-35%	-72%	-72%	-71%	-79%	-81%
NO_x	-40%	-46%	-48%	-65%	-65%	-72%
PM2.5	-10%	-18%	-19%	-40%	-37%	-45%
NMVOC	-35%	-40%	-40%	-46%	-48%	-50%
NH_3	-5%	-11%	-11%	-16%	-14%	-17%

Table 4.51 – Comparison between national emission reduction goals for 2020 and 2030, compared to the baseline year 2005, and compared with the Directive's new Goals for national emission limits (NECD)

4.4.2.3 Energy

In terms of (EU) Regulation 2018/1999 by the European Parliament and Council on the Union's governance of energy and climate-related action, at the start of 2020 Italy provided the European Commission with its Integrated National Energy and Climate Plan (PNIEC).

To support and provide a robust analytical basis for the PNIEC, two energy scenarios were developed:

1. The reference scenario that describes the evolution of the energy system, with current policies and measures, adopted up to 31/12/2016 - **BASIC scenario**.
2. The scenario that quantifies the plan's strategic goals - **PNIEC scenario**.

Since one of the PNIEC's main goals is to reduce greenhouse gas (GHG) emissions, two corresponding emission scenarios have been drawn up. The Plan's scenarios are the result of very complex work that required various players to be involved, specifically the Ministry of the Environment, Land, and sea (now the Ministry of Ecological Transition), the Ministry of Economic Development, and the Transport and Infrastructures Ministry (now the Ministry of Infrastructures and Sustainable Mobility), with technical support provided by ISPRA, GSE, RSE, ENEA and Politecnico di Milano.

Based on the scenarios developed, the combined action of policies, actions, and investments provided for in the Energy and Climate Plan determines not only in a reduction in demand as an effect of energy efficiency, but also influences how energy is produced and used, which differs from trends in the past or evolution of the system with current policies and measures.

The energy challenge poses complex problems that relate to procurement, dependency, and safety, as well as energy costs and, first and foremost, decarbonisation of the entire energy system, not only in the immediate future, but also in the long-term. Italy intends to pursue an indicative goal of reducing prime energy consumption by 43% by 2030, and final energy by 39.7% compared to the reference PRIMES 2007 scenario.

In terms of the absolute level of primary and final energy consumption in 2020, it is estimated that the indicative goals set in terms of Directive 2012/27/EU, of 158 Mtep and 124 Mtep respectively, will be surpassed. As regards the absolute level of energy consumption in 2030, Italy is pursuing the 125 Mtep goal for primary energy and 103.8 Mtep for final energy, following the trajectory shown in Figure 3, beginning from estimated 2020 consumption levels.

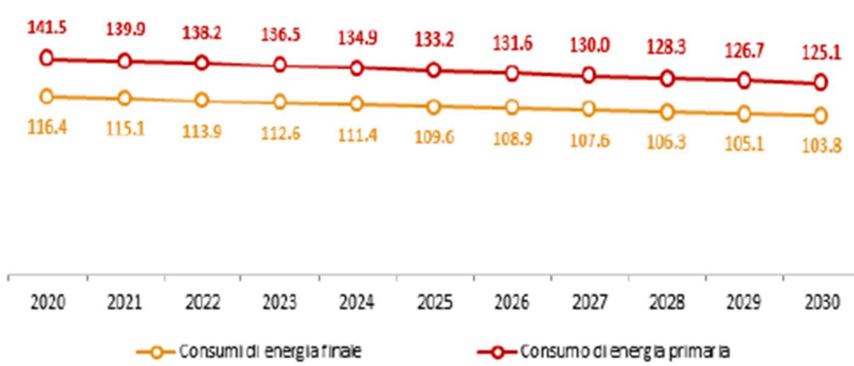


Figure 3 - Trajectory of primary and final energy consumption (Mtep) for the period 2020-2030 [Source: PNIEC Environmental Report]

The Plan's objectives and recent consumption trends taken together result in configuration of the 2030 energy system that fully satisfies the goal for reducing primary energy of 32.5%. In addition, the PNIEC introduces heightened efficiency that transforms the system and targets replacement of fossil with renewable fuels, decarbonising the national production system.

The impact of all the policies translates into less energy intensity in economic activities over time, along with a reduction in the intensity of carbon in the demand for energy over time. Energy efficiency is one of the main long-term decarbonisation factors, as can be seen from the energy intensity shrinkage continuing until 2040.

The BASIC scenario is already characterised by energy efficiency improvements, which offset the increase in consumption driven by economic growth until 2040, but these do not suffice to maintain the same rate of reduction in consumption of primary needs for the period 2010-2020. Instead, the Energy and Climate Plan's policies and measures set off an even faster reduction in energy intensity, with mean annual reductions of 2.3% for the 2020-40 period, to allow the trend of shrinkage of primary consumption to continue.

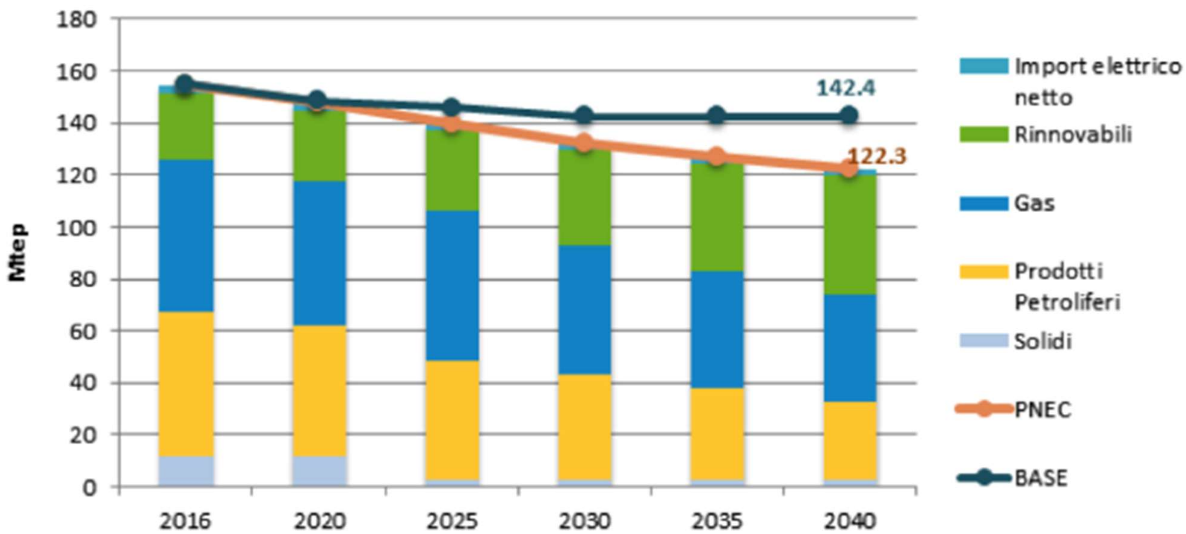


Figure 4.127 - Evolution of gross internal consumption for the BASIC and PNIEC 2040 scenarios [Source: PNIEC Environmental Report]

Renewable sources are to progressively replace the consumption of fossil fuels, to go from 16,7% of primary demand in 2016 to about 28% in the PNIEC scenario. After 2030 petroleum products will still be used for long distance passenger and goods transport, but their use is set to be significantly lower in 2040 (25% of the primary mix). This decline is to be more significant in the latter years of the scenario's projection, when petroleum for transportation will be greatly replaced by biofuels and electrically powered vehicles. The PNIEC's long-term projections see competition with RES leading to a reduction in recourse to natural fossil gas (going from 37% on 2030 to just over 33% in 2040).

In terms of final energy, the efficiency goal was developed to follow a trajectory based in the obligatory savings defined in article 7 of the EED Directive of 11 December 2018, which sets a minimum target for a reduction in final consumption of 0.8% per year for the period 2021-2030, calculated on the basis of the 2016-2018 three-year period. This is estimated to generate incremental annual savings of 0.935 Mtep in final energy, due to new actions in the 2021-2030 period, mainly aimed at the civil and transport sectors. The civil sector is identified as the main player in the actions to increase efficiency, with a reduction in energy consumption of about 5.7 Mtep compared to the BASIC 2030 scenario. More specifically, the residential sector contributes 3,3 Mtep to that reduction, while the services sector reduces projections of its consumption to 2,4 Mtep thanks to actions of upgrading buildings and installing heat pumps, as well as higher efficiency of final user devices.

Another significant contribution is to be made by the transport sector, by shifting private passenger mobility towards collective and/or smart mobility, goods transport from road to rail, and increasing the efficiency of vehicles, making it possible to contribute about 2.6 Mtep to the gap between the two 2030 scenarios.

The industrial sector will make a reduction on consumption of about 1.0 Mtep, although this should not be taken as meaning that this is a sector with reduced opportunities for action.

Of relevance in the long term are:

- Improvements to final use technologies and processes (vehicles, residential, heat recovery in industry, etc.).
- Continuing redevelopment works and insulation of buildings (given the great potential), and replacement of heat generating systems with more efficient units (heat pumps).

- Increasing electrification of final uses (especially in the transport sector).
- Limiting the increase in demand for private mobility by means of measures and investments in public collective mobility.
- Lower thermal demands for new buildings.

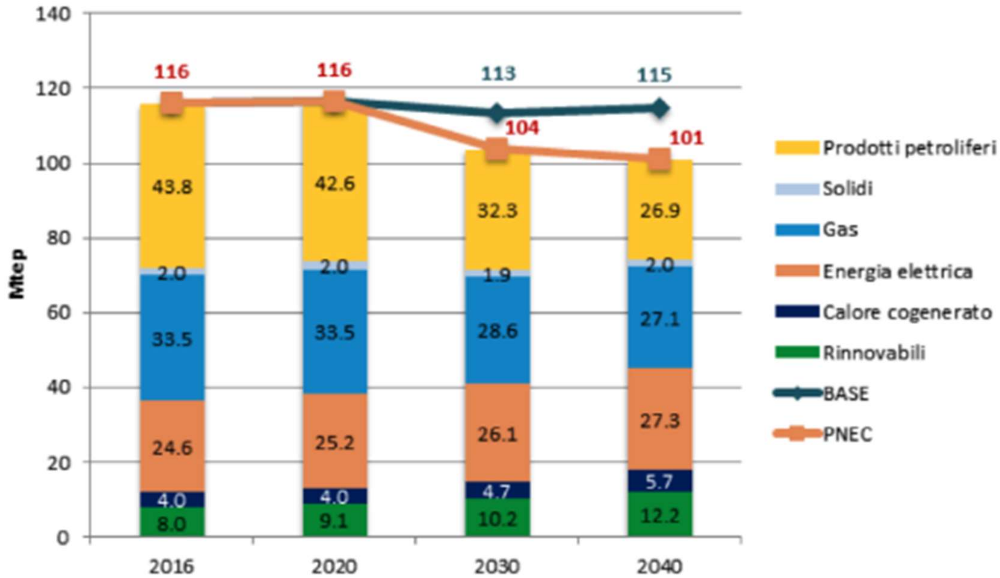


Figure 4.128 - Evolution of final consumption levels for the BASIC and PNIEC 2040 scenarios [Source: PNIEC Environmental Report]

One important driver in this scenario is decarbonisation, ever more driven by electricity generation processes. Already from the BASIC scenario, the UE-ETS mechanism favours the penetration of renewable sources in generation. The Plan's goals amplify recourse to electric RES that, for 2030, provide 187 TWh of electricity. The RES contribution continues to rise until 2040, reaching 244 TWh in production, thanks to the effects of the learning curve that sees ever lower investment costs over time, making these technologies competitive. Significant growth is also envisaged for non-programmable renewable sources, mainly solar and wind, expansion of which continues beyond 2030, and will be managed by using a significant quantity of storage systems, both on the grid (electrochemical storage and pumping), and associated with the generation plants themselves (electro-chemical storage units).

Especially in the long term, electrification plays a central role along with energy efficiency, helping with decarbonisation of the final use sectors. While the demand for electricity will increase, energy efficiency will affect how other energy vectors progress. Effectively, in 2040 the policies outlined in the Plan will continue to promote great improvement in energy efficiency in key final uses (buildings, lighting, cooling and heating, domestic appliances, and industry), as well as the replacement of fossil sources with electricity and renewable energy. As regards greenhouse gas emissions, the historical trend of national emissions and the evolution forecast for the PNIEC scenario are shown below.

Emissioni di GHG, Mt di CO_2eq	2005	2010	2015	2020	2025	2030
DA USI ENERGETICI, di cui:	**480**	**417**	**353**	**328**	**283**	**256**
Industrie energetiche	161	134	106	89	62	57
Industria	84	63	51	53	52	48
Trasporti*	128	115	106	98	95	82
Residenziale e commerciale	87	88	74	71	60	53
Agricoltura cons. energetici	9	8	8	8	7	7
Altro energia	11	10	8	8	8	8
DA ALTRE FONTI, di cui:	**101**	**87**	**80**	**78**	**75**	**72**
Processi industriali	47	36	32	32	30	29
Agricoltura coltivazioni e allevamenti	32	30	29	31	31	31
Rifiuti	22	20	19	16	14	13
TOTALE	**581**	**504**	**433**	**406**	**358**	**328**
Di cui soggetto a ESD/ESR	**330**	**301**	**274**	**260**	**241**	**216**

* Per quanto riguarda la navigazione il dato è riferito alle navi nazionali e ai movimenti nei porti, le navi internazionali non sono incluse

Table 4.52 - Historical greenhouse gas emissions up to 2015 and according to the PNIEC scenario, broken down by sector ($MtCO_2eq$) - [Source: PNIEC Environmental Report]

4.4.3 Human health and socio-economic aspects

4.4.3.1 Food safety and fishing-related aspects

The reference scenario for human health, associated with the safety of ichthyic products, represents the probable evolution of the status in the absence of the Plan, as the absence of the Plan would imply failure to identify criteria for drawing up a framework that would allow sustainable management of the activities provided for by the Plan itself. The zero option effect would therefore translate into potential continuance of current activities, without a territorial reference framework that could be used to manage interferences. As regards human health associated with food safety of fishing and aquaculture products, due to the potential arising of hypothetical new impacts, could lead to getting even further away from attaining the priority goals set by the community policies, such the "Hygiene Package". This is a set of four regulations (reg. (CE) 852/2004, reg. (CE) 853/2004, reg. (CE) 854/2004, and reg. (CE) 882/2004), dealing with food hygiene, in order to guarantee an overall, integrated approach to food safety, based on risk analysis.

Food safety is also one of the objectives of Directive 2008/56/CE (implemented in Italy by D.Lgs. 190/10), by evaluating the concentrations of contaminants in ichthyic products intended for human consumption (Descriptor MSFD - D9), which must be kept below the threshold values laid down by Regulation 1881/2006 and s.m.i. The risks to human health associated with consuming ichthyic products relate mainly to the heavy metal content in fish and biological contamination in bivalve molluscs.

As stated previously, the danger the consumer can face when consuming ichthyic products are biological (especially viruses, bacteria, and parasites), chemical (mainly environmental pollutants), and physical (presence of foreign bodies in the ichthyic product, such as fragments of plastic).

The current (2019) evaluations for metals, organochlorines, and APH in samples of fishing products shown an improvement in quality compared to the past (ISPRA, 2018). As regards, nano-plastic contamination, the EFSA highlighted the current state of a great lack of useful information for a complete risk assessment. Extremely little data is currently available in concentrations, toxicity, and toxicokinetics, dealing exclusively with microplastics, while the scientific community does not have information available yet relating to nanoplastics in ichthyic products, including fish, shrimps, and bivalve molluscs.

In Conclusion, EFSA recommends further implementation and standardisation of analytical methods for detecting micro and nano plastics, in order to evaluate their presence and quantify the levels at which they are present in foods. Further studies are also necessary, in order to find out more about the toxicokinetics and toxicity of these compounds, both in marine organisms and in man.

Application of the plan could make it possible to run the studies necessary for monitoring various types of pollutants, not only at a maritime area level, but also for the Sub-Areas, for which data is totally lacking. In general, it can be stated that failing to apply the Plan would not make it possible to carry out the actions that are expected to have positive results for human health as well.

4.4.3.2 Socio-economic aspects associated with fishing and aquaculture

The reference scenario for socio-economic aspects associated with ichthyic products, represents the probable evolution of the status in the absence of the Plan, as the absence of the Plan would imply failure to identify criteria for drawing up a framework that would allow sustainable management of the activities provided for by the Plan itself. The zero option effect would therefore translate into potential continuance of current activities, without a territorial reference framework that could be used to manage interferences. As regards the socio-economic aspects associated with fishing and aquaculture, due to the potential occurrence of hypothetical new impacts, this circumstance could result in getting even further away from attaining the priority objectives set by national, community, and international policies, such as the National Sustainable Development Strategy, the environmental and socio-economic strategies contained in the European New Green Deal, the National Biodiversity Strategy, and the Blue Economy policies.

In 2017 the European Commission identified the Blue Economy as "*A well-managed, sustainable marine and maritime economy that aims to reconcile sustainable economic growth associated with the sea with the best means of subsistence and social fairness for current and future generations, and reinforcing of transparent food systems that are reliable and safer, based on conservation of the marine ecosystems and biodiversity, and on sustainable use of the resources*". Promoting sustainable growth of maritime economies is one of the priority goals of the PCP, PSM and MSFD Directives. The National Sustainable Development Strategy (SNSvS), approved by Decision 108/2017, outlines a vision of the future and development, centred on sustainability as the shared and essential value, for tackling our Country's global challenges. Its main objective is to improve the socio-economic wellbeing conditions that characterise our Country. The latest Sea Economy Report (2021) showed how added value and employment in the sea economy, saw growth of 0.1% between 2014 and 2019. The most important sector in terms of added value and employment is tourism, while mining and recreational activities are the most marginal sectors. The ichthyic chain, which includes fishing and aquaculture, generates more than 7% of the added value, and employs almost 12% of the people. This sector is characterised by a positive evolutionary dynamic. In 2019 there were 208,606 business operating, which was up 14,7% over the 2014-2019 period. In terms of the blue economy, Italy plays its part in the effort to contain the impact of fishing on fishery resources and the marine ecosystems, pursued by the EU, acting in reducing the number of fishing vessels and engaging in fishing. The trend in the reduction in the number of boats, the power used, and the tonnage of fishing boats has continued, and the fishing regulation system is providing operators with an even more certain framework within which they can operate. Despite the slowdown recorded in 2019 (and early 2020, in which case also due to the Covid pandemic), the Coast Guard's activity of controlling fishing continues. Production by Italy aquaculture sector remains stable, while one would hope for growth to reduce dependence on importation of ichthyic products, and limit pressure applied by fishing on the ichthyic stock. The goal in Italy for 2025 regarding growth and development of the sector, could be attained by applying the Plan. Employment in the sector follows a positive trend in the leading segment (mussel farming), but is negative when it comes to fresh water production.

The impacts associated with emitting nitrogen, phosphorus, and antibiotic substances into the environment are marginal compared to those generated by other zootechnic production processes, but must be given particular attention as the pollutants are put directly into the bodies of water. Application of the Plan could make it allow definition and Assigning of Marine Zones for Aquaculture (AZA). One further fundamental objective of the MSP, in accordance with the PCP, is valorisation of artisanal fishing, which offers the best results within the ambit of consumption of ichthyic products, from a value chain point of view. In 2016 the value generated by small artisanal fishing reached 24% of the total for the sector, compared to 14% of the volume landed. This quota has remained relatively stable in recent years of observation, but reached a peak of 27% in 2011, coinciding with the peak in the catching quota. The factors that make it possible to achieve this result are the types of target species for small fishing, and the different capacity to valorise the products.

Applying the Plan could make it possible to valorise artisanal fishing and to assign AZA to reduce dependence on imported ichthyic products, and limit fishing pressure on ichthyic products, as well as implementing measures aimed at the maximum sustainable performance of fishing and controlling of illegal fishing. In general, it can be stated that failing to apply the Plan would not make it possible to carry out the actions that are expected to have positive results for the economy and social aspects of the territory.

5. Possible significant effects of the MSP on the environment

5.1 Evaluation of the possible significant effects of the MSP

5.1.1 Correlation matrix between anthropic uses of the sea, pressures, effects and environmental components

Consistently with paragraph 5.2.2 of the Preliminary Environmental Report, in order to assess the potential effects of the Plan and its impacts on the relevant environmental context, qualitative estimates were used, focusing on the description of the cause-effect interrelationships, supplemented by quantitative elements from the available physical and environmental information.

The evaluation exercise at this stage was aimed to:

- describe and estimate the potential pressures resulting from current and future sea conditions and uses, as a result of the Plan measures;
- identify the environmental issues/components potentially affected by the measures in the Plan;
- estimate the intensity and possible duration of the effects, cumulative or otherwise, on the environmental components;
- suggest possible alternatives and mitigation/compensation measures to be integrated into the Plan.

The analysis of the potential environmental effects of the Plan took into account the main interactions between the uses of the maritime space and the state of the environmental components described in the previous chapters. In order to ensure that the activities are compatible and ecologically sustainable in the medium to long term, the Preliminary Environmental Report provides an initial analysis of the interactions between sea uses and environmental components, which aimed to highlight the potential negative effects on environmental components, marine and terrestrial, from the anthropic uses of the sea, as well as to highlight the benefits from maintaining the marine environment in good condition, in order to support the achievement of good environmental status under the Marine Strategy (Framework Directive 2008/56/EC), as well as the benefits from the presence of areas of environmental protection value. This analysis of the interactions between uses and environmental components, carried out according to a risk-based approach (Stelzenmuller et al. 2020), comprising identification, analysis, evaluation phases of the interactions between uses and the environment and definition of the potential risks for the environment and for the benefits and services from ecosystems in good environmental status within the proposed Plan, has been deepened in this Environmental Report, through a more detailed identification of the potential causal factors and pressures from the anthropic uses of the sea envisaged by the Plan on a national scale. Once the factors were determined, the possible effects were outlined, i.e., the changes, both positive and negative, direct and/or indirect, potentially determined.

As a further development of section 5.2.2 of the Preliminary Environmental Report, it was deemed appropriate to provide for the structuring of the matrix designed for the purpose of assessing the interactions between anthropic uses of the sea, causal factors/pressures, potential effects and environmental themes/components not envisaging the grouping of different plan uses in a single row but maintaining only one use on each row; in order to allow a more distinctive identification of the impacts determined by each type of use, and to be able to give clear evidence of the potential effects correlated to each single use, also in accordance with the opinion expressed by the MITE, Technical Commission for Environmental Impact Assessment – EIA and SEA, SEA Subcommission. The analysis also took into account the values assigned to each effect in paragraph 5.2.2 of the Preliminary Environmental Report, to establish *a priori* whether the pressure generated by the use could give rise to positive or negative changes to the environment, in relation to whether or not the relevant environmental sustainability objectives were achieved.

This preliminary analysis made it possible to outline the implementation criteria and/or conditions capable of defining the Plan's actions in terms of their environmental sustainability, fostering the integration of environmental sustainability objectives in the implementation phase as well, even though, in some cases, it was not possible to establish *a priori* the specific value, since it strictly depends on the implementation methods and technical and territorial characteristics of the area of interest. In fact, the adaptation of the methodology to the various reference contexts makes it possible to estimate *ex-ante* the probable generation or otherwise of the identified effects and to comparatively appreciate their relative dimensions; in the implementation phase, the initial estimates can be verified through monitoring and any correction measures put into place.

On the basis of these premises, the analytical considerations regarding the assessment of the interactions between anthropic uses of the sea, causal factors/pressures, potential effects and environmental issues/components have been summed up and transformed into mutually comparable value judgments, through the assignment of scores commensurate with the intensity of the expected potential impact, according to the criteria and scale of values below:

Criteria and scores legend	
Very negative potential impact	**-2**
Negative potential impact	**-1**
Irrelevant or no potential impact	**0**
Positive potential impact	**1**
Very positive potential impact	**2**

The proposed method allows for a representation of the intensity with which a given environmental component is likely to be stressed, also as a function of an analysis of the (potential) cumulative impacts.

The matrix produces an **Environmental Compatibility Index** (**ECI**) that summarily indicates the intensity, on all the environmental components considered in aggregate, of the impact generated by each of the planned interventions or by a set of them (horizontal reading of the matrix). This index allows an integration of the cognitive framework with respect to information of a physical and/or environmental nature relative to the various contexts of analysis, in order to parameterise potential intensity (surface area of protected natural areas, species or habitats at risk, contamination, etc.). The analysis makes it possible not only to qualify the potential effects but also to establish a hierarchy of the potential impacts (negative and positive), with respect to the environmental components considered in the context analysis. This activity therefore makes it possible to identify any critical areas and/or particularly sensitive thematic components that need to be further investigated and to introduce compensation and/or mitigation measures to reduce and/or minimise potential negative impacts and enhance positive impacts, thus fostering the pursuit of sustainability objectives. The above correlation matrix constitutes **Annex VI** to the RA.

The following are some of the results of the matrix processing, including:

1. a table listing the Environmental Compatibility Index (ECI) values for the sectors/uses envisaged by the Plan; this makes it possible to visualise which environmental components are most likely to be affected by the effects (negative and positive) associated with the various uses/sectors envisaged by the Plan;
2. a table detailing the ECI values, on the basis of the main pressure factors and the possible environmental effects (negative and positive) associated with the different uses/sectors envisaged in the Plan;
3. a table that associates the main pressure factors and possible environmental effects (negative and positive) with the Plan's (national) measures and related Objectives; it can be seen that the MSP provides for measures which, to a certain extent, contain possibly negative effects and include those identified as positive, within a strategic and synergetic framework;
4. a map of the ECI values assigned to the PUs in the Adriatic Area;
5. a table that identifies the 3 Planning Units (PUs) for the Adriatic Maritime Area, to which a value of ECI < -50[80] is assigned; the expected uses/sectors for these PUs are identified, the reasons for the typological assignments adopted by the planners are highlighted, any relevant elements for the environment, landscape

[80] According to the adopted methodological approach, it is estimated that the accumulation of pressures/effects on the various environmental components may determine a potentially critical situation for the UPs as indicated

and cultural heritage are identified, the measures adopted at the Sub-Area level and the pressures/effects associated with the (priority) uses foreseen by the Plan for these PUs are summarised.

Table 5.1: Environmental Compatibility Index (ECI) associated with the different uses/sectors foreseen by the Plan; the index is obtained on the basis of pressure/effect correlation values on environmental components

uses provided for in the MSP	Water	Marine and coastal environment	Air and climate change	Biodiversity and natural areas subject to protection regimes	Landscape and Cultural Heritage	Human health and the socio-economic context	Soil	Environmental Compatibility Index
Maritime transport and ports	-4	-10	-2	-10	-1	-5	-2	**-34**
Coastal defence	-4	-5	-1	-3	-5	-1	1	**-18**
Fishing	-3	-7	1	-4	0	-5	1	**-17**
Aquaculture	-4	-5	1	-5	0	-1	0	**-14**
Energy	0	-4	3	-2	-4	0	-4	**-11**
Telecommunications	-1	-2	1	-2	0	-1	-3	**-8**
Coastal and Maritime Tourism	-3	-4	2	-4	1	1	0	**-7**
Dredged sediment immersion at sea	-1	-2	0	-1	0	0	0	**-4**
Withdrawal of relict sands	-1	-2	1	-2	2	2	3	**3**
Defence	1	0	1	0	1	0	1	**4**
Maritime Security	2	2	0	2	0	2	0	**8**
Landscape and Cultural Heritage	2	1	1	2	10	6	2	**24**
Research and Innovation	6	6	6	6	3	6	6	**39**
Environmental protection and natural resources	10	10	10	10	2	10	6	**58**

Table 5.2: ECI values on the basis of the main pressure factors and possible environmental effects (negative/positive) associated with the different uses/sectors in the Plan

Sector and intended use of the Plan	Environmental Compatibility Index	Potential causal factor/pressure	Potential effect
Aquaculture	-8	Production of waste (from effluents, sanitary treatment of organisms and treatment of underwater nets and installations	Problems of various kinds such as reduction of dissolved oxygen, alteration of organism development, intoxication; alteration of water and sediment quality; bioaccumulation of contaminants in organisms
	-7	Nitrogen and phosphorous inputs from point sources (e.g. discharges from wastewater treatment, industrial processes and aquaculture and mariculture facilities) and diffuse sources (e.g. agricultural runoff and transport emissions)	Distressed States of benthic communities and fish die-offs
	-6	Alteration of the trophic network	Inter- and intra-specific competition for food resources - Loss of biodiversity
		Voluntary and involuntary introduction of invasive species (alien and non-indigenous species)	Competition with native species, introduction of pathogenic organisms, alteration of ecosystem balances, loss of biodiversity, expansion of invasive non-indigenous species (NIS)
	-1	Alteration of the visual perception of the landscape	Visual perception of implants
	4	Effective measures and adequate funding to counter illegal activities	Sustainable use of the environment and resources
	10	Regulating the uses of maritime space	Sustainable use of the environment and resources
Defence (military uses)	-3	use of sonar for military exercises	Disturbance of fauna, removal and disorientation of fauna
	-2	Noise emissions and vibrations; variation of noise levels	Disturbance of fauna, removal and disorientation of fauna
	9	Regulating the uses of maritime space	Sustainable use of the environment and resources
Coastal defence	-8	Restoration and protection of dunes	Heavy vehicles and machines used to transport materials, in the absence of suitable access routes, can cause: direct destruction of plant communities, mobilisation of stabilised sands and soil compaction
	-5	Implementation of rigid defence systems	Changes and/or loss of habitat, resulting in non-negligible effects on the composition of benthic communities present in terms of diversity, abundance and biomass, and on trophic structure
	-3	Construction of new works visible from the coast	Impact on visual perception of the landscape
		By-pass systems	Increased resuspension and thus turbidity of water in the vicinity of the intervention area
	-2	Beach nourishment	Temporary increase in suspended particulate matter, smothering and burial phenomena, alteration of the beds on which the populations are settled, alteration of population and decrease in trophic resources
	-1	Implementation of rigid defence systems	Impact on visual perception of the landscape
	4	Implementation of rigid defence systems	Ability to facilitate the aggregation of mobile fauna, mainly fish, by providing food availability, shelter from predators and suitable sites for reproduction and recruitment
Energy	-9	Pollutant releases, accidental or otherwise	Problems of various kinds such as altered development of organisms, intoxication; altered water and sediment quality; bioaccumulation of contaminants in organisms
	-6	Seabed alteration (abrasion, sealing, dredging)	Loss of seafloor, loss of biodiversity

	-5	Altered sedimentary rates, sedimentological imbalances of various kinds; changing hydrodynamic conditions	Benthic species and habitats smothering, alteration of species life cycles
	-4	Altered sedimentary rates, sedimentological imbalances of various kinds; changing hydrodynamic conditions	Benthic species and habitats smothering, alteration of species life cycles
	-3	Noise emissions and vibrations; variation of noise levels	Disturbance of fauna, removal and disorientation of fauna
		Construction of offshore wind farms	Impact on visual perception of the landscape
	-2	Construction of wind power plants	Disruption of migratory routes, impairment of the bird population
	-1	Construction of wind/photovoltaic systems	interference with cultural heritage
	1	Construction of wind/photovoltaic systems	Renewable energy production
	5	Construction of offshore wind farms	Creation of fish restocking areas
	11	Regulating the uses of maritime space	Sustainable use of the environment and resources
Dredged sediment immersion at sea	-4	Generation and development of turbidity plumes (surface and bottom) during spillage	Benthic species and habitats smothering, alteration of species life cycles
Landscape and Cultural Heritage	3	Promoting the networking of coastal maritime heritage assets	Efficient use of coastal maritime heritage assets
		Restoration of assets of high historical and architectural value	Enhancement of the historical and architectural value of assets
	4	Interventions aimed at the protection and enhancement of coastal areas of high landscape value	Enhancing the landscape value of high-value coastal areas
	6	Promoting the culture of the sea and shipping	Increasing the degree of awareness on the part of users
	8	Regulating the uses of maritime space	Sustainable use of the environment and resources
Fishing	-6	Abrasion and/or alteration of the seafloor with fishing gear (trawl nets, dredges, turbo blowers)	Loss of biodiversity, damage to benthic habitats, removal of benthic species
		By-catch, overfishing	Loss of biodiversity, reduction of fish stocks
		Ingestion of waste and/or entrapment, intoxication; increased presence of waste	Mortality of or damage to fauna
		Fishing pressure and overfishing	Inter- and intra-specific competition for food resources - Loss of biodiversity
	-5	Alteration of the trophic network	Inter- and intra-specific competition for food resources - Loss of biodiversity
		Waste production	Problems of various kinds such as altered development of organisms, intoxication; altered water and sediment quality; bioaccumulation of contaminants in organisms
	8	Regulating the uses of maritime space	Sustainable use of the environment and resources
	9	Effective measures and adequate funding to counter illegal activities	Sustainable use of the environment and resources
Withdrawal of relict sands	-7	Seabed alteration (abrasion, sealing, dredging)	Loss of seafloor, loss of biodiversity
	-5	Altered sedimentary rates, sedimentological imbalances of various kinds; changing hydrodynamic conditions	Benthic species and habitats smothering, alteration of species life cycles

	-3	Noise emissions and vibrations; variation of noise levels	Disturbance of fauna, removal and disorientation of fauna
	8	Extraction of material to combat coastal erosion (beach nourishment)	Beach Profile Reconstruction
	10	Regulating the uses of maritime space	Sustainable use of the environment and resources
Environmental protection and natural resources	11	Increased protection of ecosystems (including deep sea ecosystems), habitats and species	Preserving biodiversity, ecosystem processes and functions
		Effective measures and adequate funding to counter illegal activities	Sustainable use of the environment and resources
	12	Management measures	Preserving biodiversity, ecosystem processes and functions
		Regulating the uses of maritime space	Sustainable use of the environment and resources
		Restoration and restoration of ecosystems	Preserving biodiversity, ecosystem processes and functions
Research and Innovation	13	Analyses aimed at the acquisition of environmental data (e.g. biocenotic maps, species distribution, hotspots)	Increased knowledge of and effects on the environment
		Funds for scientific research	Increased knowledge of and effects on the environment
		Regulating the uses of maritime space	Sustainable use of the environment and resources
Maritime Security	8	Surveillance of maritime traffic	Increasing safety conditions in maritime navigation
Telecommunications	-9	Seabed alteration (abrasion, sealing, dredging)	Loss of seafloor, loss of biodiversity
	-7	Altered sedimentary rates, sedimentological imbalances of various kinds; changing hydrodynamic conditions	Benthic species and habitats smothering, alteration of species life cycles
	8	Regulating the uses of maritime space	Sustainable use of the environment and resources
Maritime transport and ports	-9	Ship strikes	Mortality of or damage to fauna
		Pollutant releases, accidental or otherwise	Problems of various kinds such as altered development of organisms, intoxication; altered water and sediment quality; bioaccumulation of contaminants in organisms
	-8	Seabed alteration (abrasion, sealing, dredging)	Loss of seafloor, loss of biodiversity
	-6	Habitat degradation also linked to climate change (e.g. ocean acidification, rising temperatures)	Habitat transformations and food availability
	-4	Noise emissions and vibrations; variation of noise levels	Disturbance of fauna, removal and disorientation of fauna
	-3	Construction of new works visible from the coast	Impact on visual perception of the landscape
		Voluntary and involuntary introduction of invasive species	biodiversity loss and ecosystem services
	-2	Voluntary and involuntary introduction of invasive species (alien and non-indigenous species)	Introduction of pathogenic organisms, alteration of ecosystem balances, loss of biodiversity
	10	Regulating the uses of maritime space	Sustainable use of the environment and resources
	-10	Population increase	Altered water quality

Coastal and Maritime Tourism	-6	Ingestion of waste and/or entrapment, intoxication; increased presence of waste	Mortality of or damage to fauna
		Removal of organisms and organic material, including for ornamental purposes; damage to organisms during diving activities	Loss of biodiversity and damage to organisms/communities
	-3	Increased anthropic visitation of sites of cultural interest	Damage to cultural heritage through over-exploitation
	-2	Anthropic nocturnal beach attendance and artificial lighting; bathing activities; recreational boating and anchoring; morphological alteration of beaches	Disturbance of coastal nesting sites
	10	Regulating the uses of maritime space	Sustainable use of the environment and resources
		Aesthetic/cultural services, linked to education and sustainable tourism activities (e.g. whale watching); diving activities	Enhancing the territory and raising public awareness of environmental issues

Table 5.3: Comparison of the main pressure factors, possible environmental effects (negative and positive) and (national) measures of the Plan and its Objectives

Sector	Most significant pressure factors	(Possible) significant environmental effects (negative and positive)	Planned Measures (national)	Plan Objectives
AQUACULTURE	• Production of waste (including waste from sewage, sanitary treatment of organisms and treatment of underwater nets and installations	• Problems of various kinds, such as reduction of dissolved oxygen, alteration of organism development, intoxication; alteration of water and sediment quality; bioaccumulation of contaminants in organisms	NAZ_MIS|40-41	SO_A|01 - Promoting the sustainable growth of the aquaculture sector
	• Nitrogen and phosphorous inputs from point sources (such as discharges from wastewater treatment, industrial processes and aquaculture and mariculture facilities) and diffuse sources (e.g. agricultural runoff and emissions	• Distressed States of benthic communities and fish die-offs		
	• Alteration of the trophic network	• Inter- and intra-specific competition for food resources - Loss of biodiversity		
	• Voluntary and involuntary introduction of invasive species (alien and non-indigenous species)	• Competition with native species, introduction of pathogenic organisms, alteration of ecosystem balances, loss of biodiversity, expansion of invasive non-native species (NIS)		
	• Altered visual perception of the landscape	• Visual perception of implants	NAZ_MIS|19 - NAZ_MIS|20 - NAZ_MIS|21	OS_PPC|01 - Supporting the landscape value of the coastal strip
			In smaller measures: NAZ_MIS|11	OS_SS|04 - Fully grasping the economic and environmental sustainability

Sector	Most significant pressure factors	(Possible) significant environmental effects (negative and positive)	Planned Measures (national)	Plan Objectives
				opportunities arising from the circular economy
			NAZ_MIS|39	SO_A|01 - Promoting the sustainable growth of the aquaculture sector
			NAZ_MIS|41-42-43	OS_A|02 - Promoting quality aquaculture and supporting the process of establishing AZAs (Allocated Zones for Aquaculture)
	• Effective measures and adequate funding to counter illegal activities	• Sustainable use of the environment and resources	NAZ_MIS|37-38	OS_P|06 - Monitoring and combating illegal fishing
	• Regulating the uses of maritime space		NAZ_MIS|04	OS_SS|01 - Developing a sustainable marine economy, multiplying growth opportunities for marine and maritime sectors
			NAZ_MIS|11	OS_SS|04 - Fully grasping the economic and environmental sustainability opportunities arising from the circular economy
			NAZ_MIS|40	SO_A|01 - Promoting the sustainable growth of the aquaculture sector
			NAZ_MIS|41-43	OS_A|02 - Promoting quality aquaculture and supporting the process of establishing AZAs (Allocated Zones for Aquaculture)
COASTAL DEFENCE	• Restoration and protection of dunes	• heavy vehicles and machines used to transport materials, in the absence of suitable access routes, can cause: direct destruction of plant communities, mobilisation of stabilised sands and soil compaction	NAZ_MIS|63 - NAZ_MIS|64 - NAZ_MIS|65	OS_DC|03 - Considering and adequately addressing the issue of the use and protection of underwater sand for beach nourishment, to be considered as a strategic resource for coastal defence and adaptation plans
	• Beach nourishment	• Temporary increase in suspended particulate matter, smothering and burial phenomena, alteration of the population dynamics and decrease in trophic resources		
	• Implementation of rigid defence systems	• changes and/or loss of habitat, resulting in non-negligible effects on the composition of benthic communities present in terms of diversity, abundance and biomass, and on trophic structure		

<table>
<tr><th>Sector</th><th>Most significant pressure factors</th><th>(Possible) significant environmental effects (negative and positive)</th><th>Planned Measures (national)</th><th>Plan Objectives</th></tr>
<tr><td rowspan="5"></td><td>• Construction of new works visible from the coast</td><td>• Impact on visual perception of the landscape</td><td>NAZ_MIS|19</td><td>OS_PPC|01 - Supporting the landscape value of the coastal strip</td></tr>
<tr><td>• By-pass systems</td><td>• increased resuspension and thus turbidity of water in the vicinity of the intervention area</td><td></td><td></td></tr>
<tr><td rowspan="2">• Regulating the uses of maritime space</td><td rowspan="2">• Sustainable use of the environment and resources</td><td>NAZ_MIS|61</td><td>OS_DC|01 - Promoting the development, harmonization and implementation of strategies and measures to protect the coastline and combat erosion foreseen in the Flood Risk Management Plans drawn up at the scale of the Hydrographic District in compliance with the provisions of the Floods Directive (2007/60/EC) and in the Coastal Plans / Integrated Coastal Zone Management Plans prepared by many regions</td></tr>
<tr><td>NAZ_MIS|62</td><td>OS_DC|02 - Ensuring the best coherence between the uses and vocations of sea use foreseen in the MSP Plans, and coastal uses, with reference to their safeguard in a scenario of necessary adaptation to ongoing climate change</td></tr>
<tr><td></td><td></td><td>In smaller measures:
NAZ_MIS|62</td><td>OS_DC|02 - Ensuring the best coherence between the uses and vocations of sea use foreseen in the MSP Plans, and coastal uses, with reference to their safeguard in a scenario of necessary adaptation to ongoing climate change</td></tr>
<tr><td rowspan="4">MARITIME TRANSPORT AND PORTS</td><td>• Ship strikes</td><td>• Mortality of or damage to fauna</td><td>NAZ_MIS|45</td><td rowspan="4">OS_TM|01 - Promoting sustainable development of maritime transport and reducing its negative impacts</td></tr>
<tr><td>• Pollutant releases, accidental or otherwise</td><td>• Problems of various kinds such as altered development of organisms, intoxication; altered water and sediment quality; bioaccumulation of contaminants in organisms</td><td rowspan="3">NAZ_MIS|44</td></tr>
<tr><td>• Seabed alteration (abrasion, sealing, dredging)</td><td>• Loss of seafloor, loss of biodiversity</td></tr>
<tr><td>• Habitat degradation also linked to climate change (e.g. ocean acidification, rising temperatures)</td><td>• Habitat transformations and food availability</td></tr>
</table>

Sector	Most significant pressure factors	(Possible) significant environmental effects (negative and positive)	Planned Measures (national)	Plan Objectives
	• Noise emissions and vibrations; variation of noise levels	• Disturbance of fauna, removal and disorientation of fauna	NAZ_MIS|46	
	• Ingestion of waste and/or entrapment, intoxication; increased presence of waste	• Mortality of or damage to fauna	NAZ_MIS|48	OS_TM|02 - Promoting the use of alternative fuels, reducing discharges into the sea, improving port facilities for the collection of waste and cargo residues and/or encouraging the use of such facilities, improving the management of dredged sediments
	• Construction of new works visible from the coast	• Impact on visual perception of the landscape	NAZ_MIS|19	OS_PPC|01 - Supporting the landscape value of the coastal strip
	• Regulating the uses of maritime space	• Sustainable use of the environment and resources	NAZ_MIS|44-45	OS_TM|01 - Promoting sustainable development of maritime transport and reducing its negative impacts
FISHING	• Abrasion and/or alteration of the seafloor with fishing gear (trawl nets, dredges, turbo blowers)	• Loss of biodiversity, damage to benthic habitats, removal of benthic species		
	• By-catch, overfishing	• Loss of biodiversity, reduction of fish stocks	NAZ_MIS|34	OS_P|04 - Promoting the creation of areas for the recovery and protection of fish stocks and protecting Essential Fish Habitats (EFH)
			NAZ_MIS|37-38	OS_P|06 - Monitoring and combating illegal fishing
	• Ingestion of waste and/or entrapment, intoxication; increased presence of waste	• Mortality of or damage to fauna	NAZ_MIS|44 NAZ_MIS|48	OS_TM|01 - Promoting sustainable development of maritime transport and reducing its negative impacts OS_TM|02 - Promoting the use of alternative fuels, reducing discharges into the sea, improving port facilities for the collection of waste and cargo residues and/or encouraging the use of such facilities, improving the management of dredged sediments
	• Fishing pressure and overfishing	• Inter- and intra-specific competition for food resources - Loss of biodiversity	NAZ_MIS|30	SO_P|02 - Supporting the implementation of the forecasts of the European and National Multiannual Management Plans in the Geographical Sub-Areas (GSA)

Sector	Most significant pressure factors	(Possible) significant environmental effects (negative and positive)	Planned Measures (national)	Plan Objectives
			NAZ_MIS|32	OS_P|03 - Promoting, developing and spatially managing small-scale coastal fishing using sustainable techniques
	• Waste production	• Problems of various kinds such as altered development of organisms, intoxication; altered water and sediment quality; bioaccumulation of contaminants in organisms	NAZ_MIS|44 NAZ_MIS|48	OS_TM|01 - Promoting sustainable development of maritime transport and reducing its negative impacts OS_TM|02 - Promoting the use of alternative fuels, reducing discharges into the sea, improving port facilities for the collection of waste and cargo residues and/or encouraging the use of such facilities, improving the management of dredged sediments
			In smaller measures: NAZ_MIS|11-12	OS_SS|04 - Fully grasping the economic and environmental sustainability opportunities arising from the circular economy
			NAZ_MIS|28	SO_P|01 - Promoting the sustainable development of the fisheries sector
			NAZ_MIS|29	
			NAZ_MIS|31	OS_P|03 - Promoting, developing and spatially managing small-scale coastal fishing using sustainable techniques
	• Regulating the uses of maritime space	• Sustainable use of the environment and resources	NAZ_MIS|33	OS_P|03 - Promoting, developing and spatially managing small-scale coastal fishing using sustainable techniques
			NAZ_MIS|34	OS_P|04 - Promoting the creation of areas for the recovery and protection of fish stocks and protecting Essential Fish Habitats (EFH)
			NAZ_MIS|35-36	SO_P|05 - Encouraging cooperation among States in order to achieve concerted measures for the sustainable management of the activities of their national fisheries sectors
	• Effective measures and adequate funding to counter illegal activities		NAZ_MIS|37-38	OS_P|06 - Monitoring and combating illegal fishing

Sector	Most significant pressure factors	(Possible) significant environmental effects (negative and positive)	Planned Measures (national)	Plan Objectives
COASTAL AND MARITIME TOURISM	• Ingestion of waste and/or entrapment, intoxication; increased presence of waste	• Mortality of or damage to fauna		
	• Removal of organisms and organic material, including for ornamental purposes; damage to organisms during diving activities	• Loss of biodiversity and damage to organisms/communities		
	• Increasing anthropic attendance of sites of cultural interest	• Damage to cultural heritage through over-exploitation	NAZ_MIS|69	SO_T|03 - Contributing to the diversification of tourist products and services and countering the seasonality of demand for inland, coastal and maritime tourism
	• Anthropic night-time beach attendance and artificial lighting; bathing activities; recreational boating and anchoring; morphological alteration of beaches	• Disturbance of coastal nesting sites		
	• Regulating the use of maritime space	• Sustainable use of the environment and resources	NAZ_MIS|67-68	SO_T|02 - Promoting coherent planning actions on land and sea, also for tourism purposes
			NAZ_MIS|69-70	SO_T|03 - Contributing to the diversification of tourist products and services and countering the seasonality of demand for inland, coastal and maritime tourism
	• Aesthetic/cultural services, linked to education and sustainable tourism activities (e.g. whale watching); diving activities	• Enhancing the territory and raising public awareness of environmental issues	NAZ_MIS|66	SO_T|01 - Promoting sustainable forms of coastal and maritime tourism SO_T|02 - Promoting coherent planning actions on land and sea, also for tourism purposes
ENERGY	• Hydrocarbon extraction	• Pollutant releases, accidental or otherwise	NAZ_MIS|54	OS_E01 - Contributing to the energy transition towards renewable and low-emission sources through the development of offshore renewable energy production
		• Seabed alteration (abrasion, sealing, dredging)		
		• Altered sedimentary rates, sedimentological imbalances of various kinds; changing hydrodynamic conditions		
		• Benthic species and habitats smothering, alteration of species life cycles	NAZ_MIS|60	OS_E03 - Promoting the conversion of platforms and infrastructure associated with

Sector	Most significant pressure factors	(Possible) significant environmental effects (negative and positive)	Planned Measures (national)	Plan Objectives
		• Noise emissions and vibrations; variation of noise levels: Disturbance of fauna, removal and disorientation of fauna		depleted fields and synergies between compatible maritime activities
	• Construction of wind power plants	• Impact on visual perception of the landscape	NAZ_MIS|52	OS_E01 - Contributing to the energy transition towards renewable and low-emission sources through the development of offshore renewable energy production
			NAZ_MIS|19	OS_PPC|01 - Supporting the landscape value of the coastal strip
		• Disruption of migratory routes, impairment of the bird population	NAZ_MIS|54	OS_E01 - Contributing to the energy transition towards renewable and low-emission sources through the development of offshore renewable energy production
		• Creation of fish restocking areas		
	• Construction of wind/photovoltaic systems	• interference with cultural heritage • Renewable energy production	NAZ_MIS|52 NAZ_MIS|57	OS_E01 - Contributing to the energy transition towards renewable and low-emission sources through the development of offshore renewable energy production
	• Regulating the uses of maritime space	• Sustainable use of the environment and resources	NAZ_MIS|53 NAZ_MIS|55 NAZ_MIS|57 NAZ_MIS|58	OS_E01 - Contributing to the energy transition towards renewable and low-emission sources through the development of offshore renewable energy production
LANDSCAPE AND CULTURAL HERITAGE	• Promoting the networking of coastal maritime heritage assets	• Efficient use of coastal maritime heritage assets	NAZ_MIS|22	OS_PPC|02 - Promoting the recovery and redevelopment of buildings and areas subject to protection
			NAZ_MIS|23	OS_PPC|03 - Promoting and supporting the conservation of underwater archaeological heritage
			NAZ_MIS|24	OS_PPC|05 - Promoting and creating awareness on intangible cultural heritage
	• Restoration of assets of high historical and architectural value	• Enhancing the historical and architectural value of assets	NAZ_MIS|22	OS_PPC|02 - Promoting the recovery and redevelopment of buildings and areas subject to protection

Sector	Most significant pressure factors	(Possible) significant environmental effects (negative and positive)	Planned Measures (national)	Plan Objectives
	• Interventions aimed at the protection and enhancement of coastal areas of high landscape value	• Enhancing the landscape value of high-value coastal areas	NAZ_MIS|26	OS_PPC|06 - Combating unauthorised building in coastal areas
	• Promoting the culture of the sea and shipping	• Increasing the degree of awareness on the part of users	NAZ_MIS|24-25	OS_PPC|05 - Promoting and creating awareness on intangible cultural heritage
	• Regulating the uses of maritime space	• Sustainable use of the environment and resources	All precedents	
MARITIME SAFETY	• Surveillance of maritime traffic	• Increasing safety conditions in maritime navigation	NAZ_MIS|27	OS_S|02 Helping promote maritime safety, the implementation of UNCLOS standards and the EU Maritime Safety Strategy
ENVIRONMENTAL PROTECTION AND NATURAL RESOURCES	• Increased protection of ecosystems (including deep sea ecosystems), habitats and species	• Preserving biodiversity, ecosystem processes and functions	NAZ_MIS|13	OS_N|01 - Applying a consistent Ecosystem based approach (EBA) at all stages of drafting of Maritime Spatial Plans
	• Effective measures and adequate funding to counter illegal activities	• Sustainable use of the environment and resources	NAZ_MIS|37-38	OS_P|06 - Monitoring and combating illegal fishing
	• Management measures	• Preserving biodiversity, ecosystem processes and functions	NAZ_MIS|15	OS_N|03 - Transposing and promoting the implementation of the main spatial measures foreseen in the MSFD Programme of Measures
	• Regulating the uses of maritime space	• Sustainable use of the environment and resources	NAZ_MIS|16	OS_N|04 - Integrating aspects of land-sea interaction and integrated coastal zone management, with particular reference to environmental aspects
	• Restoration and restoration of ecosystems	• Preserving biodiversity, ecosystem processes and functions	NAZ_MIS|17-18	OS_N|05 - Taking into account in the medium to long term the process and objectives of marine ecosystem restoration as outlined in the proposed European Law on Environmental Restoration
			NAZ_MIS|14	OS_N|02 - Supporting the extension of EU marine protection to 30%, of which 10% in a stringent manner, by 2030
RESEARCH AND INNOVATION	• Analyses aimed at the acquisition of environmental data (e.g. biocenotic maps, species distribution, hotspots)	• Increased knowledge of and effects on the environment	NAZ_MIS|18	OS_N|05 - Taking into account in the medium to long term the process and objectives of marine ecosystem restoration as outlined in the proposed European Law on Environmental Restoration

Sector	Most significant pressure factors	(Possible) significant environmental effects (negative and positive)	Planned Measures (national)	Plan Objectives
			NAZ_MIS|13	OS_N|01 - Applying a consistent Ecosystem based approach (EBA) in the overall design and guidance of Maritime Spatial Plans
			NAZ_MIS|14	OS_N|02 - Supporting the extension of EU marine protection to 30%, of which 10% in a stringent manner, by 2030
			NAZ_MIS|18	OS_N|05 - Taking into account in the medium to long term the process and objectives of marine ecosystem restoration as set out in the proposed European Law on Environmental Restoration
	• Funds for scientific research	• Increased knowledge of and effects on the environment	NAZ_MIS|03-04	OS_SS|01 - Developing a sustainable marine economy, multiplying growth opportunities for marine and maritime sectors
	• Regulating the uses of maritime space	• Sustainable use of the environment and resources	NAZ_MIS|05	OS_SS|02 - Contributing to the National Strategy for Sustainable Development
			NAZ_MIS|06 NAZ_MIS|07	OS_SS|03 - Contributing to the European Green Deal
			NAZ_MIS|09	OS_SS|04 - Fully grasping the economic and environmental sustainability opportunities arising from the circular economy
			NAZ_MIS|15	OS_N|03 - Transposing and promoting the implementation of the main spatial measures foreseen in the MSFD Programme of Measures

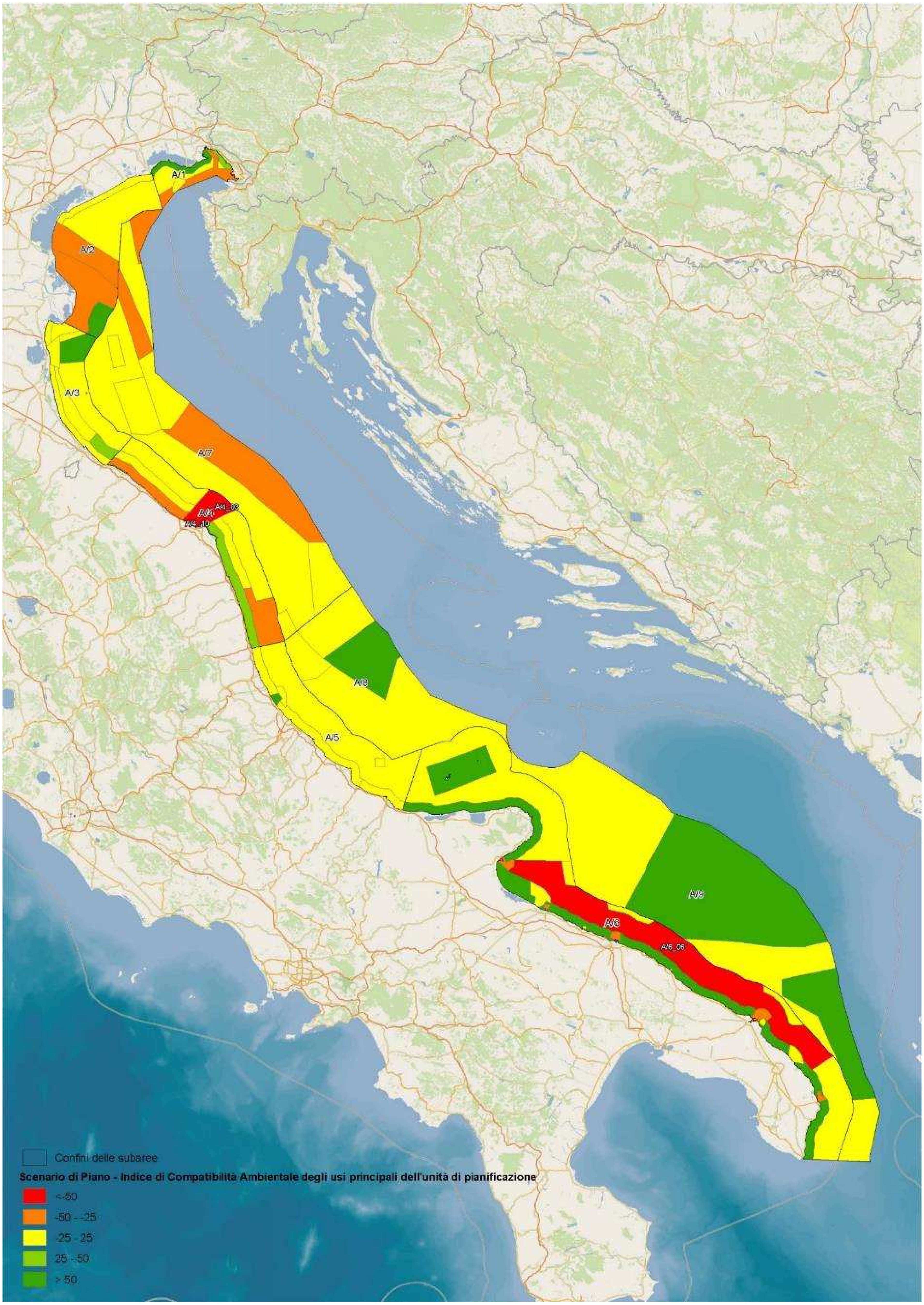


Figure 5.1: Map of ECI values attributed to UPs in the Adriatic Area

Table 5.4: Planning Units (PUs) assigned an ECI value < -50

PU with ECI < -50	ECI	Priority uses/sectors associated with UPs	Other Uses	Justification for typological attribution	Environmentally significant PU elements	"% of protected marine space in relation to PU[81]	Sub-area measures
A/4_03	-58	Fishing, Maritime transport and ports, Coastal and maritime tourism	Nautical tourism Dredged sediment immersion at sea Other uses compatible with priority uses	Between 3- and 12-miles Ancona/Falconara Marittima. Area affected by the traffic routes pertaining to the ports of Ancona and Falconara Marittima. Pleasure boating represents an important component of tourism. Dredged sediment dumping sites are identified in the area. Prohibition of new hydrocarbon exploration and production applications with the PiTESAI.	-	0.00%	NO
A/4_10	-58		Other uses compatible with priority uses	Within 3 miles Ancona/Falconara Marittima. Area affected by the traffic routes pertaining to the ports of Ancona and Falconara Marittima. Small-scale coastal fishing and hydraulic dredges represent important productive activities in the Marche region (fishing does not take place outside 3 nm from the coast due to spatial conflicts with towed gears, while hydraulic dredges limit their fishing grounds to sandy bottoms, therefore generally within 2 nm). Tourism is an important seasonal socio-economic component	The area is of relevance for underwater archaeology, given the presence of the city of Ancona, an important destination for shipping routes in antiquity. The PU encompasses the Falconara Marittima Contaminated Site of National Interest, which includes a marine portion covering approximately 1,200 hectares."	0.00%	NO
				Most relevant pressure factors	**(Possible) significant environmental effects (negative and positive)**		
			-10	Population increase	Altered water quality		
			-9	Ship strikes	Mortality of or damage to fauna		
				Pollutant releases, accidental or otherwise	Problems of various kinds such as altered development of organisms, intoxication; altered		

81 Ref. Map of sensitivities of the Protected Areas System, Biological Protection Zones and of the Fisheries Restricted Areas"

			water and sediment quality; bioaccumulation of contaminants in organisms	
	-8	Seabed alteration (abrasion, sealing, dredging)	Loss of seafloor, loss of biodiversity	
	-6	Abrasion and/or alteration of the seafloor with fishing gear (trawl nets, dredges, turbo blowers)	Loss of biodiversity, damage to benthic habitats, removal of benthic species	
		Bycatch, overfishing	Loss of biodiversity, reduction of fish stocks	
		Habitat degradation also linked to climate change (e.g. ocean acidification, rising temperatures)	Habitat transformations and food availability	
		Ingestion of waste and/or entrapment, intoxication; increased presence of waste	Mortality of or damage to fauna	
		Removal of organisms and organic material, including for ornamental purposes; damage to organisms during diving activities	Loss of biodiversity and damage to organisms/communities	
		Fishing pressure and overfishing	Inter- and intra-specific competition for food resources - Loss of biodiversity	
	-5	Alteration of the trophic network	Inter- and intra-specific competition for food resources - Loss of biodiversity	
		Waste production	Problems of various kinds such as altered development of organisms, intoxication; altered water and sediment quality; bioaccumulation of contaminants in organisms	
	-4	Noise emissions and vibrations; variation of noise levels	Disturbance of fauna, removal and disorientation of fauna	
	-3	Increased anthropic attendance of sites of cultural interest	Damage to cultural heritage through over-exploitation	
		Construction of new works visible from the coast	Impact on visual perception of the landscape	
		Voluntary and involuntary introduction of invasive species (alien and non-indigenous species)	biodiversity loss and ecosystem services	
	-2	Anthropic night-time beach attendance and artificial lighting; bathing activities; recreational boating and anchoring; morphological alteration of beaches	Disturbance of coastal nesting sites	
		Voluntary and involuntary introduction of invasive species (alien and non-indigenous species)	Introduction of pathogenic organisms, alteration of ecosystem balances, loss of biodiversity	

			8	Regulating the uses of maritime space	Sustainable use of the environment and resources		
				Effective measures and adequate funding to counter illegal activities	Sustainable use of the environment and resources		
			9	Regulating the uses of maritime space	Sustainable use of the environment and resources		
			10	Aesthetic/cultural services, linked to education and sustainable tourism activities (e.g. whale watching); diving activities	Enhancing the territory and raising public awareness of environmental issues		
PU with ECI < -50	**ECI**	**Priority uses/sectors associated with UPs**	**Other Uses**	**Justification for typological attribution**	**Environmentally significant PU elements**	**"% of protected marine space in relation to PU[82]**	**Sub-area measures**
A/6_06	-51	Fishing, Maritime transport and ports	Aquaculture Nautical tourism other uses if compatible with priority uses	Area with heavy shipping traffic (merchant, oil and passenger). Permitted fishing activities in compliance with current regulations Prohibition of new hydrocarbon exploration and production applications (see PiTESAI).	Presence of submerged archaeological assets (ARCHEOMAR data). High natural value due to high density of species and habitats (protected by the Natura 2000 Directives (Habitats and Birds). Part of the area is included in the EBSA "South Adriatic Ionian Strait".	0.64%	NO
				Most relevant pressure factors	**(Possible) significant environmental effects (negative and positive)**		
			-9	Ship strikes	Mortality of or damage to fauna		
				Pollutant releases, including accidental releases	Problems of various kinds such as altered development of organisms, intoxication; altered water and sediment quality; bioaccumulation of contaminants in organisms		
			-8	Seabed alteration (abrasion, sealing, dredging)	Loss of seafloor, loss of biodiversity		
			-6	Abrasion and/or alteration of the seafloor by fishing gear (trawl nets, dredges, turbo blowers)	Loss of biodiversity, damage to benthic habitats, removal of benthic species		
				Bycatch, overfishing	Loss of biodiversity, reduction of fish stocks		

[82] Ref. Map of sensitivities of the Protected Areas System, Biological Protection Zones and of the Fisheries Restricted Areas"

		Habitat degradation also linked to climate change (e.g. ocean acidification, rising temperatures)	Habitat transformations and food availability	
		Ingestion of waste and/or entrapment, intoxication; increased presence of waste	Mortality of or damage to fauna	
		Fishing pressure and overfishing	Inter- and intra-specific competition for food resources - Loss of biodiversity	
	-5	Alteration of the trophic network	Inter- and intra-specific competition for food resources - Loss of biodiversity	
		Waste production	Problems of various kinds such as altered development of organisms, intoxication; altered water and sediment quality; bioaccumulation of contaminants in organisms	
	-4	Noise emissions and vibrations; variation of noise levels	Disturbance of fauna, removal and disorientation of fauna	
	-3	Construction of new works visible from the coast	Impact on visual perception of the landscape	
		Voluntary and involuntary introduction of invasive species	biodiversity loss and ecosystem services	
	-2	Voluntary and involuntary introduction of invasive species	Introduction of pathogenic organisms, alteration of ecosystem balances, loss of biodiversity	
	8	Regulating the use of maritime space	Sustainable use of the environment and resources	
	9	Effective measures and adequate funding to counter illegal activities		
	10	Regulating the use of maritime space		

5.1.2 Elements related to potential negative effects of human activities on descriptors D1-D2-D3-D5-D6-D7-D9 of the Marine Strategy and MPAs

At this stage, the Plan considers the results of the monitoring as of 2018 (MATTM and ISPRA, 2019) of the state of the environment, according to the Descriptors of the Marine Strategy Framework Directive 2008/56/EC, in order to assess the potential causes and actions needed to reduce and control the potential negative effects of pressures generated by anthropic uses for each descriptor.

The following description, by descriptor, includes the analysis of aspects relating to the biodiversity and water components.

- **Descriptor 1: Biodiversity (D1)**

Qualitative descriptor 1 (Biodiversity) collects information on the distribution and status of habitats and priority conservation species, information and knowledge from monitoring by the Habitats and Birds Directives, ACCOBAMS and the Natural Capital Committee. The elements related to any potential negative effects of anthropic activities on the descriptor Biodiversity (D1) are reported below.

- ***Caretta caretta***

As La Mesa et al. (2019) explain in their report on the monitoring of species and habitats of community interest (Directive 92/43/EEC and Directive 09/147/EC) in Italy for the marine environment throughout its life cycle, *Caretta caretta* is subject to pressures from multiple human activities.

After more than 30 years of conservation efforts, in 2015 the Mediterranean subpopulation of Loggerhead was listed as Least Concern by the International Union for Conservation of Nature (IUCN) and on the Red List of Threatened Species (Casale & Tucker, 2015). Foraging areas for this species cover approximately 31.75% of the foraging area of the Mediterranean basin. The assessment of the risk produced by the use of different types of fishing gear showed that more than 40% of the foraging areas were exposed to medium to very high levels of threat, with variations found throughout the Mediterranean Sea (V. Almpanidou, A. Chatzimentor. 2021). In particular, the foraging area enclosed in the Adriatic Sea was the most severely affected by fishing, with 73.47% of its area subject to high and very high risk, compared to the Ionian and Tyrrhenian Sea areas (V. Almpanidou, A. Chatzimentor. 2021). A further potential threat is posed by marine pollution, as suggested by several trials showing the presence of high levels of diffuse contaminants in their tissues (Bucchia et al., 2015; Cocci et al., 2018, 2019, 2020). In particular, the sea turtle *Caretta caretta* is a 'flagship species', useful as an indicator of the general level of pollution in marine ecosystems.

A high number of plastic particles was detected in the faeces of wild-caught *Caretta caretta* turtles *and Chelonia mydas* living in the north-western Adriatic Sea, collected after their arrival at a local rescue centre for their rehabilitation. This is a number of microparticles varying between 10 and 15 per 100 ml; a fairly high number compared to data generally reported for the gastrointestinal contents of dead stranded turtles (Duncan et al., 2018). Entanglement in abandoned nets, traps, ties or plastic bags are regularly reported and can cause severe injuries leading to mutilation, amputation, impaired buoyancy and restricted movements that prevent the turtle from behaving normally and can lead to the death of the individual (Duncan et al., 2017). The Adriatic basin is in fact, one of the most polluted marine sites on the globe, due to its high productivity and anthropic impact, with an average concentration of > 400,000 plastic particles up to 5mm per km (MSFD Technical Subgroup on Marine Litter Group et al., 2013; Alessi and Di Carlo, 2018; Liorca et al., 2020). Therefore, the presence of a high level of plastic pollution in the faeces of turtles in the Adriatic Sea, and the acknowledged importance of the sea turtle as a flagship species for the health status of the marine environment, indicate and confirm the high level of plastic pollution in the Adriatic Sea systems. Other factors that negatively affect nesting and, consequently, the reproductive success of the species are:

- nocturnal anthropic frequentation of beaches, which can disturb nesting females;
- artificial lighting on beaches, which can cause disorientation of newborn turtles and disturb the females themselves;

- bathing activities (recreational facilities, mechanical cleaning of beaches, physical presence of equipment) that reduce the space available for nest selection, exposing the nests to storm surges and flooding, and physically damaging nests and embryo development;
- the geomorphological alteration of beaches as a result of sedimentological imbalances of various kinds can interfere with both spawning and embryonic development in the nest;
- bycatching at sea with fishing gear, especially in major aggregation areas, such as bottom trawls in neritic aggregation areas, drift longlines in pelagic feeding areas and fixed nets near spawning areas and coastal migration corridors. Other disturbing factors are maritime traffic, which is linked to the risk of collisions near spawning areas and coastal migration corridors;
- smothering by waste (plastic).

- ***Marine mammals***

The Regional Assessment of the Mediterranean Marine and Coastal Environment ('2017 Mediterranean Quality Status Report', UNEP/MAP 2017) provides information on the state of the environment and the distance to the achievement of ecological objectives and Good Environmental Status (GES), according to the Ecosystem Approach in the Mediterranean (EcAp). The Quality Status Report (QSR) on biodiversity provides information on marine mammals. Data on the distribution of marine mammals are usually collected during dedicated naval and aerial surveys, acoustic surveys or opportunistically by whale watching operators, ferries, cruise ships, military vessels. Twelve species of marine mammals – seals and 11 cetaceans – can be regularly found in the Mediterranean Sea; all 12 species belong to populations (or subpopulations, *sensu* IUCN) that are genetically distinct from their North Atlantic conspecifics.

The Mediterranean monk seal (*Monachus monachus*) and the 11 species of cetaceans (minke whale, *Balaenoptera physalus*; sperm whale, *Physeter macrocephalus*; zephyrus, *Ziphius cavirostris*; common dolphin, *Delphinus delphis*; long-finned pilot whale, *Globicephala melas*; Risso's dolphin, *Grampus griseus* orca, *Orcinus orca*; stenella or striped dolphin, *Stenella coeruleoalba*; rough-toothed dolphin, *Steno bredanensis*; common bottlenose dolphin, *Tursiops truncatus*; porpoise, *Phocoena phocoena relicta*) face numerous threats, due to strong anthropic pressures in the entire Mediterranean basin. Of the 12 marine mammal species listed above, seven are listed in a threatened category on the IUCN Red List, three are listed as data deficient and two need to be assessed.

Maritime traffic interacts with a variety of uses of the marine environment, ranging from interactions with coastal fishing to the emergence of large offshore energy infrastructure.

From an environmental point of view, the resulting pressures are:

- emission of substances;
- chemical pollution;
- marine litter;
- underwater noise;
- introduction of invasive non-indigenous species;
- accidental mortality due to fishing gear (bycatch);
- collision between vessels.

Such phenomena can seriously affect marine and coastal biodiversity and possible protection targets even at high distances from the sources of impact. More than 200 cetaceans die stranded each year due to anthropic activities (S. Lo Brutto, A. Calascibetta, G. Pavan et al. 2021).

The conservation status of cetaceans has been a concern for many years because various threats such as, accidental mortality in fishing gear (bycatch**),** vessel collisions, chemical pollution, noise pollution, offshore wind farms and general habitat degradation affect different species to varying degrees (Avila et al., 2018, Marsili et al., 2018). The risks to marine mammals are mainly determined by the nets used by multipurpose fishing vessels. Larger vessels, which generally use bottom trawls or pelagic longlines, are likely to be responsible for more accidental or intentional deaths.

Gillnets, trammel nets, longlines and bottom trawls pose a serious threat to the survival of elasmobranch (shark and ray) populations in the Mediterranean Sea (GFCM, 2014). Overfishing has an indirect effect on cetacean populations in the Mediterranean and, as such, its impact is difficult to measure. The Mediterranean Sea is the most overexploited sea in the world; some 63% of its fish stocks are exploited at biologically unsustainable levels and its demersal resources at serious and real risk of depletion (FAO, 2022).

Many of the exploited species are important prey for cetaceans and, as cetacean resource utilisation options decrease in the future, the effect of overexploitation is likely to impact intra- and interspecific competition for food resources. Furthermore, many of the species mentioned above have similar distributions and share common food resources.

- ***Posidonia oceanica, Reefs***

Marine phanerogams also play an important role in the sedimentary processes of Mediterranean coastal environments. (Coppa *et al.* , 2019). *Posidonia oceanica* is an essential component of beach morphodynamics, also through the deposition of leaves that form plant mounds, known as 'banquettes' (Simeone *et al.,* 2013), with which it contributes to determining the geomorphological variability of beaches throughout the year, constituting a significant component of the volume of coastal barriers, dunes and the material exchanged between the emerged and submerged beach during storm surges. In recent decades, the seagrass beds of *Posidonia oceanica* have been severely threatened by direct anthropic pressures, such as physical removal and eutrophication, and by climate change (Badalamenti *et al.* , 2011). It has been estimated that these meadows have regressed by 34% in the last 50 years at the Mediterranean scale and by 25% along the Italian coasts (Telesca *et al.* , 2015).

The most significant impacts are represented by:

- Beach management and removal of beached posidonia. The beaching of *Posidonia oceanica* leaves is a natural phenomenon that occurs annually along the coasts of the Mediterranean Sea. The use of beaches for tourism requires the removal of these deposits, which are considered a negative externality by beach managers and bathers. This phenomenon, which is increasing, can have a different intensity in relation to the distance from the mouths of watercourses, the regime of tides and currents, and the extension of the Posidonia meadows present near the shorelines or the relevant littoral unit (physiographic unit), with consequences that can compromise the vitality of coastal marine habitats. Approximately 83% of municipalities remove Posidonia deposits from beaches each year using heavy machinery such as excavators, which are the number one choice in about 40% of cases (Med POSBEMED - 2017). These phenomena involve the modification of the beach system with the consequent retreat of the shoreline, and the use of heavy machinery (mechanical shovels and excavators) to remove the banquette, have effects that negatively affect the nesting and thus the reproductive success of the species *Caretta caretta.*
- Works carried out on the marine state property (*demanio marittima*). Maritime works such as breakwaters and groynes, lagoon inlets, jetties and soft barriers, built between the emerged and submerged beach, have entailed, and still entail, effects ranging from the total obliteration of the beach to the triggering of irreversible erosive processes. These coastal defence works have entailed both modifications of the seafloor and hydrodynamic alterations, completely transforming coastal dynamics, as have ports. The construction of maritime works and port structures can act negatively both directly, because they are built directly on stretches of seafloor characterised by the presence of coralligenous formations (covering of the substrate), and indirectly, as in the case of beach nourishment activities with unsuitable material, with the consequent increase in turbidity.
    - Anchoring and mooring activities. Mechanical activities such as anchoring are one of the causes of destruction of the Posidonia meadows. Anchoring is today one of the major causes of degradation of the seagrass beds, as a result of the considerable increase in recreational boating and the presence of vessels in the protected marine areas of great natural interest and not just in summer. *The anchors embedded in the sediment when removed rip out the roots of the Posidonia with considerable damage to the habitat. This damage could easily be avoided through the good management of maritime spaces that includes the rules for protecting priority marine habitats in the planning processes.* With regard to moorings, berths in harbours and bays mostly use individual, traditional moorings

consisting of a block, chain and a large radius of 60 to 80 m^2 on average. One of the aspects that will have to be considered will be the reduction of deadweight and anchoring gear in general, which are harmful to the Posidonia, which in the past were sunk as ballast on the seagrass beds, and the removal and replacement of the most impactful ones with more sustainable technologies. Very often, 'classic' moorings involve a deadweight, usually made of concrete, lying on the seafloor, equipped with an eyelet to attach the chain or ropes, to the opposite end of which a mooring buoy is attached to moor the boat.

With regard to habitat 1170 'Reefs', the most significant impacts are caused by:

- eutrophication, due to the presence of urban, agricultural and industrial pollutants, increased water turbidity, climate change, (*Cystoseira* with the exception of *Cystoseira compressa*, which is considered more tolerant- Relini & Giaccone, 2009, Thibaut, 2014; Mancuso *et al.*, 2018);
- trawling activities, which damage the biocoenosis both directly, by destroying colonies, and indirectly, by causing the suspension of fine sediments whose redeposition then causes the smothering of the benthic species present. Other fishing activities such as deep-sea fishing and deep trammel netting for lobsters also cause further damage to these delicate and sensitive biocoenoses by interacting with benthic species (Bo *et al*., 2014).
- direct and indirect anthropic activities that contribute to the degradation and destruction of the coralligenous formations. Some, such as anomalies in the summer thermocline linked to ongoing climate change, may act on a large scale, while others affect more or less limited areas. In this regard, we can point out:
    - the construction of maritime works and harbour structures that can have a negative effect either directly, because they are built directly on stretches of seafloor characterised by the presence of coralligenous formations (covering of the substrate), or indirectly, as in the case of beach nourishment activities with unsuitable material, with the consequent increase in turbidity;
    - pollution and eutrophication; anchoring and excavation works for laying cables and pipes;
    - use of small dredges and anchors that destroy or damage vulnerable habitats;
    - fishing activities with a negative mechanical impact in the case of interaction by towed gears, such as trawls (bottom trawls), dredges and lines;
    - smothering caused by abandoned or lost fishing gear (ghost nets);
    - the expansion of invasive non-indigenous species (NIS).

- ***Marine Protected Areas***

MPAs play an important role in protecting and fostering the growth of fish communities and stocks within their boundaries; these benefits attract recreational fishermen both to the MPAs and the neighbouring areas. The interest of fishermen and tourists can create conflicts between sectors, e.g. between recreational and professional fishermen, divers and tourist boats, as well as damaging habitats.

Recreational fishing is regulated in the majority of MPAs in the Mediterranean; however, since this activity, however exercised, is considered productive it is not always compatible with the protection of ecosystems.

Since recreational fishing removes a significant amount of fish stocks, failure to include these catches in surveys can compromise the accuracy of the figures and lead to erroneous fisheries management recommendations. In the coastal waters of the western Mediterranean, including MPAs, vulnerable species make up almost 20 per cent of recreational fishing catches.

Some methods (such as freediving and trolling with lures) catch species that are also exploited by artisanal fisheries, especially large specimens of high economic value.

Further environmental impacts of recreational fishing are:

- The alteration of trophic nets: some species caught by recreational fishermen help regulate marine ecosystems and control the proliferation of other species, such as seahorses.
- Stress: which sometimes results in the death of specimens (as in catch-and-release fishing).

- The possible introduction of exotic species: in the Mediterranean, live exotic animals used as bait can survive and replace endemic species, changing the structure of trophic chains.
- Ghost fishing due to the loss or abandonment at sea of gear such as lines and nets, which may remain as waste on the seafloor or in the water column: this gear continues to catch fish for years, especially in rocky habitats, and damages them by exerting an abrasive action.
- Damage to sensitive habitats, mainly through:
  - the trampling of the fragile Cystoseira forests by shell collectors and shore fishermen;
  - accidental contact with sessile organisms, such as coralligenous formations by divers, especially inexperienced ones;
  - anchoring on Posidonia meadows, where lines and chains can damage the seafloor and the surrounding environment through mechanical action. In established MPAs, anchoring and mooring activities are regulated.

Small-scale fishing if fully or strictly regulated within MPAs can produce ecological benefits, e.g. an increase in stock abundance, biomass, density and fecundity.

This so-called 'reserve effect' transfers biomass to the fishing grounds and can produce economic benefits for artisanal fisheries in adjacent areas.

The potentially harmful effects of artisanal fishing include:

- Alterations in biodiversity and ecosystem functioning through the removal of key species (such as large predators) or individuals of specific size classes.
- Catching of species considered vulnerable (IUCN Red List). According to a study conducted in France, Italy and Spain, about 50 per cent of the total catch of artisanal fisheries in coastal waters, and 100 per cent of offshore fisheries, concerns vulnerable species.
- Damage to hermaphrodite species, induced by size-selective trapping.
- Deterioration of habitats through direct or indirect actions. Some techniques, such as small dredges and anchors destroy or damage vulnerable habitats, such as seagrass beds (*Posidonia oceanica*), coralligenous formations and deep rocky habitats, which host sessile and fragile organisms such as gorgonians, sponges and corals.
- Loss/abandonment of fishing gear (nets, hooks and lines). So-called ghost nets continue to catch fish and damage sessile organisms such as corals and gorgonians and constitute marine litter.
- Damage is caused by oil pollution and antifouling agents.

Small offshore wind farms, if managed sustainably, could also benefit biodiversity in ways beyond carbon-neutral power generation.

Many marine scientists are convinced that the coexistence of wind and nature is possible and, indeed, desirable and that wind farms are a protected place for fish, crustaceans and other species. In 2014, a group of Scottish, Dutch and US marine scientists led by the University of St. Andrews (Scotland) demonstrated, for the first time, that marine mammals preferentially used an artificial structure in the open sea to search for food. Subsequently, similar research by German, Dutch, Belgian and Danish scientists revealed that wind farms can protect and even feed a wide range of marine life, including European lobsters (*Homarus gammarus*), brown crabs (*Cancer pagurus*) and common harbour porpoises (*Phocoena phocoena*) as well as threatened species such as North Sea cod (*Gadus morhua*) and seals. Up to a tonne of mussels can grow on the foundation of a single wind turbine and marine scientists have found that these North Sea renewable energy sites, some of which span an area of 80 km^2, can be considered a network of marine life sanctuaries and a nursery/Kinderstube for underwater species (B. A.-Schenkemeyer 2018).

Even the European flat oyster (*Ostrea edulis*), another species that has been overexploited to the point of extinction, is now being cultivated under turbines in the North Sea off the coast of the Netherlands, thanks to the EU-funded Multi-Use offshore platforms demoNstrators for boostIng cost-effecTive and Eco-friendly proDuction in sustainable marine activities UNITED project, which examines possible alternative uses of wind farms. Further impacts are due to illegal activities that may jeopardise the protection of the characteristics of the relevant environment and the institutional purpose of the marine protected area.

- **Descriptor 2: Non-indigenous species (D2)**

The European Union, in the Marine Strategy Framework Directive 2008/56/EC, lists alien species among the descriptors of good environmental status of the sea (see Descriptor 2: Non-indigenous species. "Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems"), just as the Mediterranean EcAp (Ecosystem Approach) strategy, promoted by UNEP/MAP, considers alien species among the ecological targets. Biological invasions are among the main threats to biodiversity worldwide, impacting native species, the economy and health to such an extent that they are present in numerous international directives and conventions: Rio de Janeiro Convention on Biodiversity, Protocol on Protected Areas and Biological Diversity (follow-up to the Barcelona Convention), CBD (Convention of Biological Diversity), Habitats Directive and numerous others. Although the environmental problems caused by IAS are recognised worldwide, knowledge of their current and future impacts on native biodiversity is still largely unknown (Downey and Richardson 2016; Essl et al. 2020).

Alien species have entered the Mediterranean as a result of:

- voluntary introduction by humans (import of species for aquaculture or aquaristics, import of live bait).
- Involuntary introduction (maritime traffic, organisms associated with imported species for aquaculture) and through migration (through the Suez Canal or from the Strait of Gibraltar 1).
- Escape from aquaculture facilities and the spread of alien species. Accidental releases can lead to the introduction of alien species into the marine environment, with consequences such as competition with native species for resources and territory, transfer of pathogens or parasites, disturbance of wildlife and disruption of ecosystem functions.
- Excess nutrients in the food web Several studies have pointed out that overfeeding of reared individuals can alter the structure of benthic communities, as unconsumed feed can affect surrounding food webs, fostering some organisms over others.
- Discharge of effluent from aquaculture facilities that may contain residues from sanitary treatments, antifouling agents and leftover feed. Inappropriate management may induce eutrophication and reduction of dissolved oxygen.

Maritime traffic through ballast water and fouling (organisms attached to the hull) is now a major vector for the introduction of alien species. Some alien species can be invasive, capable of colonising large areas in a short time. Their introduction and spread has been found to threaten biodiversity and related ecosystem services. The IMO (International Maritime Organisation) Convention on the Management of Ballast Water provides for the development of an early warning system to ensure the rapid identification of introduced undesirable species and associated risk assessment, followed by prompt alerting of the relevant authorities.

- **Descriptor 3: Commercial fish and shellfish (D3)**

In the Marine Strategy Framework Directive (EC/2008/56 - Cycle II 2018-2024) species exploited for commercial fishing purposes are considered within the Qualitative Descriptor 3 for the determination of good environmental status. The MSFD, as reported by ISPRA in the 2018 MSFD Summary Report, observes that a large part of the stocks assessed in the sub-regions presents unsustainable exploitation status, which was already known in the case of the Mediterranean.

Generally speaking, this condition is linked to excessive fishery pressure and, only sometimes, to inadequate biomass. In addition, no formal analytical stock assessment is conducted for an important percentage of the stocks (particularly in the Western Mediterranean and Central Mediterranean-Ionian Sea sub-regions). The Adriatic is the sub-region with the highest proportion of stocks within biologically safe limits (14%), but at the same time the one with the highest prevalence of stocks in inadequate condition (over 50%). A comparison between the latest assessment and the previous one shows a slight improvement in the state of fish stocks, with a trend for some stocks towards reduced fishing mortality, but still in most cases as unsustainable (ISPRA, 2018). According to the 2021 Ispra Yearbook of Environmental Data, the Adriatic Sea in 2019 had 87.5 per cent of overfished stocks. The main environmental criticalities from anthropic uses and related pressures are linked to an excessive fishing pressure, determined by the size of the activity and, in particular, by the fishing effort (E), calculated by multiplying the tonnage (expressed in GT "Gross Tonnage") by the average fishing days (as per EC Regulation 2091/1998) and by the Catch Per Unit Effort (CPUE), which indicates the amount of catch obtained for a unit of effort.

According to the 2021 Ispra Yearbook of Environmental Data, in 2018, compared to 2017, the capacity of the national fishing fleet decreased slightly (-1%) in terms of number of vessels and -4.3% in terms of capacity expressed in GT (gross tonnage). The decrease in fishing activity in Italy, especially since the early 2000s, is also evidenced by a net change in average fishing days, which, for example, from 2007 to 2018 decreased by 17.5 fewer fishing days per vessel. Fishing effort, which has been steadily decreasing since 2004, increased between 2008 and 2009, from 25.2 to 26.5, then started to drop once more to 16.4 in 2018. Catch per unit effort (CPUE) continued to increase compared to previous years, standing at 11.7 kg/day for 2018. From 2009 to 2014, a steady decline in both indicators (effort and CPUE) was observed, probably pointing to the fact that, as the intensity of exploitation decreased there was no overall recovery of exploited resources; subsequently, however, a trend reversal was observed with a slight increase in CPUE against the continued decline in effort. Over the 'long' period (1996-2018), the number of vessels making up the national fleet decreased by 24.5%, in accordance with the trend in overall power (-35.9%) and tonnage (-36.1%) (Ispra, 2021).

Fishing pressure is undoubtedly the most significant impact on stocks, but not the only one; other factors may pose threats such as the following:

- illegal, unreported and unregulated (IUU) fishing;
- unfair competition to EU fisheries from other Mediterranean countries that are not bound by the rules, undermining efforts to rebuild stocks;
- warming of the Mediterranean Sea, at a rate 20 % faster than in the rest of the world (according to MedECC data, climate change could lead to the local extinction of commercial fish and marine invertebrates by up to 50 % by 2050);
- plastic pollution;
- fuel leakages;
- loss of habitat;
- maritime traffic;
- the proliferation of invasive exotic species.

A problematic issue, which is raising growing concern in several areas of the Mediterranean, particularly in the Adriatic and Ionian seas, is the use and disposal of mussel nets ('socks'). According to recent data, plastic socks are the seventh most common waste category on beaches and the third most common on the seafloor (Interreg-PHAROS4MPAs-2019). Compared to other sea farming methods, cage farming poses potentially higher risks to different habitats, communities and sensitive species. In the Mediterranean, this system is mainly used for breeding sea bream, sea bass, shi drum (*Umbrina cirrosa*) and tuna.

- **Descriptor 5: Eutrophication (D5)**

Eutrophication is one of the 11 qualitative descriptors of the EU Marine Strategy (Directive 2008/56/EC), for which Italy conducted an initial assessment, in 2012, under Article 8 of the said Directive, and is among the most widespread and deleterious anthropic impacts on marine ecosystems. The northern Adriatic Sea represents the most significant area, at national level, for the eutrophication phenomenon and is divided into *'coastal waters'* and '*offshore waters'*, in accordance with the criteria of the new EU Decision 2017/48 of the European Commission. It receives important nutrient inputs from rivers and is therefore subject to eutrophic processes in coastal areas south of the Po. Eutrophication is a process driven by the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorous compounds, leading to increased growth, primary production and biomass of algae, resulting in an accumulation of organic matter, hypoxia/anoxia of the bottom waters, possible suffering of the benthic communities and fish die-offs. The causes of eutrophication are mainly due to nutrient inputs into the sea from rivers or coastal settlements, which cause serious negative impacts on the health of marine ecosystems, particularly on *Posidonia oceanica* meadows and surface algal populations in the microtidal environment, to which most species belonging to the genus *Cystoseira* (with the exception of *Cystoseira compressa*, considered to be more tolerant) is sensitive, and to a wide range of environmental stresses, related in particular to eutrophication, the presence of urban, agricultural and industrial pollutants, increased water turbidity, climate change (Relini & Giaccone, 2009, Thibaut, 2014; Mancuso *et al*., 2018). Regarding the effects of farming activities, aquaculture of euryhaline and marine species, in transitional environments and at sea, produces the input or subtraction of nutrients, compounds of nitrogen and phosphorus. Marine aquaculture influences the trophic status of its environment through two processes: nitrogen and phosphorous input by farmed fish, in the form of uneaten feed, faeces and excretions; nitrogen and phosphorous subtraction by mussels that use their compounds as a trophic resource. The balance is given by how much nitrogen and phosphorous is introduced by intensive fish farming and how much is subtracted by filtration from farmed mussels. The discharge of effluents from aquaculture facilities may contain residues from sanitary treatments, antifouling agents and leftover feed.

Inappropriate management can induce eutrophication and reduction of dissolved oxygen. Further impacts relate to the sustainable use of goods and services; the main sources of nutrients are from the crop and livestock farming and civil sectors (urban settlements). In the near future, any approach to assessing changes in eutrophication indicators will have to take into account changes related to atmospheric precipitation, warming and acidification of the seas, which will have an increasing impact on trophic processes and will most likely result in reduced amounts of dissolved oxygen in the marine environment (Wakelin et al., 2020).

- **Descriptor 6: Sea-floor integrity (D6)**

The pressures interacting with the seafloor are mainly those reported by European documents and in the Reporting Sheets prepared for the 2012 Initial Assessment (Phase I MSFD) "Physical Loss" and "Physical Damage", the latter being replaced in the New Decision by "Physical Disturbance", meaning the temporary and reversible disturbances. With regard to "Physical Damage", the EC identified as pressures capable of producing effects/impacts on the seafloor, abrasion, especially caused by fishing activities that actively interact with the seafloor (trawling, fishing with otter trawls and hydraulic or turbo-blowing dredges). Specifically, this pressure affects most of all mobile seabeds located beyond 3NM from the coast (or at depths greater than 50m) up to a maximum depth of 1000m. In addition, the EC has identified extraction and change in siltation (related to river inputs, shipping, etc.). With regard to the Reporting Sheet "Physical Loss", the two pressures indicated by the EC are sealing and smothering. The biogenic substrates potentially subject to significant pressure (from abrasion and/or sealing) are mainly maërl beds and *Posidonia oceanica* meadows, the latter habitat already protected by current regulations. The 2018 Summary Report clarifies that the available data from the Monitoring Programmes do not allow a value to be established constituting a threshold above which a significant impact can be found. In particular, no data are available on the extent of the biogenic substrates of mobile seabeds (maërl beds); therefore, it is neither possible to establish whether these substrates are subject to pressures producing physical disturbance/physical loss, nor is it possible to establish a significant pressure threshold. However, this information represents a serious limitation in maritime spatial planning.

- **Descriptor 7: Hydrographical conditions (D7)**

With regard to this qualitative descriptor, the methodological approach involved the analysis of significant and permanent alterations to the oceanographic background characteristics of the hydrological processes and the physiographic conditions produced by new infrastructure built (or planned) since 2012 and subject to national Environmental Impact Assessment (EIA). In assessing the level of significance of the alterations produced by the engineering works, the analysis was restricted to coastal and marine infrastructure subject to a national EIA procedure. This made it possible to exclude all coastal defence works, the construction of small ports or marinas, and extensions of existing port infrastructures that do not require a national EIA and which are deemed not to produce any significant impact on both the spatial and temporal scales of marine ecosystems, as a specific consequence of altered hydrographical conditions.

Specifically, the assessment of the engineering works did not concern impacts on the ecosystems but focused mainly on benthic habitats, with a regression to the limits of the Habitats Directive.

This descriptor seems to disregard the impact of coastal defences, both as a modification of the seafloor and as a hydrodynamic alteration. In the Adriatic, Ionian and Tyrrhenian maritime areas, numerous coastal defence works have led to modifications of the seabed, completely transforming coastal dynamics. These works, even if small in size and affecting only the coastal strip, are nevertheless widely present along all the country’s coasts and interfere with the hydrodynamics and transportation of sediments, considerably altering the natural balances of the beach system and the marine ecosystem. Changes in hydrographical conditions have produced corridors for alien species, changed sedimentation regimes and created substrates for planktonic species with benthic stages, such as jellyfish. The construction of maritime engineering works (dykes, protective groynes, lagoon inlets, jetties and soft barriers) and harbour structures can have a negative effect both directly, because they are built onto stretches of seafloor characterised by the presence of coralligenous formations (covering the substrate), and indirectly, as in the case of beach nourishment activities with unsuitable materials and consequent increased turbidity. Moreover, these works built between the emerged and submerged beach, have entailed – and indeed still entail – effects ranging from the total cancellation of the body of the beach to the triggering of irreversible erosion processes. Therefore, the impacts produced on a local scale by coastal defence works and small harbours should also be taken into account.

- **Descriptor 9: Contaminants in seafood (D9)**

In the Marine Strategy Framework Directive (EC/2008/56 - Cycle II 2018-2024), contaminants in fish and other seafood are considered within the Qualitative Descriptor for the determination of good environmental status No. 9, which States "*Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards*". The parameters considered, listed in Regulation (EC) No 1881/2006 *et seq.* are: Heavy Metals (Lead, Cadmium and Mercury); Dioxins and PCBs; and Polycyclic Aromatic Hydrocarbons (PAHs).

The latest assessment of the GES under Art. 8 of the MSFD was carried out by ISPRA in the MSFD Report 2018. The data used for the quality status assessment are drawn from specific monitoring activities carried out for the purposes of the Marine Strategy Directive by CNR, according to WP 5.1 (Decree 11 February 2015).

In general, the percentage of data coverage is not extensive enough to provide a meaningful representation of the quality of maritime areas nor to allow a judgement on the environmental status as set out in the GES definitions of Ministerial Decree No. 36 of 15 February 2019. The Adriatic Sea sub-region, however, features a higher percentage of coverage than the other two sub-regions. Despite the lack of information, it can be observed that the available data on the concentrations of contaminants detected in the samples of fishery products do not show exceedances of the threshold values for metals (Cd; Pb; Hg), nor for polycyclic aromatic hydrocarbons (PAH: benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene and chrysene), nor for organochlorines. Thus, a qualitative improvement can be seen, in general, compared to the data processed in the past Initial Assessment (IA), in which exceedances were found for metals in all three sub-regions, although, as already mentioned, the current coverage percentages are lower than in the past assessment (ISPRA, 2018).

Fishery products are exposed to contaminants in the environment due to both natural causes (e.g. natural geological factors including geothermal activity) and anthropic causes (industry, e.g. sewage discharge, agriculture, aquaculture, etc.). In the earth's crust, heavy metals are found in crystalline form and are naturally present in soils and, therefore, in sediments and in marine and transitional waters, and are then found as "natural" contaminants in food. However, human activities have led to an increase and progressive dispersion of these metals into the environment. Mining, metallurgical and metal-processing activities have led to their dispersion into the living environment and are also a risk factor for the general population.

Trophic chains represent the eco-biological target for the set of contaminants present in the environment, which, by penetrating food chains, can be transferred (and often bio-magnified) in prey-predator sequences, all the way to humans. From a strictly sanitary point of view, "heavy metals" s.s., such as lead, cadmium and mercury, represent chemical elements known to be capable of residing and/or concentrating in fishery products (Jaworski JF et al., 1987), with a significant variability, also linked to the different characteristics and trophic level occupied in the food chains by the species (Wang WX., 2002) and zoological groups included in the heterogeneous commodity category. In the past, environmental contamination by heavy metals was generally associated with real "accidents", but with the exponential growth and spread of industrialisation, the phenomenon has turned from an "accidental" to an infrastructure and production problem of increasing intensity, which has become even more difficult to assess. In addition, the growing use of fertilisers and plant protection products has also been added to a widespread state of environmental impairment caused by industrial releases, contamination due to (active or decommissioned) mining activities and improper waste disposal. Pollution of marine waters is mainly due to the development of anthropic activities resulting in the direct or indirect introduction into the aquatic environment of substances capable of producing harmful effects on living organisms and, consequently, on human health; in particular, it depends on the contaminants transported into the sea by rivers and inland catchment basins, which feature large-scale industrial and crop and livestock farming activities and/or intense urbanisation phenomena, while a significant share is due to the direct input, into coastal waters, of urban landfills and industrial discharges (Focardi *et al.* , 2001).

In addition, the presence of contaminated sites (both national SNI and regional SRI) has undoubtedly become one of the most relevant issues for land management: on the one hand, for their environmental and health implications and, on the other, for the socio-economic repercussions from the possible closure of factories and/or the impairment of residential and agricultural settlements in the vicinity of the “contaminated sites”, which can be defined as areas in which the contribution of one or more pollutants determines the effective alteration of the natural characteristics of the soil and water tables.

5.1.3 Possible interactions between the MSP (Sector, Uses, Measures) and the Marine and Coastal Environment

The coastal marine environment component, which includes aspects related to water, biodiversity and areas subject to protection regimes, suffers direct negative effects mainly due to infrastructure engineering projects that lead to the fragmentation of habitats, environments and ecological networks, especially in non-man-made contexts. Eutrophication, a phenomenon mainly due to nutrient enrichment leading to an increase in primary production and algal biomass and consequent alteration of benthic communities, is of great concern in some marine areas. The contamination of sediments, flora and fauna by man-made chemicals is a phenomenon that negatively affects biodiversity. Coastal and maritime activities, such as fishing, shipping, tourism, aquaculture, pollution and oil and gas extraction, place multiple pressures on the coastal marine environment. Waste dispersed in the marine environment is present in all marine ecosystems: plastics, metals, cardboard and other waste products accumulate on the coastlines and seafloor and in surface waters.

Offshore activities and ships also cause underwater noise pollution that can negatively affect the coastal marine environment. As noted in the European Environment Agency's (EEA) 2021 report on the state of Europe's seas, concentrations of contaminants in pieces (such as microplastics) can be thousands of times higher than the seawater, which exposes marine species and habitats to harmful chemicals. This is due to a number of problems such as the lack of effective regulation, adequate control measures and river basin management; deterioration of the coastal areas caused by pollution, urbanisation and the destruction of natural habitats; land-use conflicts, over-exploitation of resources, loss of biodiversity and the possible effects of climate change.

However, efforts to move towards zero pollution will require a focus on water resources as part of the European Green Deal's Zero Pollution Action Plan, which includes restoring the natural functions of aquifers, surface, marine and coastal waters, combating pollution caused by urban surface runoff, and responding to new issues such as microplastics and chemicals. One of the key components of the European Green Deal, the producer-to-consumer strategy, aims to significantly reduce agricultural use and the risk of chemical pesticides, antibiotic use and fertiliser leakage into the environment, e.g. through integrated pest management and an integrated nutrient management plan. The EU Biodiversity Strategy 2030 also pursues similar objectives.

Maritime transport currently plays, and will continue to play, an essential role in world and European trade and economy. In recent years, the maritime sector has taken significant steps to alleviate its environmental impact on marine life. In view of an expected increase in maritime transport globally, as far as the EU is concerned, a new report reveals for the first time the full extent of the sector's impact on the coastal marine environment and identifies issues that need to be resolved with a view to sustainable development (European Environment Agency-2021). Despite the actions taken at the European level to protect marine biodiversity, the overall problems persist.

The coastal marine environment continues to be over-exploited for fishing, leading to particularly serious problems for biodiversity. The fishing fleet is greatly oversized and a reduction in capacity would be required to adapt it to the available fish resources.

According to the MSP forecasts, as shown by the matrix in Section 5.1.1, the most important pressure factors are related to maritime transport, the construction of new port infrastructure, coastal defence works, energy production facilities, both onshore and offshore, aquaculture facilities, fishing, and coastal and maritime tourism. Effects related to pressure factors have been extensively discussed in section 5.1.2 Elements related to potential negative effects from human activities on descriptors D1-D2-D3-D5-D6-D7-D9 of the Marine Strategy and in the following sub-sections. With regard to infrastructure engineering works, however, it must be considered that they are subject to EIA procedures and it is at this stage, in which the typological, dimensional, and locational aspects are clarified, that the possible extent of the impact must be assessed. The environmental context in which the engineering works are located, and the relevant protection regime must be taken into account during the project drafting and EIA phases.

For all other coastal defence works not subject to an EIA that may adversely affect them. either directly or indirectly, the relevant impacts should be taken into account as reported in section 5.1.2.

A number of (national) measures of the MSP (NAZ_MIS|61, NAZ_MIS|62, NAZ_MIS|63, NAZ_MIS|64, NAZ_MIS|65), consistent with the DNSH principle, are of fundamental importance to support the development, harmonisation and implementation of strategies and measures for coastal defence and erosion control (OS_DC|01), to guarantee the best coherence between the sea uses and its vocations of use, as per the MSP Plans and coastal uses (OS_DC|02), and to adequately consider and address the issue of the use and safeguarding of underwater sand for beach nourishment, to be considered as a strategic resource for coastal defence and adaptation plans (OS_DC|03). A number of (national) measures of the MSP, in accordance with the DNSH principle, will be fundamental for the assessment processes concerning aquaculture uses, including the NAZ_MIS|39 and the NAZ_MIS|40 functional to the achievement of the goal of the OS_A|01 Plan aimed at promoting the sustainable growth of the aquaculture sector and the NAZ_MIS|41 measures, NAZ_MIS|42, NAZ_MIS|43, functional to the achievement of the goal of the OS_A|02 Plan, aimed at promoting quality aquaculture and supporting the process of defining AZA (Allocated Zones for Aquaculture).

With regard to fisheries, several of the (national) measures of the FMP (NAZ_MIS|28, NAZ_MIS|29, NAZ_MIS|30, NAZ_MIS|31, NAZ_MIS|32, NAZ_MIS|33, NAZ_MIS|34, NAZ_MIS|35, NAZ_MIS|36, NAZ_MIS|37, NAZ_MIS|38) aim at fostering the sustainable development of the fishery chains (OS_P|01), at fostering the implementation of the forecasts of the European and National Multiannual Management Plans in the Geographical Sub-Areas (GSA) (OS_P|02), at promoting, developing and managing small-scale coastal fishing through sustainable techniques (OS_P|03), at fostering the creation of areas aimed at the recovery and protection of fish stocks and the protection of Essential Fish Habitats (EFH) (OS_P|04), to encourage cooperation between States in order to achieve concerted measures for the sustainable management of their respective national fishing sectors (OS_P|05) and to control and combat illegal fishing (OS_P|06), in accordance with the DNSH principle.

The measures related to the protection of the environment and natural resources (NAZ_MIS|13, NAZ_MIS|14, NAZ_MIS|15, NAZ_MIS|16, NAZ_MIS|17, NAZ_MIS|18) aim at the Ecosystem based approach (EBA) in the general approach and indications of the Maritime Spatial Plans (OS_N|01), to foster the extension of the protection of the EU seas to 30% by 2030 (OS_N|02), to transpose and promote the implementation of the main spatial measures provided in the MSFD Programme of Measures (OS_N|03), to integrate the aspects of land-sea interaction and integrated coastal zone management, with particular reference to environmental aspects (OS_N|04) and to the goals of marine ecosystem restoration, as indicated in the proposed European Nature Restoration Law (OS_N|05). The uses envisaged in the MSP also envisages the NAZ_MIS|71 measure, aimed at directing marine research activities based on the fact-finding needs of the Plan, to strengthen and support the planning process and its sustainable growth objectives (OS_RI|01). Scientific research plays a key role in verifying the effects on coastal marine species and habitats. Monitoring and control of environmental, socio-economic and institutional components are essential for proper management of a marine area. Furthermore, biocenotic mapping has proven a fundamental tool for assessing environmental conditions and planning possible protection and resource management actions in marine areas.

The world of research is therefore called on to play a fundamental role, both in ensuring the development of new methodologies and monitoring tools, and in contributing to the training of professionals capable of supporting public decision-makers and businesses. Even in marine areas subject to protection regimes, scientific research plays a primary role as it must support the managing entity in its strategic decision-making process, providing data on the abundance of focal species, the population structure of focal species, the distribution and complexity of habitats, the composition and structure of communities, the degree of recruitment within communities, the integrity of the trophic network, the type, level and profitability of fishing effort, water quality, analysis of signs of "recovery", assessment of anthropic impacts, all potential biophysical indicators of effective management of a Marine Protected Area. Governments, management entities, NGOs and others are increasingly interested in developing and applying management assessment systems to adapt future management operations; scientific research should support this mechanism by providing more and more innovative tools, accurate, updated data and comparisons with other international situations.

The "National Recovery and Resilience Plan" must also be seen as an opportunity to rethink the world of research, to overcome the chronic shortage of resources, compared to the European average, by investing in human resources and equipment in tackling environmental emergencies, also fostering coordination and cooperative interaction between public bodies, but also with the private sector.

When defining the envisaged measures, the assessment should be based on a coherent ecosystem approach, also taking into account the protection needs of marine and coastal areas, particularly for the high sensitivity areas identified in Chapter 4, Section 4.3.1.1.

For the definition of the areas of greatest environmental sensitivity within the "Adriatic" area of the MSP, reference was made to waters (in terms of percentage of the surface area) falling within Marine Protected Areas (established under Laws 979/1982 and 394/1991, as amended) and in the other types of protected areas referred to in the Official List of Protected Areas (EUAP), in the Biological Protection Zones referred to in the Decree of 22 January 2009 of the MIPAAF (Ministry of Agricultural, Food and Forestry Policies) (OJ General Series no. 37 of 14-02-2009) and in the Fisheries Restricted Area referred to in the recommendations of the GFCM-FAO (*General Fisheries Commission for the Mediterranean-Recommendation*: GFCM/41/2017/3). The analysis conducted revealed the following situation for the Adriatic MA:

Sub-area A/3 features the highest percentage of protection of the marine space equal to 22.2%, compared to the other Sub-areas, due to the presence of the Biological Protection Zone (BPZ) "Outside Ravenna and neighbouring areas" and of Natura2000 Network sites, while Sub-area A/4 features a marine space protection percentage of 0.3%, due to the absence of both MPAs and BPZs. The percentages of 19.7% of Sub-Area A/8 for the presence of the FRA Jabuka/Pomo Pit Fisheries Restriction Zone, and 19.6% of Sub-Area A/6 for the presence of the MPA "Tremiti Islands" and the MPA "Torre Guaceto", the BPZ "Tremiti Area", the BPZ "Off the Apulia Coast" and Natura2000 Network sites are worth highlighting. Overall, the most sensitive areas are represented by Sub-Areas A/3, A/8 and A/6. The provisions of the MSP are to guarantee the goals of species and ecosystem protection and the permitted uses should not lead to pressure factors for habitats. For these areas, the MSP measures, such as NAZ_MIS|05, will be important, i.e. to develop a Maritime Strategy (National Strategy for the Sustainable Development of the Sea Economy) at national level, implemented in synergy with the implementation of the Maritime Spatial Plans, in order to provide a structured impulse to the sustainable development of the Italian sea economy, in the short, medium and long term, aimed at contributing to the National Strategy for Sustainable Development (OS_SS|02). On the other hand, it will be necessary to verify the possible critical issues linked to the uses in the areas for which Maritime Transport and Ports (e.g. A/1_04) are included among the priority uses (P), an area mainly affected by important commercial traffic routes, but also coinciding with a sea SAC and a connecting area in which there are seagrass beds and rocky outcrops (*trezze* or *tegnue*) with coralligenous and rhodolite biocoenoses.

In addition, the area also acts as a protection area for target species such as *Caretta caretta* and *Tursiops truncatus*, which can be found throughout the Upper Adriatic Sea, and is also a breeding and growth area for fish species of commercial interest. Contributing to this will be such measures in the MSP as NAZ_MIS|69, which aims to define tools to control tourism pressure from a perspective of sustainability, and NAZ_MIS|70, which aims to identify and promote sustainable technologies and practices in tourism navigation.

Furthermore, certain engineering works, such as coastal defence works, are instrumental in safeguarding the coastline, which continues to recede also as a result of climate change.

- **The effects of renewable energy production on the marine and coastal environment**

The potential impacts of offshore renewable energy facilities, and in particular wind turbines, on marine and coastal environments may affect habitats, fish, birds, marine mammals and other species (e.g. plants, algae, invertebrates and bats).

The main impacts on **habitats** can be summarised as follows:

- loss of existing habitats and replacement with other habitats (e.g. by adding concrete, steel or rock structures);
- creation of new marine habitats;
- disturbance and degradation of habitats (including penetration, abrasion and compression of sediments and cable laying);
- asphyxiation due to falling sediment in suspension;
- alteration of physical processes due to the presence of new structures;
- release of contaminants or mobilisation of pre-existing contaminants.

In most cases, these impacts envisage a potentially complex range of impacts. For example, damage and habitat disturbance can be caused by any activity that interacts with the seabed. Such activities could include (i) the use of sampling equipment for sampling and coring, (ii) the wake of thrusters, or (iii) the preparation of the seafloor prior to laying foundations and cables. These impacts may have potentially wide-ranging spatial effects and may occur at any time during and after the life cycle of the project. Habitats listed in Annex I of the Habitats Directive that are potentially vulnerable to impacts from offshore wind farms include “sandbanks which are slightly covered by sea water all the time” [1110], “reefs” [1170] and “Posidonia beds” [1120]. Posidonia beds are at risk due to direct physical destruction and sedimentation alterations in hydrographical regimes. Depending on the location of the wind farm and the associated power transmission infrastructure, other habitats or habitat complexes could also be affected. Such habitats and habitat complexes include “estuaries” [1130], “mudflats and sandflats not covered by sea water at low tide” [1140] and “large shallow inlets and bays” [1160]. Some marine habitats, particularly “submerged or partially submerged caves” [8330], are unlikely to be affected by offshore wind farms.

Although activities such as geophysical and geotechnical surveys are unlikely to result in significant impacts on habitats, the potential for geotechnical coring or other activities to result in direct loss of/disturbance to protected habitats should be considered. Attention should also be paid to repowering activities, as they may involve activities with similar effects to other phases. Potentially, repowering activities may even extend the duration of existing impacts beyond the period initially assessed. Installations may affect intertidal and subtidal habitats through (i) loss of habitat in the footprint area of turbines and related infrastructure, (ii) disturbance due to sediment dispersal/sedimentation caused by different activities, which may lead to seafloor asphyxiation, alteration of the physical structure of habitats or remobilisation of pollutants, and iii) temporary disturbances due to the interaction of operations with the seabed, including the use of anchoring legs of self-lifting platforms[83], ship anchors, etc.. Long-term effects on habitats include the introduction of new artificial substrates that may attract benthic and other organisms. Finally, the habitats listed in Annex I of the Habitats Directive may be affected by the exclusion of other activities previously present, such as fishing, thus allowing the restoration of benthic habitats that have been severely damaged by trawling.

Most of the wind farms, and their associated cable systems, are currently located in areas with relatively soft sediments (e.g. sandy bottoms with varying percentages of finer sediments, larger gravel, boulders, etc.): recent studies have shown that the introduction of hard surfaces in areas where sandy sediments prevail has often resulted in significant alteration of benthic communities. Although this alteration can be assessed positively, the marked change in conditions could lead to significant impacts if existing habitats are protected within a Natura 2000 site. Engineered structures or other artificial hard substrates lead to (i) permanent changes in sediment structure, (ii) the sealing of marine sediments, and (iii) the consequent loss of typical soft-bottom habitats. The artificial introduction of hard substrates therefore does not necessarily lead to an ecological improvement of marine habitats. The condition and conservation goals of Natura 2000 sites should be taken into account in assessments, and caution should be exercised when there is limited information available on

[83] Type of mobile platform anchored to the seabed by means of a system of piles known as “anchoring legs”.

the actual historical background conditions. Another aspect that needs to be emphasised is the difference between fixed and floating wind turbine technology, also in relation to the nature of the seafloor on which these structures are placed. Some types of fixed foundations, such as air foundations, do not require piling or drilling of the seabed. This means that the probability of significant impacts is low compared to monopile foundations or foundations that otherwise require the use of anchor piles.

The energy produced by floating wind turbines has a much smaller footprint in terms of habitat destruction. With regard to the potential impacts of the infrastructure on **fish species,** reference is made to those whose effects propagate over a wide distance, e.g. disturbance due to underwater noise and alteration of water quality (e.g. due to suspended sediments). Electromagnetic fields generated by cable systems used to transport electricity from a wind farm to the mainland are also a potential type of impact. In this regard, the sturgeon's ability to detect electromagnetic fields has been observed, although the probability and significance of any impact is not yet well understood. However, there is considerable uncertainty as to whether magnetic fields or induced electric fields may have detrimental effects or whether such effects may be ecologically significant. Underwater noise may need to be taken into account if a wind farm is sufficiently close to a designated site in coastal or estuarine waters, which could be affected by the noisiest wind farm construction activities (e.g. driving of foundation piles and/or detonation of unexploded ordnance). In order to take into account the effects of underwater noise on fish species, it would be possible to classify species according to their sensitivity to underwater noise, based on the presence or absence of a swim bladder: it is understood that fish with a swim bladder are sensitive to acoustic pressure. However, estimates of the distances at which disturbance effects occur are still very uncertain. The interaction between **birds** and offshore power plants, especially wind power plants, has been extensively studied in Europe and worldwide. As a result, numerous national guidance documents are available on birds and such infrastructure (especially wind[84]).

The types of impacts of offshore wind turbines on birds are largely similar to those identified in relation to onshore wind farms, although the cumulative effects may be more significant for offshore structures. These types of impacts have been examined extensively and are summarised below:

- habitat loss and degradation: the elimination or fragmentation of supporting habitats that birds would otherwise use;
- disturbance and displacement: the tendency of birds to move away can lead to habitat loss;
- collision: fatal interaction between flying birds and wind turbine structures;
- Barrier effect: wind farms constitute an impenetrable area for birds in flight, requiring them to cover additional distances resulting in a greater expenditure of energy;
- alteration (e.g. possibility of finding support).

Each type of impact can potentially affect the survival and reproductive capacity of individual specimens. This may lead to alterations in the demographic parameters of a population, which may result in a measurable change in its size. **Marine mammals** (porpoises and cetaceans) can be affected in various ways by offshore wind farms. So far, within the context of offshore wind projects, the focus has primarily been on the effects of underwater noise, due in particular to the construction of wind turbine foundation piles, e.g. monopile foundations and lattice structures. These types of foundations can produce high levels of impulsive noise that can adversely affect the activity level of marine mammals. These effects are progressively reduced the further away we move from the site. In addition to the effects caused by noise, there are a variety of additional potential effects of wind farms on marine mammals, the importance of which may increase as our understanding of their significance for these species improves. A few examples are given below:

- acoustic perturbation and displacement
- hearing impairment (injuries caused by underwater noise)
- interference in communication
- loss of habitat

[84] In Italy, one example is the Ministerial Decree of 10 September 2010, whose Attachment 4 "Wind farms: elements for their proper inclusion in the landscape" contains "*aspects relating to their potential environmental and landscape impacts and construction criteria and mitigation measures to be taken into account, both in the design phase and in the compatibility assessment phase of the projects*".

- collision with vessels
- barrier effect
- reduction of fishing pressure
- alteration of water quality (contaminants)
- effects of electromagnetic fields on navigation
- cliff effect

With regard to noise, in addition to the noise generated by pile driving operations, the noise produced during the pre-construction and operating phase of the plant may also affect marine fauna. For the construction of an offshore wind farm, geophysical and geotechnical surveys are often carried out in combination with surveys. Such surveys involve high levels of noise, which can generate permanent and temporary damage to the hearing apparatus, escape/avoidance tendencies and other behavioural incidences. Some echosounders use frequencies in the hearing range of harbour porpoises and may disturb the species, which is highly dependent on acoustic communication for its survival. The continuous noise produced by the vessels involved in periodic maintenance can also cause disturbance. While the noise generated by pile driving can cause serious physical harm to some animals but only lasts for a few months (during the construction phase of the wind farm) and then stops, in contrast, the noise caused by the operation of a wind farm is much less but lasts for many years and could affect the behaviour of some species, possibly altering the balance of the site's ecosystem. Neither the initial nor the long-term noise impacts of offshore wind farms on marine fauna are yet fully understood. The noise generated by pile driving can also potentially cover the loud vocalisations emitted by truncate bottlenose dolphins at a distance of 10-15 km and weak vocalisations even at a distance of 40 km.

The displacement effect of dolphins (i.e. their moving away from the pile-driving site) may outweigh interference in communication during the construction phase. Less intense levels of noise, e.g. during the operation of the wind farm, could, however, have significant consequences over a longer period of time if normal behaviour is impaired. A possible further repercussion concerns, as mentioned above, the potential loss of habitat: theoretically, the construction of an offshore wind farm can be assumed to result in a loss of habitat at least equivalent to the footprint area of the new infrastructure (including wind turbine or substation foundations, corrosion protection and cable protection). The increased vessel traffic associated with wind farms also increases the risk of marine mammals colliding with them. Most analyses of marine mammal collisions with vessels, however, are not related to wind turbines, but mostly focus on shipping traffic along offshore shipping lanes and involve large species such as sperm whales and whales. It has been found that most fatal collisions occur with vessels of 80 m or more travelling at speeds of 14 knots or more.

In any case, the intensification of vessel traffic caused by wind farm activities is an important cumulative effect, which is particularly significant in seas that already feature a high degree of shipping pressure, such as the Mediterranean Sea. Another potential negative effect relates to the concept of the so-called “barrier effect”, which is based on the assumption that the presence of wind turbines and their associated activities could be an obstacle to the movement of certain species of marine mammals. The duration of this effect would be longer than temporary disturbances during the construction and decommissioning phases or single events during the operation phase, e.g. maintenance work. With regard to species commonly found in the vicinity of existing offshore wind farms (e.g. harbour porpoises, common seals or grey seals), however, there appears to be no evidence of a possible barrier effect. Some evaluations have also ruled out the possibility that multiple simultaneous pile-driving activities may collectively constitute a barrier to movement from one area to another. For other species (e.g. fin whales, *Balaenoptera physalus*, sperm whales, *Physeter macrocephalus*, and Cuvier’s beaked whales, *Ziphius cavirostris*), potentially present in new wind farm development areas, such as the Mediterranean, no information on the potential barrier effect is however available.

Marine mammals are vulnerable to toxic contaminants, which can bioaccumulate and be transmitted from mothers to their offspring through lactation. Most of the relevant pollutants that can bioaccumulate are no longer used and the current effects are largely the result of past discharges. However, fat-soluble chlorinated organic compounds, such as industrial polychlorinated biphenyls (PCBs), can be ingested through food and potentially lead to reduced reproductive capacity and a weakened immune system. From this point of view, it should be remembered that any offshore installation requires the use of various chemicals, such as lubricating oils, engine oils, hydraulic fluids and antifouling compounds (compounds that prevent the formation of algae on marine infrastructure). The alteration of water quality may also depend on the mobilisation of suspended sediments. The rather low sensitivity of marine mammals to suspended sediment, together with the generally limited spatial and temporal extent of any effects, usually results in low impacts. A further repercussion may concern the electromagnetic fields created during the operation of the plant, from normal alternating current (AC) and high voltage direct current (HVDC) electricity transmission cables. These fields can in turn induce electric fields in the marine environment, which are assumed to potentially affect the orientation ability of cetaceans. There is no known evidence that this effect occurs in practice, and it is not currently considered to have a significant effect on cetaceans. Finally, reference is also made to the so-called "reef effect", which can occur when new structures are built in marine waters. Colonisation (settlement of species on structures) of artificial "reefs" by algae and other organisms ("reef effect") may result in the alteration of the surrounding natural habitats, including prey and their behaviour. This alteration may include beneficial effects from reduced fishing activity and increased aggregations of (prey) fish. Wind farms can therefore potentially have a positive impact on marine mammals and fish through the creation of habitats following the introduction of new hard substrates (foundations and corrosion protection) and/or the reduction/exclusion of fishing activities. When decommissioning, it is therefore necessary to weigh the pros and cons of not removing certain structures, such as wind turbine foundations or rock armour, as this could be beneficial for marine mammals. These pros should be weighed against the cons of removing the structures, which could arise from other conservation interests (e.g. if the pre-existing habitats were of a different nature) and advantages for the users of the sea, e.g. fishing interests and navigation safety.

The potential impacts on **plants**, **algae** and **invertebrates** are generally considered in relation to their habitats. In turn, the sensitivity of marine habitats is often partly described in relation to factors such as the resistance and resilience of typical and associated species. However, the effects on the receptors examined may have consequences for groups such as marine mammals or seabirds if, for example, the search for food is affected. The only plant species specifically associated with the habitat types listed in Annex I of the Habitats Directive are *Zostera marina*, *Zostera noltii*, *Cymodocea nodosa* and *Posidonia oceanica* (Posidonia meadows, *Posidonion oceanicae*). Other aquatic plants are also potentially vulnerable to the effects of habitat loss and disturbance if they are located in the vicinity of offshore wind farms. Due to the need for aquatic plants to live in shallow water exposed to sunlight, interactions with offshore wind farms are more likely to occur at the level of power transmission cables rather than in the areas where turbines are located. However, at the site of the Middelgrunden offshore wind farm, in the shallow waters of the Öresund Strait in Denmark, aquatic plant meadows (*Zostera marina*) were present prior to the construction of the wind farm.

Monitoring of these seagrass meadows has revealed that, three years after the construction of the turbines the level of plant cover had not been affected, meaning that there was no negative impact due to the construction of the wind farm (including dredging and laying of the gravity foundations). It was observed that seaweed generally colonises the new surfaces provided by wind turbine foundations. Equivalent habitats are provided by the offshore oil and gas extraction sector; however, wind turbine foundations are more numerous. This colonisation contributes to an increase in structural and biological diversity, potentially resulting in a reef effect, which leads to further effects in relation to the colonisation of invertebrates.

As far as marine invertebrates are concerned, wind farm infrastructure introduces new hard substrates, above and below the water surface, to which they may adhere. In some cases, this reef effect may increase diversity, although some studies have also suggested that it risks contributing to the spread of invasive exotic species. Regardless of the net increase in biodiversity, an alteration of habitats or species communities may, however, have negative effects on the conservation goals of the Natura 2000 site in question.

Offshore wind installations must therefore always be subject to appropriate assessment.

Attention was also paid to the increase in temperature around the cables in relation to the effects on the benthos. The operation of submarine power cables, in fact, generates heat, warming the local sediments.

The degree of heating depends on the characteristics of the cables, the electricity transported, the depth to which the cables are buried and the characteristics of the sediments. Heat dissipates rapidly in seawater. Consequently, the effects on sediments at shallow depths are negligible, where cables are buried 1 m or more and there is efficient heat exchange with the body of water above.

This means that the surface epifauna and infauna, which dwell in the top centimetres of the sediments, will not be exposed to a significant temperature change. Most benthic animals inhabit the upper 5-10 cm of the seafloor in the open sea and the upper 15 cm of the seafloor in the intertidal zones, where the temperature increase will be modest, provided the cables are buried deep enough. Some animals, such as langoustines, dig deeper into the seafloor, although the overall habitat area subject to warming is likely to be very limited.

Finally, with regard to the effects on **bats** due to offshore wind farms, the risk of mortality due to a direct collision or barotrauma has a cross-border dimension, as bats may dwell hundreds of kilometres from the offshore infrastructure in question. In order to assess the incidences of possible increased mortality at sea, it is necessary to know or be able to estimate the size of the bat population, including the part of the population that crosses the sea. Potentially relevant species are the Nathusius' pipistrelle (*Pipistrellus nathusii*), the common noctule (*Nyctalus noctula*) and the parti-coloured bat (*Vespertilio murinus*).

- **The effects on the marine and coastal environment of hydrocarbon prospection, exploration and production activities**

Hydrocarbon prospection, exploration and production activities and the subsequent decommissioning of plants determines specific pressures that must be taken into account to identify possible environmental impacts at sea. During the **exploration** phase, surveys (of a geographical, geological, geophysical and geochemical nature) are carried out to ascertain the geo-mineral characteristics of the site and to locate the presence of hydrocarbon accumulations below the surface of the explored seabed. In particular, geophysical surveys exploit the properties of elastic waves that propagate in the seabed and are reflected differently according to its geological and mineralogical characteristics. The acoustic waves used in this type of investigation constitute a pressure (noise) that produces effects on marine organisms with high risks for biodiversity. Collection vehicles emit noise and light in an environment that is normally in complete darkness. Dredging the seafloor also raises clouds of sediment. One of the main open questions still to be defined is how far deep-sea currents would spread these clouds. By settling back on the seafloor, the sediments could smother living species even if they live far away from the area where the operations take place.

Each mining operation would remove a "biologically active" surface layer from the seafloor, each year, from an area of approximately 200-300 square kilometres (National Geographic 2022).

Also to be considered at this stage are the other sources of environmental pressure related to the operation of the vessels used for geophysical surveys, which produce underwater noise (although vessels suitable for carrying out seismic surveys must be equipped with particularly "silent" propulsion systems to avoid interference with acoustic acquisition systems), emit fumes that fall back into the sea, release effluents and may impact with charismatic marine megafauna.

Another effect due to the extraction of raw materials and hydrocarbons is the control of environmental risks due to the management of extractive waste by the mining industry.

Waste from the extraction industries represents a quantitatively significant waste stream in the EU. According to the European Environment Agency, it is estimated that this type of waste accounts for about 29% of the total waste generated each year in the EU and that its annual volume exceeds 400 million tonnes.

The **research** phase, for verifying the validity of the stratigraphic-structural results collected in the previous phase, envisages the drilling of exploratory wells, an activity that requires the use of a drilling rig mounted, depending on the depth of the seabed, on a platform resting on the seafloor, on a semi-submersible platform or on an anchored vessel. The discharge of civil effluents, leakage of drilling fluids and/or drilling debris may constitute specific pressures associated with the execution of exploratory wells, in addition to the noise induced by the drilling operations (pumps, motors, jacking and rotary rigs, etc.). Additional pressures associated with this phase are related to the area of marine surface occupied by the drilling rig (the extent of the area depends on the type of platform on which the rig is mounted), with limitations to navigation and fishing and a punctual increase in maritime traffic for the use of support and service vehicles. The subtraction of space from other uses of the sea, e.g. fishing activities, can also have environmental consequences in marine areas far from the research (and possibly, cultivation) site, as in the case of the concentration of the fishing effort in areas not affected by restrictions and prohibitions. The usability of the landscape, however temporary, may also be affected by the presence of the facility and its means of service.

The **production** phase includes the actual drilling of wells to exploit the reservoir, the installation of the relevant structure and finally production (extraction of the oil or natural gas from the subsoil and possible first treatment on the offshore platform). For the exploitation of hydrocarbon deposits at sea, different types of platforms are used, either fixed or floating. The drilling and installation of the platforms, the operation of the rig and the presence itself constitute pressures with possible impacts on marine environments.

Compared to the pressures mentioned for the exploration phase, those relating to the liquid or gaseous hydrocarbon production phase are more or less the same, with pressures on habitats and the landscape, the production of underwater noise, the subtraction of maritime space, environmental pressures dependent on the movement of service vehicles and the combustion of propellants, and the possible alteration/obstruction of migratory routes as well. Among the pressures that hydrocarbon activities may exert on the marine environment, the interaction of the offshore structure with the migratory routes of birds should also be mentioned. In particular, the artificial lighting that oil platforms generate in the offshore marine environment, although this phenomenon is still poorly understood, may affect both migratory and resident birds.

During the production phase, generally speaking, we may also add the discharge of civil effluents into the sea and the discharge, into the sea or into certain geological formations, of effluents from the extraction and treatment of hydrocarbons, so-called “production waters”. These, after being treated to remove the hydrocarbons, in accordance with the Ministerial Decree of 28 July 1994 and the Ministerial Decree of 3 March 1998 (mineral oil concentration of less than 40 mg/l - Art.104, paragraph 5, of Legislative Decree 152/2006 as amended) and subject to authorisation by the Ministry of the Environment and Protection of Land and Sea, may be discharged into the sea. The production phase also involves the installation of submerged structures extending for miles from the wellheads to the coast. This is the case with gas and oil pipelines, which can cause environmental damage to the habitats and populations they cross.

The offshore structure **decommissioning** phase begins with the end of the mining operations and the closing of the deposit and ends with the removal of the casing column, the intermediate columns and the production column beneath the seabed, through cutting and recovery, or, alternatively, with the authorisation of an alternative reuse or partial removal of the platforms or related infrastructure, in accordance with a specific project prepared and approved pursuant to the "National Guidelines for the Decommissioning of Extraction Platforms for the Production of Hydrocarbons at Sea and Related Infrastructures", approved by D.M. of 15 February 2019. The platform decommissioning operations require certain preliminary offshore activities to be carried out, such as surveys and inspections, cleaning the marine concretions, securing the safety and rehabilitating the related facilities (which involves pipe emptying and remediation operations, by means of washing with water and/or steam and the possible use of chemical additives) and the preparatory work for decommissioning. This preliminary phase is then followed by the cutting and removal of the platform, transportation of the removed materials to the mainland and dismantling of the removed materials, and finally the disposal of the said materials. The pressures that may generate significant impacts on the environment are therefore mainly noise and vibrations, the to and fro of ships, emissions of pollutants into the atmosphere, discharges of water, production of sewage and waste, pollutant leakage, night lighting, and the movement of marine sediments. A positive effect of such operations could be the removal of materials useful for combating coastal erosion (beach nourishment). Coastal erosion is a generalised and continuous process taking place along sandy coasts. The construction of harbours on sandy coasts or emergency defence works built to protect built-up areas or communication infrastructures have also locally aggravated the phenomenon.

For this reason, the need to plan and design coastal defence works in accordance with Integrated Coastal Zone Management (ICZM) criteria has increased over the years, taking into account not only the effectiveness of a work in counteracting erosion, but also how the alterations produced in the environmental matrices can affect the economic and social resources, landscape component, and conservation of ecological resources and biodiversity. All maritime engineering works modify the coastal morphology and interfere with the littoral transportation of sediments. Therefore, the choice of the best solutions to contrast erosion must be supported by a careful analysis of the whole set of (marine, continental and anthropic) factors that most influence coastal dynamics, on the scale of both the hydrographical basin and the underlying coastal areas (physiographical units).

5.1.4 Possible interactions between the MSP (Sector, Uses, Measures) and the environmental component Soil

A study by Marino and Tomassetti (ISPRA2018) notes that the intensive aquaculture of fish species can result in the release of waste, both organic, in solid and/or dissolved form, and inorganic, composed largely of carbon, nitrogen and phosphorous.

When they exceed the natural assimilation capacity of an ecosystem, alterations can occur in the water column and sediments with phenomena that are usually localised and rather modest in size. However, in some cases, and under particular environmental conditions and types of farming, eutrophication phenomena, dissolved oxygen depletion and changes in biodiversity on a local scale may occur.

Aquaculture in cages with increased sedimentation of particulate organic waste may lead to increased oxygen demand of the sediment community and may affect sediment chemistry, which, in turn, may cause changes in species diversity, abundance and biomass of benthic fauna and flora. The latter can also be affected by smothering, due to the sediment generated by waste products or shellfish harvesting, especially if hydraulic or mechanical dredges are used. Where smothering occurs only periodically, the level of recoverability is generally reasonable, especially if bivalve fields are percolated by currents (ISPRA 2018). An improvement in productivity and an increase in quality and environmental sustainability of aquaculture could be achieved through appropriate spatial planning for the development of new sites shared with other activities, and facilitate the licensing procedures (SHAPE Project, 2014; Adriplan, 2015).

As argued by national and international researchers, the impact of trawling on sediment structure, benthic biodiversity and all the basic nutritional resources in these deep-sea sedimentary ecosystems is often severe, and there is no information available on the recovery time of benthic ecosystems below 500 m depth. A group of researchers have compared sediment samples from “ploughed” and “unploughed” areas off the Spanish coast and found that trawling has drastically reduced the total amount of small animals living in marine sediments, such as nematodes, small worms that are the dominant group in these environments and are really important in ecosystem processes (www.mongabay.com). Another effect of trawling is the loss or abandonment of nets, traps and longlines (lines several kilometres long), which remain in the sea as waste (Ghost Gear Report), damaging the underwater habitats because fishing nets are made of nylon, polypropylene, polyethylene, polyester and other materials, which are cheap and strong but cause a serious environmental problem if abandoned in the sea. Another consequence of trawling is the release of carbon dioxide (CO2), due to the mechanical action on the carbon-containing sediments that are mobilised from the bottom. The release of CO2 from the bottom increases the acidity of the oceans and reduces their ability to absorb it from the atmosphere (www.lifegate.it). The construction of infrastructures at sea can determine two different effects on the Soil component: the first is due to the infrastructure itself, which could constitute an obstacle to the free propagation of waves and, by interacting with it, give rise to various kinds of effects that can be felt even at great distances, and the second is due to the execution of the works, which could lead to the mobilisation of materials by rolling or suspension during the infrastructure laying operations. These phenomena, varying in intensity through time and space, could interfere with the natural dynamics of coastal sediments.

Coastal protection works built along Italian coastlines over the years belong to different types, adopted according to the geological and sedimentological context or according to design purposes; the most common, as reported in ISPRA's research on the coastline in Italy (2022), are attached breakwaters, detached breakwaters and transverse groynes. Attached breakwaters, generally consisting of natural or man-made boulders, are attached to the coastline, as the name suggests, to strengthen it, however entailing changes in the profile of the emerged and submerged beach, as the sediments at the foot of the structure tend to be resuspended and transported offshore by the reflected waves and permanently removed from the solid transport balance, with the possible occurrence of scouring at the foot of the breakwater.

To this can be added the failure to form a new shoreline at the back of the breakwater, the alteration of currents and littoral solid transport, and the disappearance of the beach and dune habitat (ISPRA 2014). Detached breakwaters are also made of natural or artificial materials placed on medium shallow seabeds; they may consist of single or series of structures, with openings at intervals to facilitate water circulation and exchange.

The formation of rip currents between the breakwaters, the displacement of the littoral current towards the open sea, the formation of a sandy bar at a certain distance from the shoreline, deposition in the protected area and erosion in the sectors adjacent to and in front of the breakwaters, and the growth of the beach behind with thin material are the most common effects produced by these works (ISPRA 2014).

The function of groynes is to intercept littoral currents, so as to redistribute sediments along the shore, allowing the formation of a protective beach or slowing down ongoing erosion. These defence works can lead to the upstream shoreline advancing, the strengthening of the beach profile and changes in the grain size of the sediments of the downstream beach. Moreover, they usually trigger erosion in the under-billow areas, altering the layout of the shoreline, changing the over-billow and under-billow beach profile and forming rip currents (ISPRA 2014). A very common "soft engineering" approach to coastal protection along sandy shores in Italy is beach nourishment, which is a process by which suitable sediment, usually sand, lost through drift or erosion is replaced from other sources, of marine or terrestrial origin, to replenish the (emerged and/or submerged) beach. The results of this type of intervention are immediate and the sandy beaches, therefore, become accessible to the public instantaneously, which is one of the main advantages of beach nourishment, together with the fact that, by adopting grain sizes compatible with the pre-existing sand, the originality of the site is preserved and enhanced. With regard to the physical effects associated with beach nourishment, replenishing the shoreline with sand can produce morphological and granulometric variations attributable to the advancement towards the sea of the beach's equilibrium profile and the increased width of the emerged beach.

There may also be a temporary increase in suspended particulate and increases in turbidity levels resulting from the use of materials with mineralogical characteristics that are too different from those present on the native beach (ISPRA 2014). Depending on the degree to which a coastal dune cordon is compromised, it may be possible to restore and protect the dune system by means of the morphological reconstruction of coastal dunes (conventional engineering) or to the construction of windbreaks and restoration with plant species (naturalistic engineering). For the morphological reconstruction of the dunes, sediments that are compatible, in terms of their granulometry and mineral composition, with the pre-existing sediments are used, possibly protecting them from erosion with windbreaks and/or semi-rigid elements placed at the foot of the dune and shaping the dune profile so as to minimise wind deflection. In these cases, the impacts on the environment are limited to the sand removal and relocation from neighbouring shorelines. Naturalistic engineering aims to foster and accelerate the stabilisation mechanisms of wind deposits and revegetation.

The replanting of vegetation follows the preparation of a substrate, with the aim of fertilising the soil and, through the use of geotextiles, counteracting wind erosion (ISPRA 2014).

By-pass systems are set up to protect adjacent shores and seabeds in order to restore sediment transport from one side to the other of maritime engineering works, such as harbours or transverse groynes.

The potential physical effects associated with these systems are mainly due to the mechanism of sediment suction and reflow, which can produce an increase in resuspension and therefore water turbidity in the vicinity of the intervention area (APAT 2007, ISPRA 2014).

The relict sand deposits correspond to ancient beaches, also known as "fossil beaches", formed during the Ice Ages, when the sea level had dropped about 120 m below the present day, and which today are sometimes covered by recent pelitic sediments. These natural submerged deposits can provide suitable sediments for replenishing eroding shorelines through dredging operations. The effects on the marine environment generated by dredging relict sands are observed both on the seafloor and in the water column. In fact, dredging operations can lead to alterations in morphology, granulometric and chemical variations (dissolved oxygen) and changes in the compaction of surface sediments on the seabed and resuspension of the fine fraction of the sediment removed, with the possible generation of surface and deep turbidity plumes in the water column (ISPRA 2018).

The physical-mechanical effects of dredging operations depend on the type of dredge used: stationary dredges, used when the deposit is predominantly vertical, produce a series of sub-circular depressions and/or pits of varying size (diameter from 20 to over 100 m, depth from 2 to 20 m), while self-propelled dredges produce a series of sub-parallel furrows of varying size (from 1-2 m up to 4-5 m wide, 0.5 to 2 m deep). Other factors contribute to determining the nature and extent of the physical alteration of the seafloor, such as the geometry and method of production of the deposit: deposits of wide spatial extent are produced for a limited thickness over large areas, while less extensive deposits are produced at depth for a maximum useful thickness (ISPRA

2018). Numerous studies report great variability in the time required for seabed recovery, understood as the restoration of the seafloor to its morphological and sedimentological conditions prior to dredging.

These times can vary from 1 month to more than 15 years, with faster recovery if the dredging is carried out with a self-propelled dredge, in a very dynamic environment, while after the use of stationary dredges, especially in low energy environments, restoration can be extremely slow and may not even be completed in the case of very deep cavities. The construction of offshore wind farms involves significant effects on the seafloor due to the laying of the foundations, which can be either monopile, tripod or four-leg (or pillar) foundations. Monopile foundations can be built up to a depth of 30 m and consist of a pipe that is driven into the seafloor. More stable three- or four-legged foundations can be used for greater depths but involve a greater impact on the seafloor. The laying of the foundations can lead to a load of suspended sediment in the water column, increasing its turbidity with a negative impact on the fauna, in particular on corals, sponges and anemones, and with probable negative influences on algae photosynthesis as well.

To reduce this negative effect, self-propelled anti-turbidity structures can be used, the use of which, recently monitored in the Venice lagoon, has provided encouraging results.

A quantitative (incomplete and rather speedy) indication of environmental sensitivity, in relation to the soil component, can be achieved by way of a series of indicators that are particularly significant in the coastal context, with both constant updating and national geographical coverage. These indicators consist of: coastal erosion, urbanisation of the coastal strip, shoreline naturalness, coastal subsidence, flood risk (based on the flood risk management plan or PRGA). For each planning unit, using GIS techniques, the contribution of each indicator on the sensitivity of the soil component was assessed and, subsequently, a relative sensitivity index was calculated from their geographical overlap and summation. The results of this procedure made it possible to identify, for the maritime area in question, 35 planning units with an environmental sensitivity index of the soil component. Of these, 3 have a “very high” index, 1 a “high” index, 12 a “medium” index and, finally, 19 a “low” index as shown in the table below.

Sub-area	Planning Unit	Soil Component Sensitivity Index
A/3	**A/3_01**	Very high
A/3	**A/3_05**	Very high
A/4	**A/4_11**	Very high
A/5	**A/5_04**	High
A/3	**A/3_03**	Medium
A/2	**A/2_03**	Medium
A/2	**A/2_02**	Medium
A/2	**A/2_01**	Medium
A/4	**A/4_07**	Medium
A/6	**A/6_01**	Medium
A/6	**A/6_07**	Medium
A/6	**A/6_08**	Medium
A/6	**A/6_12**	Medium
A/6	**A/6_17**	Medium
A/6	**A/6_22**	Medium
A/1	**A/1_01**	Medium
A/3	**A/3_02**	Low
A/1	**A/1_03**	Low
A/5	**A/5_01**	Low
A/5	**A/5_06**	Low

Sub-area	Planning Unit	Soil Component Sensitivity Index
A/5	**A/5_05**	Low
A/4	**A/4_04**	Low
A/4	**A/4_10**	Low
A/4	**A/4_09**	Low
A/6	**A/6_03**	Low
A/6	**A/6_02**	Low
A/6	**A/6_05**	Low
A/6	**A/6_09**	Low
A/6	**A/6_11**	Low
A/6	**A/6_14**	Low
A/6	**A/6_19**	Low
A/6	**A/6_21**	Low
A/6	**A/6_23**	Low
A/6	**A/6_26**	Low
A/1	**A/1_02**	Low

Table 5.5 Classification of the Planning Units of the "Adriatic" Maritime Area, according to the Soil sensitivity index. Data from ISPRA, National Civil Protection, Copernicus Corine Land Cover, PCN National Geoportal MITE – processed in 2022 by SOGESID.

In particular, for planning units A/3_01 (Comacchio coastline in the province of Ferrara), A/3_05 (coastline from Marina di Ravenna to Cattolica, in the provinces of Ravenna, Forlì-Cesena and Rimini) and A/4_11 (Rio Canale beach, beach between the Acquarossa ditch and the S. Lucia and the littoral on the left mouth of the F. Tronto (in the provinces of Fermo and Ascoli Piceno) as well as for the Planning Unit A/5_04 (Teramo littoral) the most significant effects of the MSP on the Soil component are expected. Figures 5.1.3A, 5.1.3B and 5.1.3C represent the Planning Units listed above and all the others reported in Table 5.1.3 in their geographical and administrative context of belonging.

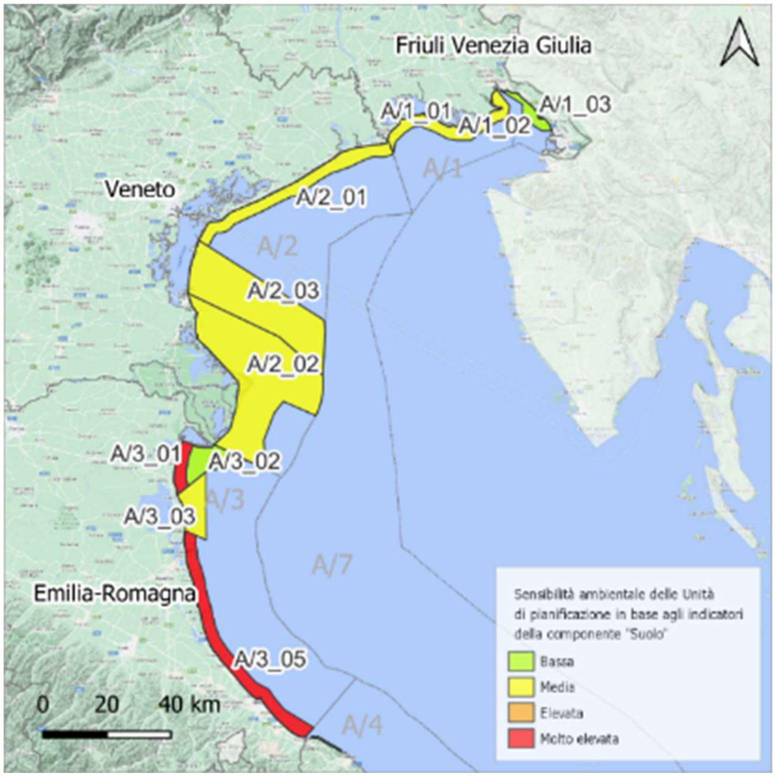


Figure 5.2 Mapping of the Planning Units falling within the Adriatic Sea Sub-areas A1, A/2 and A/3 according to the sensitivity index of the Soil component. Data from ISPRA, National Civil Protection, Copernicus Corine Land Cover, PCN National Geoportal MITE – processed in 2022 by SOGESID.

Figure 5.3 Mapping of the Planning Units falling within the Adriatic Sub-areas A/4 and A/5 according to the sensitivity index of the Soil component. Data from ISPRA, National Civil Protection, Copernicus Corine Land Cover, PCN National Geoportal MITE – processed in 2022 by SOGESID.

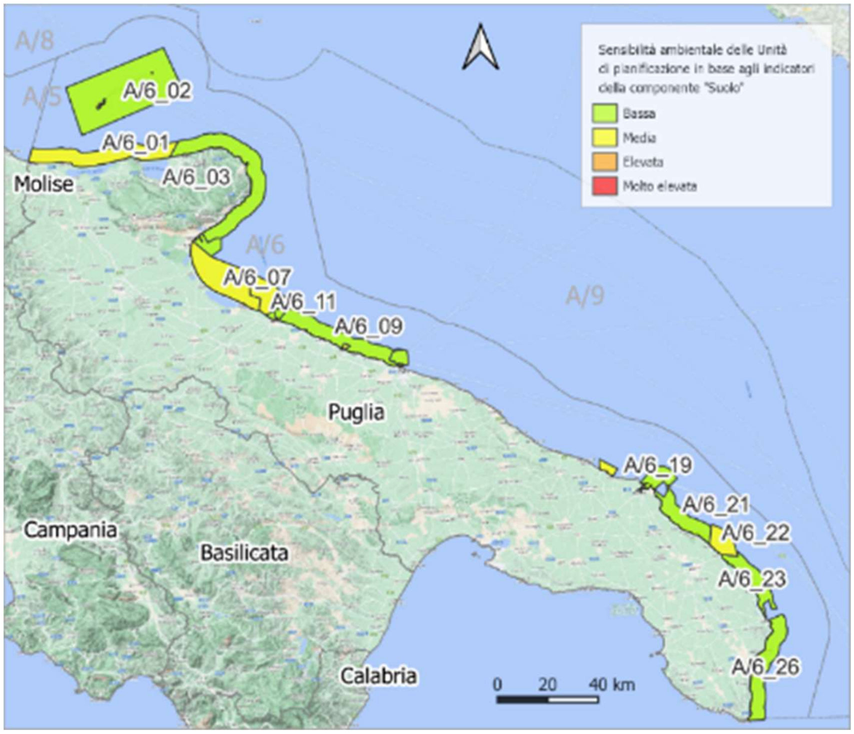


Figure 5.4 Mapping of the Planning Units falling within the Adriatic Maritime Sub-area A/6 according to the sensitivity index of the Soil component. Data from ISPRA, National Civil Protection, Copernicus Corine Land Cover, PCN National Geoportal MITE – processed in 2022 by SOGESID.

➢ **The effects on the Soil of renewable energy production**

No further particular issues are reported beyond what has already been noted with regard to potential impacts on marine environments.

➢ **The effects on the Soil of hydrocarbon prospecting, exploration and production activities**

With regard to the soil component, the greatest impacts are caused by possible hydrocarbon spills from pipelines or well structures and other chemicals from tank ruptures. The disposal of stratum water and drilling sludge may be another possible source of contamination for this environmental component. Other impacts are due to the physical occupation of soil by extraction facilities and pipelines and interference with soil due to construction and engineering works in relation to oil extraction projects. Moreover, hydrocarbon extraction produces localised subsidence above the deposit, whether on land or at sea; therefore, this activity, if conducted at sea, cannot cause effects on the ground level along the coastal strip.

5.1.5 Possible significant effects of the MSP measures on air and climate change

➢ **Air and climate change effects of renewable energy production**

The construction of energy production facilities powered by offshore renewable sources, especially wind power, will have a typically positive impact on air and climate change. On the other hand, the development of renewable energy installations is one of the pillars underpinning the EU's environmental policies in the fight against climate change, as well as for issues related to, for example, the security and affordability of energy supplies. The production of energy from renewable sources, in fact, saves emissions of pollutants and climate-altering compounds that would occur in the case of energy production using traditional fossil fuels (as well as considering the average national energy production mix). Achieving the PNIEC's (National Integrated Plan for Energy and the Climate) 2030 target for offshore wind power (900 MW) would allow emission savings of about 450 thousand tonnes per year of CO_2, 370 tonnes per year of NOx and 4 tonnes per year of dust.

Therefore, the positive effects of these projects on this environmental component should be noted.

- **The effects on air and climate change of hydrocarbon prospection, exploration and production activities**

The repercussions of hydrocarbon extraction activities (prospection, exploration, production and decommissioning) on the environmental air component primarily arise from ducted (boiler smokestacks, turbochargers, generators) and non-ducted (fugitive emissions) atmospheric emissions. Particular attention must be paid to the presence of flares. In order to prevent any fugitive emissions that may occur, an appropriate periodic maintenance programme is adopted by the Proponent/Plant Operator, to identify any leaks and their repair. During gas flaring and gas venting, in connection with well operations, the gases emitted may include Volatile Organic Compounds (VOCs), nitrogen oxides (NOx), sulphur dioxide (SO_2), hydrogen sulphide (H_2S), carbon monoxide (CO) and carbon dioxide (CO_2). Some of these gas emissions can be very toxic and in some cases fatal to humans and other animals, depending on the concentrations and time of exposure.

5.1.6 Possible significant effects of MSP measures on human health and the socio-economic context

The MSP, through the NAZ_MIS|05 (national) measure, aims at implementing a nationwide Maritime Strategy (National Strategy for the Sustainable Development of the Sea Economy), to be implemented in synergy with the implementation of the Maritime Spatial Plans, capable of ensuring a structured impulse to the sustainable development of the Italian marine economy, in the short, medium and long term. In order to define the reference context and assess the potential (positive) impacts on the socio-economic system, related to a sustainable development of the sea economy, the MSP has provided for a specific measure, namely the NAZ_MIS|04 and NAZ_MIS|03 (aimed at "*Developing methods and tools for the quantitative assessment of the socio-economic effects of the planned decisions, to support the adaptive management phases of the MSP*".

As shown by the matrix in Section 5.1.1, most of the expected effects on the socio-economic system are of a positive nature; this is also explained by the fact that the MSP has among its objectives that of "*Developing a sustainable economy of the sea multiplying growth opportunities for marine and maritime sectors*" (SO_SS|01) and to "*Contributing to the National Strategy for Sustainable Development*" (SO_SS|02 through NAZ_MIS|05) and "*Contributing to the European Green Deal*" (SO_SS|03 through NAZ_MIS|06) and "*Fully grasping the economic and environmental sustainability opportunities arising from the circular economy*" (SO_SS|04 through NAZ_MIS|09). The support in the MSP for sectors such as fisheries (NAZ_MIS|28-29 and NAZ_MIS|31-38), aquaculture (NAZ_MIS|20 and NAZ_MIS|39-43), the strengthening, development and valorisation of shipbuilding (NAZ_MIS|10-12), traditional maritime activities (NAZ_MIS|24), maritime transport (NAZ_MIS|44-51), coastal tourism (NAZ_MIS|66-70) is framed within a rationale of sustainable development; this means, first of all, reducing environmental pressure factors (atmospheric emissions, water pollution, production and risk of waste dispersion at sea, underwater noise emissions, risk of accidents, disturbance of marine fauna, reduction of biodiversity, etc.), improving production processes and the competitiveness of production sectors (reducing costs by increasing energy efficiency, creating better working conditions for operators, creating balanced conditions in tourist flows, etc.), carrying out environmental remediation and redevelopment of coastal areas, promoting/creating awareness of the value of the economic activities that make up the intangible heritage linked to the uses of the sea (OS_PPC|05).

The current geopolitical framework has also highlighted the necessity of several goals of the European Green Deal, especially those aiming at achieving the energy independence of the EU countries and at fostering the energy transition towards renewable and low-emission sources through the development of offshore renewable energy production (OS_E01; to this end, the MSP contains measures, such as NAZ_MIS|52, NAZ_MIS|55-58). Some aspects related to the topic of energy will be analysed in more detail below.

The potential negative effects on human health from the sectors envisaged in the MSP are mainly related to "Maritime transport and ports" (increase of pollutants in the atmosphere, release of pollutants, including accidental releases and risk of accidents, disturbance of marine fauna), Fishing (presence of contaminants in the catch, increase of waste, etc.), Aquaculture (nitrogen and phosphorous inputs from point sources and increase of waste, etc.), Coastal and maritime tourism (increase of population and need for waste water management, waste production), and the production of hydrocarbons at sea and related infrastructure.

- **The effects on the socio-economic context of energy production from renewable sources**

Installations powered by renewable sources, including wind farms, ensure a significant contribution to the achievement of national, EU and international energy and environmental goals and commitments. In addition, the installation of such plants favours the use of local resources, promoting economic growth and contributing to job creation by boosting the development, also at local level, of innovation potential through the promotion of research and development projects.

- **The effects on human health and socio-economic context of hydrocarbon prospection, exploration and production activities**

Hydrocarbon exploration and exploitation can be responsible for the release of various chemicals, the substances present in the oil and gas mixtures and their deposits, as well as the additives used in extraction procedures, in particular chemical additives used in fracking, and their subsequent release into the environment. The physico-chemical properties and environmental behaviour of these chemicals can differ widely. Most of these chemicals, including hydrocarbon mixtures, are volatile and can be dispersed in the air. Many others are water-soluble and can pollute groundwater. Possible health impacts related to hydrocarbon exploration and cultivation result from possible exposure:

- direct inhalation of air pollutants and/or dermal absorption;
- indirectly through ingestion of food or contaminated water.

Many pollutants are released into the atmosphere as a result of this type of operations, namely, nitrogen oxides (NOx) and sulphur oxides (SOx), volatile organic compounds (VOCs), BTEX (total benzene, toluene, ethylbenzene and xylenes), PM (Particulate Matter), polycyclic aromatic hydrocarbons (PAHs such as phenanthrene, naphthalene), phenols, biocides.

Exposure via inhalation can cause short-term damage to human health (irritation of the eyes, nose and throat, respiratory tract infections, headaches, nausea, allergic reactions, worsening of health conditions in individuals with asthma and emphysema, etc.) and long-term damage (tumours, leukaemia, cardiovascular diseases, liver and kidney diseases, reduction of red and white blood cells, chromosomal aberrations, genetic malformations, etc.). Groundwater and surface water can be contaminated due to:

- spills and leaks during transport, storage and use;
- migration of hydrocarbons and other fluids that can penetrate into the groundwater through rock fractures, faults and abandoned wells;
- failure of wells, if improperly designed, constructed or maintained.

Water contaminated by petroleum products often contains arsenic, cadmium, mercury, lead, zinc and copper; these heavy metals are toxic to humans and animals, even in small concentrations, because they are persistent substances that bioaccumulate in organisms. Mercury, for example, accumulates in tissues faster than it is excreted. The indirect exposure route includes contamination of food and drinking water. Unfortunately, limited quantitative information is available on both direct (air and water) and indirect (diet) pathways.

Other possible impacts are from noise and radiation exposure, due to the presence of Naturally Occurring Radioactive Material (NORM) in the excavated spoils.

As with any mining activity, oil and gas extraction can produce emissions of Naturally Occurring Radioactive Materials (NORM), such as uranium, thorium and their radioisotopes, as well as iodine, potassium and others. Among these NORMs (Naturally Occurring Radioactive Materials), the most common are radium-226 and radium-228, which result from the decay of uranium and thorium, respectively. The severity or type of their effects on health depends on the amount and duration of exposure to this radiation. Cancer is considered the primary effect, followed by changes in DNA or mutations. Radon and its decay products, if inhaled at certain doses and for prolonged periods, can cause DNA damage and lung cancer. The IARC has classified radon in Group 1, which includes substances with sufficient evidence of carcinogenicity.

5.1.7 Possible significant effects of the MSP measures on landscape and the cultural heritage

Generally speaking, infrastructure construction has a direct negative effect on the landscape and cultural heritage component, consisting in the fragmentation of habitats, environments and ecological networks, especially in non-man-made contexts (i.e. outside urban or port areas), the alteration of morphological/ settlement systems, the alteration/impairment of the view and of the qualifying and defining elements of the landscape (man-made and natural), as well as of the possibility of perception/use of the historical heritage.

According to the MSP forecasts, as shown in the matrix in section 5.1.1, the most important pressure factors are related to the construction of new port infrastructure, coastal defence engineering works, energy production facilities, both onshore and offshore, and aquaculture facilities.

In all these cases, it is above all the alteration of the landscape perception values that makes the new infrastructure potentially critical. However, it must be considered that these works are subject to an EIA and it is in this phase, in which the type, dimensions and location of the project are clarified, that the possible extent of its impact will be assessed. When designing the projects and during the EIA phase, the historical and urban context, the relationship with the cultural and landscape heritage into which the engineering work is introduced and the relative legal safeguards (as set out in the Regional Landscape Plans, analysed in Chapter 4) should be taken into account; in order to rule out any interference with the archaeological heritage preserved underground, preventive archaeological surveys and investigations will be required, in compliance with the rest of the Regulations). A number of (national) measures of the MSP, including NAZ_MIS|22 ("*Recognition of the property assets characterising the coastal landscape (e.g. lighthouses, towers), also built on non-heritage-listed areas, in order to identify and plan enhancement actions at the sub-area scale*") may contribute to support the EIA processes. Specific Objective OS_PPC|03 of the Plan ("*Promoting and supporting the conservation of the underwater archaeological heritage*") is expressly linked to underwater heritage, according to which "*the Plan, in accordance with the UNESCO Convention on the Protection of the Underwater Cultural Heritage, aims to ensure and strengthen the protection of the underwater cultural heritage, encouraging international cooperation, promoting in situ conservation of artefacts and sites, and promoting actions for raising public awareness, appreciation and protection of the heritage. In accordance with the European Convention on the Protection of the Archaeological Heritage (Valletta Convention), the Plan aims to foster cooperation between archaeologists, urban planners and affiliated professionals to ensure optimal conservation of the archaeological heritage, facilitating public access where possible*." It is precisely for this reason that the MSP has envisaged Measure NAZ_MIS|23 aimed at "*fostering and supporting the conservation of the underwater archaeological heritage*" and at "*defining a unitary framework (at the maritime area scale), accompanied by mapping, of the areas where underwater archaeological assets subject to protection are located, of the anthropic activities in such areas that are currently banned, or which may be banned in the future (including trawling), of the interventions implemented to this end or of any future interventions that may be implemented (also by means of mechanical and technological instruments), and of the necessary monitoring activities*." Some of the (national) measures of the MSP (e.g. NAZ_MIS|09, NAZ_MIS|13 and NAZ_MIS|16) aim at enhancing the role of the sea economy and furthering the aspects of land-sea interaction and integrated coastal zone management. In the definition phase of these measures, therefore, opportunities for development, including infrastructure development, based on a coherent ecosystem approach, should be assessed, taking into account the need to protect the cultural and landscape heritage, especially in highly sensitive areas, within the meaning of Chapter 4, paragraph 4.3.1.3. The analysis carried out through the definition of a (relative) index that measures the density of cultural heritage (both punctual and areal) in the 300m strip and the surface area subject to landscape constraints, has revealed the following situation for the **Adriatic** M.A.:

Subarea	**PU code**	**Uses and Principles**	**Total sensitivity weight**
A/6	**A/6_15**	Tourism, Landscape and Cultural Heritage	25
A/6	**A/6_09**	Tourism, Landscape and Cultural Heritage	15

Based on the above table, with regard to most of the areas recognised as "most sensitive", the forecasts of the MSP are to guarantee the goals of environmental and landscape protection, and the permitted uses should not lead to pressure factors for the landscape. For such areas, the measures of the MSP will be significant, such as NAZ_MIS|24 aimed at achieving the goal of the OS_PPC Plan|05 ("*Promoting and creating awareness on the intangible cultural heritage*") and NAZ_MIS|26 aimed at drawing up a study on the extent of illegal building in the coastal strip. Finally, it should be considered that some of the MSP measures (NAZ_MIS|19, NAZ_MIS|20 and NAZ_MIS|21) are functional to the achievement of the goal of the OS_PPC|01 Plan

("*Supporting the landscape value of the coastal strip*") and may contribute to minimise the visual impact on the coastal landscape of facilities and structures built on the coastal strip, through the definition of guidelines, principles, criteria and standards integrating the specific indications relative to the levels of protection of the Regional Landscape Plans and other planning tools in force. Generally speaking, the improved infrastructural planning of the coastal strip also has positive effects, contributing to improve the conditions of access and use of the cultural heritage, which, as seen in Chapter 4, is very often concentrated in the immediate vicinity of the coastal strip. Since the MSP aims to support the goals of the European Green Deal (OS_SS|03), the infrastructure planning and design process should also take into account the possibility of providing for sustainable mobility corridors. This may be achieved through other MSP measures, such as NAZ_MIS|69, which aims at defining tools to control tourism pressure in a sustainable way, NAZ_MIS|25, which aims at preserving the naval heritage of historical interest, and NAZ_MIS|70, which aims at identifying and promoting sustainable technologies and practices in the field of navigation for tourism purposes.

Moreover, some engineering works, such as coastal defence works, are instrumental in safeguarding the landscape and the coastline, which continues to recede also as a result of climate change.

In the current planning phase of the MSP, also taking into account some of the comments made by the Environmental Authorities (SCA) in the scoping phase, an attempt was made to verify the visual interference potential of offshore wind farms. This is a sensitive and controversial issue, which is why NAZ_MIS|52[85] and NAZ_MIS|54[86] were included in the MSP measures. In the framework of this ER, following an approach used in the EIA phase for offshore wind farm projects, a graphic elaboration has been prepared (see Annex MSP_ADR_AMBD018) that assesses the risk of visual intrusion as a function of the distance from the coast of the perimeter of the PUs to which the MSP assigns energy use as a priority.

The above is in accordance with the evaluation approach set out in the PNIEC (National Energy and Climate Plan), PiTESAI (Plan for the Sustainable Energy Transition of Relevant Areas) and PONIR (National Operational Programme for Infrastructure and Networks).

- **The effects on the landscape and cultural heritage related to the production of energy from renewable sources**

Visual impact is considered one of the most relevant impacts relating to offshore wind farms. Wind turbines, in fact, are visible from very far away, in different ways, depending on the characteristics and layout of the facilities, the lay of the land, population density and atmospheric conditions. The visual alteration of an offshore wind installation is mainly due to the wind turbines (poles, nacelles, rotors, propellers). The impact analysis, in this case, should refer to all the works planned in relation to the facility as a whole, considering that a large part of the impact also depends on the location and arrangement of the machines. Regarding the location of large-scale offshore wind farms, the inevitable alteration of the appearance of the site and the perception of the associated values, considering the ineffectiveness of any masking measures, the choice of location and design configuration, where possible, should be aimed, as a matter of priority, at areas that are already impaired (e.g. coastal port areas), where compatible with the wind of course, and at the creation of new values consistent with the landscape context. Wind farms should become a feature of the landscape,

[85] Through this measure, the MSP proposes to "*develop national guidelines for the identification of suitable sites for offshore renewable energy facilities (wind, solar, onshore and offshore currents) and the assessment of single and cumulative environmental and landscape impacts, considering potential impact elements, during the construction, operation and decommissioning phases, and also taking into account the elements for the onshore transport of the produced energy. These Guidelines will allow to: i) improve the spatial planning process (e.g. in terms of spatial robustness and resolution); ii) guide the plant design process; iii) facilitate the permit-granting phases (e.g. EIA and VINCA – Environmental Incidence Assessment)*".

[86] Through this measure, the MSP proposes to "*establish an observatory for monitoring the impacts of offshore wind farms on the environment and other uses of marine space and the coast, considering the definition, implementation and evaluation phases of the monitoring plans required for the installation and operation of wind farms. The evaluations produced by this observatory shall be taken into account when implementing the monitoring plans of the MSP, and therefore in the possible revision of any similar plans*."

contributing to the recognition of its specificity through a coherent relationship with the surrounding context. In this sense, wind farms will determine the design of a new landscape.

- **The effects on the landscape and cultural heritage of hydrocarbon prospection, exploration and production activities**

With specific reference to cultural and landscape assets, the potential impacts of the different phases of offshore hydrocarbon exploration and exploitation activities are, in general:

- linked directly or indirectly to the material and perceptive alteration/modification of a landscape, due to engineering work and the transformations of land use, temporary or otherwise, required for hydrocarbon prospection, exploration and cultivation operations;
- linked directly or indirectly, in the short or long term, individually or cumulatively and synergetically, either permanently or temporarily, to the alteration/modification/destruction of other components such as habitats, ecosystems, biodiversity, soil and water, as well as air (in the construction and decommissioning phase);
- due to any decrease/loss of the identity and/or intangible values linked to the established uses of marine areas.

5.2 Verification of compliance with the DNSH principle

The Recovery and Resilience Facility (RRF) regulation stipulates that no measure included in the Recovery and Resilience Plan (RRP) shall result in significant harm to environmental goals, within the meaning of Article 17 of EU Reg. 2020/852 (Taxonomy regulation).

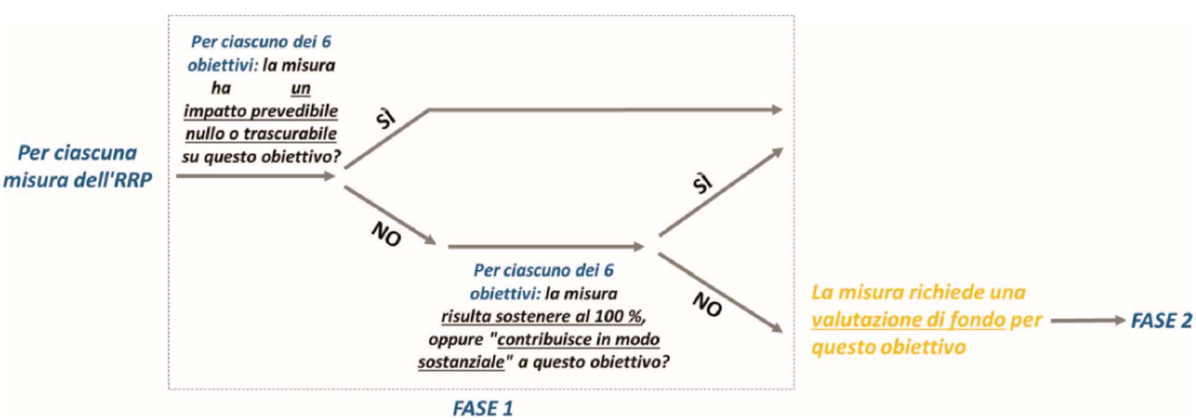
In addition, the RRP assessment must ensure that every single measure, i.e. every reform and investment, envisaged by the plan complies with the "do-no-significant-harm" (DNSH) principle.

It identifies the following criteria to determine how each economic activity contributes substantially to the protection of the ecosystem, without harming any of the environmental goals:

1. **Climate change mitigation**: an economic activity must not lead to significant emissions of greenhouse gases (GHG).
2. **Climate change adaptation**: an economic activity must not have an increased negative impact on the current and future climate, on the activity itself or on people, nature or property.
3. **Sustainable use and protection of water and marine resources:** an economic activity must not be **detrimental** to the good health of water bodies (surface, groundwater or marine) or harm its quality or reduce its ecological potential.
4. **Transition to the circular economy, including waste prevention and recycling**: an economic activity must not result in significant inefficiencies in the use of recovered or recycled materials, increase the direct or indirect use of natural resources, or significantly increase waste or the burning or disposal thereof, causing significant long-term environmental damage.
5. **Prevention and reduction of air, water and soil pollution**: an economic activity must not cause increased emissions of pollutants in the air, water or soil.
6. **Protection and restoration of biodiversity and health of ecosystems**: an economic activity must not harm the good condition and resilience of ecosystems or the conservation status of habitats and species, including those of interest to the Union.

The Commission has provided technical guidance on how to apply the DNSH principle in the context of the RRF through the guide, published on 18 February 2021, and its annexes available also in Italian at the following link: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021XC0218(01)

In particular, the Commission has prepared a checklist (see Annex I) to support the compliance analysis. The checklist is based on the following decision tree (p. 8 of the Technical Guide):



Consistent with the text of the regulation and the Commission's operational guidelines, a single template was prepared to collect the information necessary for evaluating the 72 national measures of the Plan in the light of the DNSH principle, divided into the two steps described below.

Phase 1

The effects generated on the six environmental goals by each of the Plan's measures were traced to four distinct scenarios:

a) The measure has no or negligible impact on the achievement of this goal.
b) The measure appears to fully support the achievement of this goal (100%).
c) The measure substantially contributes to this goal.
d) None of the above options: the measure requires a background assessment for this goal.

If, with regard to an individual goal, the measure is classified in one of the first three scenarios, a brief justification is provided to highlight the reasons why the intervention is associated with a limited risk of environmental damage, regardless of its potential contribution to the green transition, and the verification of compliance with the DNSH principle is therefore completed.

In the event that the measure is not classified in any of the first three scenarios, with regard to at least one of the objectives, a background assessment of compliance with the DNSH principle has to be carried out for the corresponding environmental goals (Step 2).

Phase 2

Stage 2 of the checklist includes, for each of the six objectives, questions corresponding to the legal requirements of the DNSH assessment.

1. **Climate change mitigation -** Is the measure expected to result in significant greenhouse gas emissions?
2. **Climate change adaptation -** Is the measure expected to worsen the negative effects of the current and expected future climate on itself or on people, nature or assets?
3. **Sustainable use and protection of water and marine resources -** Is the measure expected to harm: (i) the good ecological status or potential of water bodies, including surface and groundwater; or (ii) the good ecological status of marine waters?
4. **Transition to the circular economy, including waste prevention and recycling -** Is the measure expected to: (i) result in a significant increase in waste generation, incineration or disposal, with the exception of the incineration of non-recyclable hazardous waste; or (ii) result in significant inefficiencies, not minimised by appropriate measures, in the direct or indirect use of natural resources at any stage of their life cycle; or (iii) cause significant and long-term environmental damage from a circular economy perspective?
5. **Prevention and reduction of air, water and soil pollution -** Is the measure expected to result in a significant increase in pollutant emissions in the air, water or soil?
6. **Protection and restoration of biodiversity and health of ecosystems -** Is the measure expected to: (i) significantly harm the good condition and resilience of ecosystems; or (ii) harm the conservation status of habitats and species, including those of interest to the Union?

For a measure to be included in the Plan, the answers to these questions in the checklist must be “no”, to indicate that no significant harm is being done to the specific environmental goal.

Here, too, it is necessary to provide a background assessment of compliance with the DNSH principle, through the possible selection from a range of options based on the support list provided in Annex II to the Technical Guidance by the Commission.

5.2.1 Verification of compliance with the DNSH principle of the national measures of the Plan

See Annex VII of the ER for details of the verification of the national measures.

With reference to the environmental goal DNSH “**1. Climate change mitigation**”, phase 1 of the verification of compliance with the DNSH principle resulted in all 71 national measures of the Plan being classified in one of the first three scenarios, namely

A. 42 measures have no or negligible impact on the achievement of this goal, for one of the following reasons:
   - they do not entail any foreseeable negative and significant effects with respect to the climate change mitigation goal;
   - they promote sustainable development and thus indirectly also climate change mitigation;

- they foster the development of the circular economy and thus indirectly also climate change mitigation;
- they represent an information opportunity to the climate change mitigation goal.

B. 8 measures appear to fully support the achievement of this goal, for one of the following reasons:
   - they converge towards the achievement of climate change mitigation goals;
   - they specifically refer to climate change mitigation and adaptation objectives;
   - they make it possible to analyse the impacts of climate change on MSP and identify relevant climate change mitigation and adaptation actions.

C. 21 measures substantially contribute to the achievement of this goal, as they enable convergence towards climate change mitigation goals.

With regard to the environmental goal "*1. Climate Change Mitigation*", none of the 71 national measures of the Plan therefore required a background assessment of compliance with the DNSH principle (Step 2).

With regard to the environmental goal DNSH "**2. Climate change adaptation"**, phase 1 of the verification of compliance with the DNSH principle resulted in all 71 national measures of the Plan being classified in one of the first three scenarios, namely

A. 49 measures have no or negligible impact on the achievement of this goal, for one of the following reasons:
   - they do not entail significant negative foreseeable effects with respect to the climate change adaptation goal;
   - they promote sustainable development and thus indirectly also climate change adaptation;
   - they foster the development of the circular economy and thus indirectly also climate change adaptation;
   - they represent an information opportunity to the goal of climate change adaptation.

B. 22 measures substantially contribute to the achievement of this goal, for one of the following reasons:
   - they converge towards the achievement of climate change adaptation goals;
   - they promote sustainable development and thus indirectly also climate change adaptation;
   - they specifically refer to climate change mitigation and adaptation goals;
   - they make it possible to analyse the impacts of climate change on MSP and identify related climate change mitigation and adaptation actions.

Similarly to the previous goal, with regard to the environmental goal "*2. Climate change adaptation"*, none of the 71 national measures of the Plan therefore required a background assessment of compliance with the DNSH principle (Stage 2).

With regard to the DNSH environmental goal "**3. Sustainable use and protection of water and marine resources**", phase 1 of the verification of compliance with the DNSH principle resulted in 70 national measures of the Plan being classified in one of the first three scenarios, namely

A. 8 measures have no or negligible impact on the achievement of this goal, because, in view of the direct effects and primary indirect effects over the life cycle, these measures will not pose any risk of environmental degradation related to the protection of water quality and marine resources, since they are implemented in accordance with the applicable national and international regulations;
B. 31 measures fully support the achievement of this goal, because they fully contribute to the achievement of the good ecological potential of water bodies, waters and marine resources in accordance with the applicable national and international regulations;
C. 31 measures substantially contribute to the achievement of this goal, since in view of the direct effects and primary indirect effects over the life cycle, these measures substantially contribute to the achievement of the good ecological potential of water bodies, waters and marine resources, since they are implemented in a sustainable manner and in accordance with the applicable national and international regulations.

With regard to the environmental goal "*3. Sustainable use and protection of water and marine resources*", measure NAZ_MIS|41 of the Plan, which provides for the development, adoption and implementation of AZA

Plans at a regional scale, in accordance with the MSP Plans and with the support of the AZA Technical Guide (ISPRA /HIPAA), required a background assessment of compliance with the DNSH principle (Phase 2). This assessment has made it possible to verify that the measure in question does not harm the good ecological status or potential of water bodies, including surface and groundwater, or the good ecological status of marine waters, as it relates to the implementation of best environmental practices in accordance with current national and international regulations.

With regard to the DNSH environmental goal "**4. Transition to the circular economy, including waste prevention and recycling",** phase 1 of the verification of compliance with the DNSH principle resulted in all 71 national measures of the Plan being classified in one of the first three scenarios, namely

A. 35 measures have no or negligible impact on the achievement of this goal, for one of the following reasons:
   - they do not interact with the aims of the goal, as they are not relevant;
   - they reduce or do not foresee the determination of significant negative effects with respect to the target, despite the foreseeable increase in anthropic pressure.

B. 14 measures were found to fully support the achievement of this goal, for one of the following reasons:
   - the proposal of the measure aims at structuring a supply chain based on the circular economy, thus directly contributing to its dissemination, affirmation and implementation (*NAZ_MIS|10*, *NAZ_MIS|11*, *NAZ_MIS|12);*
   - the activities envisaged by the measure are fundamental and necessary for the development of the circular economy, including waste prevention and recycling *(NAZ_MIS|48, NAZ_MIS|50);*
   - waste prevention and recycling and the development of the circular economy can be increased through targeted studies and pilot projects for the integration of aquaculture activities and environmental conservation *(NAZ_MIS|40);*
   - the definition of the National Strategy for Sustainable Development of the Marine Economy directly promotes the introduction of circular economy principles, including waste prevention and recycling *(NAZ_MIS|05);*
   - the measure, through the establishment of the planned GDL, can increase and enhance the stock of knowledge needed to achieve the expected results of waste prevention and recycling in the perspective of the circular economy *(NAZ_MIS|08);*
   - a study aimed at identifying the areas with the highest concentration of water pollution, waste dispersion, underwater noise emissions, and collisions with marine megafauna allows for the implementation of actions aimed at the transition to the circular economy *(NAZ_MIS|44)* through the planned mitigations;
   - the strengthening of the marine economy within the framework of the National Strategy for the Circular Economy, through the actions envisaged in the measure, directly promotes the increase and development of the principles of the circular economy including waste prevention and recycling *(NAZ_MIS|09);*
   - experimentation and reconversion projects of platforms and related infrastructures are fully in accordance with the production and consumption model of the circular economy *(NAZ_MIS|60);*
   - the mapping and planning of the use of submarine sands favours the implementation of actions aimed at developing the circular economy *(NAZ_MIS|63);*
   - a study on the socio-economic characterisation and evolutionary trends of the different sectors of the Italian marine economy contributes to the dissemination of waste prevention and recycling issues in the perspective of the circular economy *(NAZ_MIS|04);*
   - the measure is based on the circular economy production and consumption model *(NAZ_MIS|25).*

C. 22 measures substantially contribute to the achievement of this goal, for one of the following reasons:
   - certain activities envisaged in the measure, including in particular the energy efficiency of vessels, can contribute to the development of waste prevention and recycling with a view to the circular economy (*NAZ_MIS|28*, *NAZ_MIS|29*);

- the development of a plan for the identification of AZAs in accordance with the plan contributes to the development of the circular economy and waste prevention and recycling (*NAZ_MIS|41*, *NAZ_MIS|42*);
- the regulation of recreational traffic and the creation of facilities to ensure environmentally friendly moorings can facilitate the implementation of actions aimed at developing the circular economy (*NAZ_MIS|68*);
- the activities envisaged by the measure may foster the implementation of actions aimed at developing the circular economy (*NAZ_MIS|54*);
- the activities envisaged in the measure, such as the mapping of suitable sites for the delivery of dredged materials, the updating of available databases and the management practices of dredged sediments, may foster the implementation of actions aimed at developing the circular economy (*NAZ_MIS|47*);
- the introduction and affirmation of the circular economy is significantly promoted by the activities envisaged in the measure through deepening and sharing environmental knowledge (*NAZ_MIS|14*);
- the creation of an MSP - PiTESAI working group is essential for achieving the goal of developing and establishing the circular economy. (*NAZ_MIS|59*);
- the activities envisaged in the measure can facilitate the acquisition of data and contribute to implementing waste prevention and recycling actions (*NAZ_MIS|15*);
- improved regulation of shipping lanes and the strengthening of actions to conserve marine ecosystems and biodiversity can facilitate the implementation of actions aimed at developing the circular economy (*NAZ_MIS|45*);
- a unified framework, accompanied by mapping of areas with submerged archaeological assets already protected or to be protected, can contribute to the development of waste prevention and recycling with a view to the circular economy (*NAZ_MIS|23*);
- the activities envisaged by the measure, through the consideration of environmental impacts and potential impacts during construction, operation and decommissioning, can foster the implementation of actions aimed at developing the circular economy (*NAZ_MIS|52*);
- the measure, through the planned study, can increase and enhance the body of knowledge required for implementing circular economy strategies (*NAZ_MIS|07*);
- the activities envisaged by the measure may foster the implementation of actions aimed at developing the circular economy (*NAZ_MIS|55*);
- increasing projects, surveys and research aimed at sustainable fisheries can contribute to activities aimed at developing the circular economy (*NAZ_MIS|31*);
- the measure, through monitoring and the subsequent definition of measures aimed at sustainable development, can contribute to implementing the circular economy (*NAZ_MIS|67*);
- the measure can increase and enhance the knowledge base on the coastal marine environment by making it functional to the goals of waste prevention and recycling and the circular economy (*NAZ_MIS|70*);
- the activities envisaged in the measure, through monitoring and analysis, can foster the acquisition of data and contribute to implementing waste prevention and recycling actions (*NAZ_MIS|13*);
- the transfer and application of the results of scientific research in the MSP process, the targeting of marine research on the priority needs of the MSP process, and the dissemination of this research to society can facilitate the implementation of actions aimed at developing the circular economy (*NAZ_MIS|71*);
- the measure can increase and enhance the knowledge base on the coastal marine environment by making it functional to the goals of waste prevention and recycling with a view to developing the circular economy (*NAZ_MIS|02*);

- the activities envisaged in the measure, through technological development and monitoring systems, can directly influence the prevention and recycling of waste and the development of the circular economy (*NAZ_MIS|43*).

With regard to the environmental goal "**4. Transition to the circular economy, including waste prevention and recycling",** none of the 71 national measures of the Plan therefore required a background assessment of compliance with the DNSH principle (Stage 2).

With regard to the DNSH environmental goal "**5. Prevention and reduction of air, water and soil pollution**", phase 1 of the verification of compliance with the DNSH principle resulted in all the 71 national measures of the Plan being classified in one of the first three scenarios, namely:

A. 16 measures have no or negligible impact on the achievement of this goal, since the prevention and reduction of air, water and soil pollution appear to be only marginally affected;
B. 33 measures appear to fully support the achievement of this goal, for one of the following reasons:
    - the activities envisaged by the measures can positively influence the prevention and reduction of air, water and soil pollution (*NAZ_MIS|10, NAZ_MIS|13, NAZ_MIS|15, NAZ_MIS|18, NAZ_MIS|19, NAZ_MIS|21, NAZ_MIS|26, NAZ_MIS|38, NAZ_MIS|39, NAZ_MIS|41, NAZ_MIS|42, NAZ_MIS|43, NAZ_MIS|49, NAZ_MIS|50, NAZ_MIS|51, NAZ_MIS|56*);
    - the restriction of the number of daily accesses, the financing of measures to protect and enhance the environmental and cultural heritage, and the construction of facilities and implementation of initiatives for sustainable tourism can significantly promote the goals of preventing and reducing air, water and soil pollution (*NAZ_MIS|69*);
    - an assessment of the socio-economic effects of plan choices can facilitate the prevention and reduction of air, water and soil pollution (*NAZ_MIS|03*);
    - targeted studies and pilot projects for the integration of aquaculture activities and environmental conservation can improve the prevention and reduction of air, water and soil pollution (*NAZ_MIS|40*);
    - studies on the socio-economic characterisation and evolutionary trends of the different sectors of the Italian sea economy can foster the prevention and reduction of air, water and soil pollution (*NAZ_MIS|04*);
    - coastal and maritime eco-tourism initiatives and awareness-raising and information activities under Measure 2 (Descriptors 1 and 6) of the PoM MSFD 20/12/2021 Update can significantly support the prevention and reduction of air, water and soil pollution (*NAZ_MIS|66*);
    - the prevention and reduction of air, water and soil pollution can be facilitated through the definition of the National Strategy for the Sustainable Development of the Marine Economy (*NAZ_MIS|05*);
    - a unitary framework with the mapping of areas with submerged archaeological assets already subject to protection or to be protected can contribute to preventing and reducing air, water and soil pollution (*NAZ_MIS|23*);
    - the study foreseen in the measure can contribute to preventing and reducing air, water and soil pollution (*NAZ_MIS|06*);
    - improving the regulation of shipping lanes and strengthening the conservation of marine ecosystems and biodiversity can increase the prevention and reduction of air, water and soil pollution (*NAZ_MIS|45*);
    - the coexistence of offshore renewable energy installations with maritime transport, fishing with gears, sand extraction for coastal defence works, offshore aquaculture facilities, managed tourism, scientific research can ensure the goals of prevention and reduction of air, water and soil pollution (*NAZ_MIS|57*);
    - experiments and projects for the reconversion of platforms and related infrastructures can help prevent and reduce air, water and soil pollution (*NAZ_MIS|60*);
    - the goals of preventing and reducing air, water and soil pollution can benefit from the establishment of GDL on administrative procedures for beach nourishment (*NAZ_MIS|65*);

- a recovery, re-use and recycling chain for by-products of aquaculture and professional fishing activities can contribute to preventing and reducing air, water and soil pollution (*NAZ_MIS|11*);
- the regulation of recreational traffic and the creation of facilities to ensure environmentally friendly moorings can help prevent and reduce air, water and soil pollution (*NAZ_MIS|68*);
- a national recovery, dismantling, reuse/recycling chain of end-of-life recreational, sport and fishing boats can contribute to preventing and reducing air, water and soil pollution (*NAZ_MIS|12*);
- a long-term strategy for securing the participation and involvement of stakeholders in the implementation, monitoring and evaluation process of maritime plans can contribute to preventing and reducing air, water and soil pollution (*NAZ_MIS|01*);
- the identification of priority areas to be restored and the restoration measures and methods to be adopted can significantly promote the prevention and reduction of air, water and soil pollution (*NAZ_MIS|17*).

C. 22 measures substantially contribute to the achievement of this goal, for one of the following reasons:
   - the activities under the measures are essential for the goals of preventing and reducing air, water and soil pollution (*NAZ_MIS|52*, *NAZ_MIS|53*, *NAZ_MIS|54*, *NAZ_MIS|55*, *NAZ_MIS|58*, *NAZ_MIS|59*);
   - the prevention and reduction of air, water and soil pollution are significantly increased by the activities in the measure, through deepening and sharing environmental knowledge (*NAZ_MIS|14*, *NAZ_MIS|16*);
   - the achievement of air, water and soil pollution prevention and reduction objectives requires coherence between existing coastal/GIZC strategies and plans, projects affecting coastal morphology and MSP plan forecasts (*NAZ_MIS|62*);
   - the transfer and application of the results of scientific research in the MSP process, the targeting of marine research on the priority needs of the MSP process and the dissemination of this research to society can ensure the achievement of the goals of preventing and reducing air, water and soil pollution (*NAZ_MIS|71*);
   - the reduction of conflicts and impacts related to the use of marine sands for defence works is fundamental for the goals of preventing and reducing air, water and soil pollution (*NAZ_MIS|64*);
   - the activities envisaged in the measure are essential in the prevention and reduction of air, water and soil pollution (*NAZ_MIS|48*);
   - the measure, through the establishment of the envisaged GDL, can increase and enhance the stock of knowledge necessary to achieve the expected results of preventing and reducing air, water and soil pollution (*NAZ_MIS|08*);
   - the measure, through the planned study, can increase and enhance the stock of knowledge needed to achieve the expected results of preventing and reducing air, water and soil pollution (*NAZ_MIS|07*);
   - all the activities envisaged in the measure can contribute significantly to achieving the goals of preventing and reducing air, water and soil pollution (*NAZ_MIS|61*);
   - certain activities envisaged in the measure, including, in particular, improving the energy efficiency of vessels, can contribute significantly to preventing and reducing air, water and soil pollution (*NAZ_MIS|28*);
   - the activities envisaged in the measure are fundamental to the goals of preventing and reducing air, water and soil pollution (*NAZ_MIS|63*);
   - certain activities envisaged in the measure, including in particular improving the energy efficiency of vessels and the use of renewable energy in the fishing sector can contribute significantly to preventing and reducing air, water and soil pollution (*NAZ_MIS|29*);
   - the measure can increase and enhance the wealth of knowledge on the coastal marine environment by making this wealth functional to the goals of preventing and reducing air, water and soil pollution (*NAZ_MIS|70*);

- a study aimed at identifying the areas with the highest concentration of air emissions, water pollution, waste dispersion, underwater noise emissions, and collisions with marine megafauna can reduce air, water and soil pollution (*NAZ_MIS|44*);
- the measure can increase and enhance the knowledge of the coastal marine environment by making this knowledge functional to the goals of preventing and reducing air, water and soil pollution (*NAZ_MIS|02*);
- the activities envisaged in the measure, such as the mapping of suitable sites for the delivery of dredged materials, the updating of available databases and the management practices of dredged sediments, are essential to achieve the goals of preventing and reducing air, water and soil pollution (*NAZ_MIS|47*).

Therefore, with regard to the environmental goal "**5. Prevention and reduction of air, water and soil pollution",** none of the 71 national measures of the Plan required a background assessment of compliance with the DNSH principle (Stage 2).

With reference to the DNSH environmental goal "**6. Protection and restoration of biodiversity and health of ecosystems',** phase 1 of the verification of compliance with the DNSH principle resulted in 70 national measures of the Plan being classified in one of the first three scenarios, namely

A. 8 measures have no or negligible impact on the achievement of this goal, because, in view of the direct effects and primary indirect effects over the life cycle, these measures will not pose any risk of environmental degradation related to protecting and restoring biodiversity and ecosystems, since they are implemented in accordance with the applicable national and international regulations;
B. 31 measures fully support the achievement of this goal, since they fully contribute to protecting and restoring biodiversity and ecosystems, in accordance with the applicable national and international regulations;
C. 31 measures substantially contribute to the achievement of this goal, because, in view of their direct effects and primary indirect effects over the life cycle, they substantially contribute to protecting and restoring biodiversity and ecosystems, since they are implemented in a sustainable manner and in accordance with the applicable national and international regulations.

With regard to the environmental goal "*6. Protection and restoration of biodiversity and health of ecosystems*" the NAZ_MIS|41 measure of the Plan, which envisages the development, adoption and implementation of AZA Plans at the regional scale, in accordance with the MSP Plans and with the support of the AZA Technical Guide (ISPRA /HIPAA), required a background assessment of compliance with the DNSH principle (Phase 2). This assessment verified that the measure in question does not significantly harm the good condition and resilience of ecosystems or the conservation status of habitats and species, including those of interest to the Union, as it relates to the implementation of best environmental practices in accordance with the applicable national and international regulations.

5.2.2 Verification of compliance with the DNSH principle of the Plan measures at the sub-area level

Likewise to the activities conducted with regard to the 71 national measures, verification of compliance with the DNSH principle was also carried out for the 53 measures at the sub-area level of the "Adriatic" maritime area. With regard to the DNSH environmental goal "**1. Climate change mitigation**", the stage 1 verification of compliance with the DNSH principle resulted in 51 measures of the Plan at the sub-area level being classified in one of the first three scenarios, namely:

A. 45 measures have no or negligible impact on the achievement of this goal, for one of the following reasons:
    - they promote the development of the circular economy and thus indirectly also climate change mitigation;
    - they do not entail any foreseeable negative and significant effects with respect to the climate change mitigation goal;
    - they promote the development of port efficiency and thus indirectly also climate change mitigation;
    - they promote the development of environmental management systems for marinas and thus indirectly also climate change mitigation.

B. Four measures appear to fully support the achievement of this goal, as they specifically address climate change mitigation goals;
C. 2 measures substantially contribute to the achievement of this goal, for one of the following reasons:
   - they contribute, among others, to climate change mitigation and adaptation objectives;
   - they specifically foster the environmental and energy sustainability of ports and thus indirectly also climate change mitigation.

With regard to the environmental goal "**1. Climate change mitigation**", the following two measures of the Plan at the sub-area level required a background assessment of compliance with the DNSH principle (Stage 2), namely:

- ***(A/1)_MIS|23*** *Measures for exploiting opportunities offered by cruise tourism: systematisation of proposals aimed at directing cruise tourism flows to the inland areas, by valorising the local resources and professional skills.*
- ***(A/2)_MIS|2*** *Identifying how to support the actions and activities to be pursued by the Extraordinary Commissioner, within the meaning and for the purposes of Law 125/2021, with regard to cruise tourism. Assessing how the maritime spatial plan should be updated, based on the actions implemented by the said Commissioner.*

The assessment process verified that these two measures comply with the DNSH principle for Goal 1, albeit subject to the condition, respectively, that cruise tourism flows to the inland areas are managed in a sustainable manner and without leading to an increase in GHG emissions (e.g. by using electric vehicles, cycling, etc.) and that sustainable actions and activities are planned and do not lead to an increase in GHG emissions.

With regard to the environmental goal DNSH "**2. Climate change adaptation"**, phase 1 of the verification of compliance with the DNSH principle resulted in 51 measures of the Plan at sub-area level being classified in one of the first three scenarios, namely

A. 39 measures have no or negligible impact on the achievement of this goal, since they do not entail any foreseeable negative and significant effects on the climate change adaptation goal;
B. 2 measures appear to fully support the achievement of this goal, since they specifically address climate change adaptation goals;
C. 10 measures substantially contribute to the achievement of this goal, for one of the following reasons:
   - they converge towards the achievement of climate change adaptation goals;
   - they represent an information opportunity on the topic of the goal in question.

With regard to the environmental goal "**2. Climate change adaptation"**, the following two measures of the Plan at the sub-area level required a background assessment of compliance with the DNSH principle (Phase 2), namely:

- ***(A/2)_MIS|1*** *In consideration of the important interactions between the Venice Lagoon and the Adriatic Sea (land-sea interactions), with regard to ports and maritime transport, and of the consequent repercussions for the Maritime Spatial Plan, promoting (i) the approval of the Morphological Plan of the Venice Lagoon, (ii) the definition of the new Protocol for the management of lagoon sediments, (iii) the excavation and adaptation of navigation channels in the lagoon system, (iv) the definition of a management regulation for interactions between the regulated port and the MOSE flood barrier system.*
- ***(A/2)_MIS|2*** *Identifying how to support the actions and activities to be pursued by the Extraordinary Commissioner, within the meaning and for the purposes of Law 125/2021, with regard to cruise tourism. Assessing how the maritime spatial plan should be updated, based on the actions implemented by the said Commissioner.*

The two measures in question do not worsen the negative effects of the current climate and the expected future climate, on itself or on people, nature or assets, provided that the manner of implementation of these measures takes into due account the effects of climate change on the areas concerned and that solutions are proposed to meet the goals of climate change adaptation.

With regard to the DNSH environmental goal "**3. Sustainable use and protection of water and marine resources**", the phase 1 verification of compliance with the DNSH principle resulted in 48 measures at the sub-area level of the "Adriatic" maritime area being classified in one of the first three scenarios, namely:

A. 2 measures have no or negligible impact on the achievement of this goal, since in view of the direct effects and the primary indirect effects over the life cycle, the interventions envisaged by the measures will not entail any risk of environmental degradation, with respect to protecting water quality and marine resources, since they are implemented in accordance with the applicable national and international regulations;
B. 25 measures are found to fully support the achievement of this goal, because they contribute to the conservation and improvement of the environmental quality of the sub-area, fully contributing to the achievement of the good ecological potential of water bodies, waters and marine resources in accordance with the applicable national and international regulations;
C. 21 measures substantially contribute to the achievement of this goal, because these activities contribute to the conservation and improvement of the environmental quality of the sub-area, as well as to the achievement of the good ecological potential of water bodies, waters and marine resources in accordance with the applicable national and international regulations.

With regard to the environmental goal "**3. Sustainable use and protection of water and marine resources**", the following five measures of the Plan at the sub-area level required a background assessment of compliance with the DNSH principle (Stage 2):

- ***(A/1)_MIS|1*** *Supporting and fostering the use of fossil fuels capable, in any case, of contributing to the decarbonisation of the sector in a transitional phase (liquefied natural gas and oil, methanol), of second-generation biodiesel and zero-emission fuels from renewable sources (ammonia, hydrogen and electricity).*
- ***(A/1)_MIS|23*** *Measures for exploiting opportunities offered by cruise tourism: systematisation of proposals aimed at directing cruise tourism flows to the inland areas, by valorising the local resources and professional skills.*
- ***(A/1)_MIS|24*** *In order to guarantee the navigability of the lagoon waterways, in the context of land-sea interaction, supporting the ordinary maintenance management works on the lagoon floor by applying special guidelines for the management of dredging operations (Guidelines for the Technical Management of Dredging in the Lagoon Area). These are aimed at verifying the existence of the necessary environmental criteria for handling sediments in the lagoon, in application of Art. 185 c. 3 of Legislative Decree no. 152/2006.*
- ***(A/1)_MIS|27*** *Identifying areas of sea immersion of sediments beyond 3 NM from the coastline, as provided in par. 3.1.1 of the Technical Annex to DM 173/2016, subject to site characterisation.*
- ***(A/2)_MIS|8*** *Adopting the measure of the Regional Council for defining the AZAs (Allocated Zones for Aquaculture) at sea, as macro-areas eligible for aquaculture concessions.*

The assessment has verified that the 5 measures in question do not harm the good status or good ecological potential of water bodies, including surface and groundwater, or the good ecological status of marine waters, because the proposed measures, of high socio-economic value, will be implemented according to the best sustainable management practices and in accordance with the applicable national and international regulations, contributing to decarbonisation and the transition to zero emissions from renewable sources and in accordance with the Marine Strategy goals.

With regard to the DNSH environmental goal "**4. Transition to the circular economy, including waste prevention and recycling**", the stage 1 verification of compliance with the DNSH principle resulted in all 53 measures of the Plan at the sub-area level being classified in one of the first three scenarios, namely:

A. 21 measures have no or negligible impact on the achievement of this goal, for one of the following reasons:
   - the envisaged activities do not interact with, or have a marginal and indirect impact on, the goals of waste prevention and recycling and on the transition to the circular economy, because they are developed with regard to issues that differ substantially from those that may significantly affect these goals;

- they are to be implemented according to the best environmental, energy and operational standards, and, therefore, have no, or at most a negligible, negative effects on the goal.

B. 10 measures were found to fully support the achievement of this goal, for one of the following reasons:
   - they promote sustainable development and environmental protection strategies;
   - they promote prevention in waste management through the implementation of EMSs;
   - they provide for the development of studies, research and experimentation aimed at promoting the conversion of platforms.

C. 22 measures substantially contribute to the achievement of this goal, for one of the following reasons:
   - the activities envisaged by the measure concern issues closely related to the mitigation of environmental impacts, the protection of habitats and sustainable development, being synergic with the pursuit of the goals of waste prevention and recycling and the transition to the circular economy;
   - they promote forms of sustainable management of port and port-related facilities, being synergetic with the pursuit of the goals of waste prevention and recycling and the transition to the circular economy;
   - they promote environmental monitoring, education and awareness-raising activities on issues fully consistent with the goal pursued;
   - they include studies and monitoring activities aimed at improving, *inter alia*, the management of coastal marine sediments, fully in accordance with the transition to the circular economy principles.

This assessment made it possible to verify that for the environmental goal "*4. Transition to the circular economy, including waste prevention and recycling*" none of the 53 measures of the Plan at the sub-area level therefore required a background assessment of compliance with the DNSH principle (Stage 2).

With regard to the environmental goal DNSH "**5. Prevention and reduction of air, water and soil pollution**", the stage 1 verification of compliance with the DNSH principle resulted in 47 measures of the Plan at the sub-area level being classified in one of the first three scenarios, namely:

A. 16 measures have no or negligible impact on the achievement of this goal, because the planned activities have a marginal and indirect impact on the goals of preventing and reducing air, water and soil pollution, since they are developed on issues that are substantially different from those that most influence these goals;

B. 10 measures are found to fully support the achievement of this goal, because they fully contribute to achieving the goals of preventing and reducing air, water and soil pollution through sustainable development and environmental protection strategies;

C. 21 measures substantially contribute to the achievement of this goal, because the goals of preventing and reducing air, water and soil pollution are pursued to a significant extent by the activities envisaged in the measure, since these activities concern issues closely related to environmental impacts, habitat protection and sustainable development.

With regard to the environmental goal **"5. Prevention and reduction of air, water and soil pollution",** the following 6 measures of the Plan at the sub-area level required a background assessment of compliance with the DNSH principle (Stage 2):

- ***(A/1)_MIS|28*** *Sharing with the competent Authorities reference uses for the sea water bodies that are compatible or consistent with the protection and safeguard requirements of coastal landscapes, as identified through the processes for conforming the urban planning tools to the PPR (Regional Landscape Plan), within the framework of which surveys are conducted and landscape maps produced for identifying significant aspects of scenic perception.*
- ***(A/1)_MIS|29*** *As part of the activities for conforming urban planning tools to the PPR (Regional Landscape Plan), promoting the recognition of local landscape systems as structuring elements of coastal landscapes, in order to valorise them within the strategic networks of cultural heritage, ecology and slow mobility, also through the implementation of landscape projects.*

- ***(A/2)_MIS|1*** *In consideration of the important interactions between the Venice Lagoon and the Adriatic Sea (land-sea interactions), with regard to ports and maritime transport, and of the consequent repercussions for the Maritime Spatial Plan, promoting (i) the approval of the Morphological Plan of the Venice Lagoon, (ii) the definition of the new Protocol for the management of lagoon sediments, (iii) the excavation and adaptation of navigation channels in the lagoon system, (iv) the definition of a management regulation for interactions between the regulated port and the MOSE flood barrier system.*
- ***(A/2)_MIS|4*** *Measures to be implemented through the LIFE CARE Project (DGR no. 389/2022), for the purpose of (i) establishing a veterinary hospital in the Po Delta Regional Natural Park to take care of turtles stranded alive or found by fishermen accidentally in their fishing gear. This facility will take care of the first aid and rehabilitation of turtles in Veneto and will network with similar facilities in Emilia-Romagna. Measures to be implemented through the LIFE Transfer Project: (ii) improving the priority habitat 1150 * Coastal lagoons. The measure aims first and foremost at solving the drastic regression of submerged marine phanerogams – which are fundamental for the conservation status of the lagoons and for the maintenance of important nursery functions, for example – in this habitat, also considering the slow speed at which this vegetation is able to colonise the lagoon areas. The interested lagoon habitats include Caleri, Barbamarco, Canarin and Vallona.*
- ***(A/2)_MIS|5*** *(i) Development of common management proposals by the Northern Adriatic Fishery District (established by Ministerial Decree of 23 February 2010 between MIPAAF (Ministry of Agriculture and Fisheries) and the regions of Emilia Romagna, Friuli Venezia Giulia and Veneto), (ii) implementing the "Guidelines for environmental and productive reactivation of fishery resources in connection with seafloor dredging", approved with DGR No 1009 of 20 July 2021, (iii) implementing the project for repopulating marine ecosystems, approved with DGR No 976 of 13 July 2021, (iv) supporting sustainable management projects proposed by professional maritime fishing enterprises, under the EMFAF (European Maritime, Fisheries and Aquaculture Fund).*
- ***(A/2)_MIS|9*** *(i) Promoting the approval process of the New Morphological Plan of the Venice Lagoon and the New Protocol for sediment management in the Venice Lagoon, (ii) classifying the ports and maritime outlets under regional jurisdiction and identifying the relative management authority or entity, for the purpose of implementing the delegation processes under Law Decree No 112/1998, art. 105 paragraph 2, letter e), (iii) defining a spending item for financing dredging interventions of the maritime passes subject to regional jurisdiction and including them in the Three-Year Programme of Public Works, (iv) including in the Economic Frameworks relative to the Projects the expenses required for archaeological surveys, pursuant to art. 25 of the Legislative Decree 50/2016, and for implementing the so-called "Environmental Rearrangement Plan", provided by Regional Decree 1009/2021 and agreed on with the competent CO.GE.VO. (Clam Management Consortia).*

This assessment verified that these 6 measures comply with the DNSH principle for Goal 5, because they contribute to the sharing of environmental, urban and landscape knowledge and needs.

With regard to the DNSH environmental goal "**6. Protection and restoration of biodiversity and health of ecosystems",** phase 1 of the verification of compliance with the DNSH principle resulted in 48 measures of the Plan at the sub-area level being classified in one of the first three scenarios, namely:

A. 2 measures have no or negligible impact on the achievement of this goal, because, in view of the direct effects and primary indirect effects over the life cycle, the measures will not pose any risk of environmental degradation related to protecting and restoring biodiversity and ecosystems, since they are implemented in accordance with the applicable national and international regulations;
B. 25 measures are found to fully support this goal, because they contribute to the conservation and improvement of the environmental quality of the sub-area, fully contributing to protecting and restoring biodiversity and ecosystems, in accordance with the applicable national and international regulations;
C. 21 measures substantially contribute to the achievement of this goal, because these activities contribute to the conservation and improvement of the environmental quality of the sub-area, as well as to protecting and restoring biodiversity and ecosystems, in accordance with the applicable national and international regulations.

Also with regard to the environmental goal "*6. Protection and restoration of biodiversity and health of ecosystems*", the following 5 measures of the Plan at the sub-area level required a background assessment of compliance with the DNSH principle (Stage 2):

- ***(A/1)_MIS|1*** *Supporting and fostering the use of fossil fuels capable, in any case, of contributing to the decarbonisation of the sector in a transitional phase (liquefied natural gas and oil, methanol), of second-generation biodiesel and zero-emission fuels from renewable sources (ammonia, hydrogen and electricity).*
- ***(A/1)_MIS|23*** *Measures for exploiting opportunities offered by cruise tourism: systematisation of proposals aimed at directing cruise tourism flows to the inland areas, by valorising the local resources and professional skills.*
- ***(A/1)_MIS|24*** *In order to guarantee the navigability of the lagoon waterways, in the context of land-sea interaction, supporting the ordinary maintenance management works on the lagoon floor by applying special guidelines for the management of dredging operations (Guidelines for the Technical Management of Dredging in the Lagoon Area). These are aimed at verifying the existence of the necessary environmental criteria for handling sediments in the lagoon, in application of Art. 185 c. 3 of Legislative Decree no. 152/2006.*
- ***(A/1)_MIS|27*** *Identifying areas of sea immersion of sediments beyond 3 NM from the coastline, as provided in par. 3.1.1 of the Technical Annex to DM 173/2016, subject to site characterisation.*
- ***(A/2)_MIS|8*** *Adopting the measure of the Regional Council for defining the AZAs (Allocated Zones for Aquaculture) at sea, as macro-areas eligible for aquaculture concessions.*

This assessment verified that the 5 measures in question do not significantly harm the good condition and resilience of ecosystems or the conservation status of habitats and species, including those of interest to the Union, because the proposed measures, of high socio-economic value, will be implemented according to the best sustainable management practices and in accordance with the applicable national and international regulations, contributing to decarbonisation and the transition to zero emissions from renewable sources and in accordance with the Marine Strategy goals.

5.3 Outcomes of the Impact Assessments on the Natura 2000 network

The study attached to this report (Annex IX) is part of the Integrated Assessment of Plans in relation to Natura 2000 sites and Strategic Environmental Assessment and is aimed at providing useful technical elements for the screening and "*appropriate assessment*" phase of the Habitat procedure. In particular, they serve the purpose of identifying any elements capable of producing significant negative impacts on the habitats and species of Community interest, for which the Natura 2000 sites potentially affected by the Plan have been designated, i.e. the ones indicated in Annexes I and II of Directive 92/43/EC and Annex I of Directive 2009/147/EC, as well as the species of habitual migratory birds, both in isolation and in combination with other plans, projects or interventions, with a special focus on priority habitats and species. When carrying out this analysis, within the framework of the direvtive, it shall be necessary to adopt the precautionary principle: "*In the Impact Assessment procedure, the precautionary principle should be applied whenever it is not possible to exclude, with reasonable scientific certainty, the occurrence of significant interferences generated by a plan/programme/project/intervention/activity on the Natura 2000 network sites*". The study applies the provisions set out in Annex G to Presidential Decree 357/97, as supplemented, and in the National Guidelines for Impact Assessment (VIncA), as defined in the MoU of 28/11/2019, pursuant to Article 8, paragraph 6, of Law 5 June 2003, No 131, between the central Government, the regional governments and the Autonomous Provinces of Trento and Bolzano, published in the Official Journal of 28/12/2019 (GOV 2019).

The Study provides a fact-finding and regulatory framework, should the conditions occur, for subjecting to the VINCA the individual implementation plans/projects relative to the different sectors/uses mapped and classified within the Plan. Given the strategic level of planning, consistent with the technical and regulatory guidelines, the analysis reported in the Study, based on the Plan forecasts, was aimed at identifying the potential direct and indirect impacts, cumulative or otherwise, on the habitats and species of the Natura 2000 Sites.

The potential impacts linked to the implementation of the Plan provisions have been identified and analysed by reconstructing the Threats, as outlined in the Management Plans of the individual Natura 2000 Sites.

Even though the sea planning process has positive effects on the Natura 2000 Network, according to the objectives set out in Directive No 2014/89/EU establishing a framework for maritime spatial planning, aimed at promoting the sustainable development of marine areas and the sustainable use of marine resources (art. 1), the implementation of certain measures set out in the Plan or the cumulative effect due to the implementation of certain uses provided by the Plan may lead to potential impacts on the SCIs, SACs and SPAs. For all these reasons, an analysis of potential threats was carried out, which identified the Natura 2000 Network Sites potentially exposed to greater impact risks, due to overlapping uses, number of species and number of habitats.

In parallel, the conservation measures envisaged in the various Natura 2000 Sites were verified to assess whether they were sufficient to minimise the risks or should be supplemented, at a later stage, with additional measures. In fact, the National VINCA Guidelines clearly provide that "*it is reasonable to assume that the conservation goals are relatively stable over time, and in fact, in most cases they must be long-term goals, although it is likely that the conservation measures required to achieve these goals will change in response to changes in the types of pressures to which the sites are exposed and, of course, to the hopefully positive effects of the conservation measures already undertaken*". The fact that, to date, no procedures have yet been defined for carrying out the various permitted activities has prevented a more detailed understanding of the possible interferences with the habitats and species, on the basis of differentiations for the various sub-areas or on a site-specific scale. Therefore, in some cases, it seemed unnecessary and, indeed, too simplistic, at this stage, to conduct an analysis of the impacts, considering it more appropriate to postpone any further inquiry into the matter in connection with the definition of the implementation tools provided by the Plan. In other words, the MSP does not identify the specific locations of the interventions and, therefore, the Environmental Impact Assessment, in terms of both the screening activities and appropriate assessments, has made it possible to identify, through risk assessment, the areas of high and medium environmental sensitivity to pressure/threats, as a result of which the subsequent sector plans/projects – which shall be implemented in relation to the uses envisaged by the MSP – will require punctual verification subject to the VINCA.

Therefore, consistently with the Guidelines, "*in the event that the planning level subject to SEA fails to identify the location of the planned projects, it shall be necessary to require the impact assessments of the individual* *interventions, which must however also be verified in consideration of the cumulative effect produced by them*", the completed VINCA has provided a framework of requirements for the submission to the VINCA procedures of individual implementation plans/projects, for the issuing of authorisations, of concessions of maritime spaces, and for the implementation of all the measures envisaged by the Plan that might have potential direct, indirect and/or cumulative effects on habitats and species of interest for conservation purposes. This having been said, insofar as the conservation measures set out in the various Management Plans of the Natura 2000 sites examined either provide for bans on certain activities arising from the distribution of the maritime space, or no measures are envisaged for limiting the potential risk of certain uses. Another key aspect is the implementation of the Plan measures, which, in the specific cases of the Natura 2000 Sites, should be aimed primarily at limiting the potential threats identified in the introductory chapters of this Impact Assessment. On the basis of the risk assessment of the pressures/threats, carried out in relation to the uses envisaged by the Plan, the impact assessment highlighted potential direct and/or indirect impacts on habitats and species of interest for conservation purposes that are likely to be minimised through the adoption of specific mitigation measures *"aimed at minimising or even eliminating the negative impact of a plan during or after its implementation*". In relation to the intended uses and depending on the potential threats identified, the main minimisation (or mitigation) measures that could be adopted are listed in the conclusion.

5.4 Overview of the possible critical environmental issues identified

During the definition phase of the Plan (see Chapter 4 of the Plan), a number of areas of particular attention and issues of environmental importance were identified[87], to be considered in the plan according to the pressures linked to the main uses[88] , in order to "*support the process of defining the vocations of the sub-areas and relative planning units at the strategic level, as well as defining the measures of the plan itself*".

The methodology adopted within the ER, as seen in the previous sections, requires a matrix-based comparison between the anthropic uses of the sea, pressures, effects and environmental components (see **Annex VI** of the ER), with the aim of defining an **Environmental Compatibility Index** (ECI); according to this index, which also takes into account the potential cumulative impacts linked to the coexistence between uses envisaged by the Plan, situations of potential criticality were identified, depending on the (main) uses attributed to the different PUs. The most relevant environmental pressures/impacts are linked to those areas where Fishing, Maritime Transport and Port Activities, and Coastal Tourism overlap as uses envisaged by the MSP.

With regard to the **Adriatic** Maritime Area, the sub-areas recognised as potentially critical in this sense are **A/4_03** and **A/4_10**, and **A/6_06.** In these scenarios, the potential (negative) critical issues are mainly related to (potential) pressures on the marine environment and biodiversity (altered water quality, increased mortality or damage to marine fauna, issues of various kinds such as altered development of organisms, intoxication, bioaccumulation of contaminants in organisms, loss of seabed, damage to benthic habitats, etc.), and the potential for damage to the marine environment and biodiversity.), especially as a result of population growth, the risk of collision between vessels and the release of pollutants, alteration of the seafloor (abrasion, sealing,

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87 Reference should be made to section 6.2.5 of the Plan "*Attention items relating to single and multiple impacts on biodiversity and coastal marine habitats"*, which, in tabular form, "*provides a summary overview of the main attention items relating to single and multiple impacts on biodiversity and coastal marine habitats, to be considered in the development of the vocations and definition of the plan measures described below*".

88 These include, for example: Identification and adoption of behavioral and technological practices to reduce the impacts of underwater noise on biota; identification of areas with the highest incidence of collisions with marine megafauna; increase knowledge of the areas of highest incidence of air emissions and water pollution related to maritime transport; strengthening maritime traffic management, through existing spatial measures (transit corridors and traffic separation schemes); Identify the areas with the greatest impact on coastal and maritime tourism, with particular reference to pleasure boating; Strengthen multi-level governance systems that identify and promote concerted measures for the monitoring and sustainable management of fisheries, also with a view to international cooperation; to promote actions aimed at the training of the operators of the ichthyic sector about the sustainability aspects of the professional fishing; systematise and strengthen knowledge on Essential Fish Habitats of key fish species; identify priority areas for environmental and/or marine resource conservation, using an ecosystem-based approach that therefore considers connections at the whole sphere scale; systematise available information on habitats and species and fill knowledge gaps.

dredging) also as a result of fishing gear (trawl nets, dredges, turbo-blowers), accidental catches and overfishing, habitat degradation also linked to climate change (e.g. ocean acidification, rising temperatures).

These situations of potential criticality were then verified against the Plan's national measures (for the PUs identified as potentially critical for the Adriatic Area there are in fact no measures defined at the Sub-Area level available to date) and it was found that the MSP provides for regulatory measures that should help reduce the pressure factors and thus the potential (negative) effects on the environment.

However, mitigation measures are envisaged to reduce the effects related to certain pressures and will be explained in Chapter 6 below. Finally, an assessment of the (national) measures of the MSP was conducted against the "do-no-significant-harm" (DNSH) principle, using the checklist prepared by the European Commission[89] . Substantial consistency was found for all DNSH objectives. A small number of measures in the MSP have no or negligible impact on the DNSH objectives, while most of them are fully in accordance with the environmental protection and climate change adaptation/mitigation goals.

No background assessment of compliance with the DNSH principle (Stage 2) was found to be necessary for none of the 71 national measures of the Plan. Reference should be made to **Annex VII** and **Annex VIII** of the ER for a more detailed understanding of the assessments.

5.5 Issues related to cross-border environmental aspects

By its very nature, the sea is a resource that cannot be confined within national boundaries, and any intervention, action or change triggered by a state with a sea border can produce changes affecting the entire marine space. The maritime environment is a global and continuous space, physically unique, but from a legal point of view it is made up of different parts, each of which is subject to specific rules. Participatory maritime spatial planning is essential to address conflicts and resolve disputes between stakeholders, in particular to limit cross-border environmental impacts. In the last decade, increasing pressures on marine ecosystems, as a result of human activity, have led to the proposal that maritime spaces should undergo spatial organisation and planning in order to ensure the sustainable use their resources.

The cross-border nature of the marine environment requires regional cooperation, both between member States and with third countries, to achieve shared, coherent and more effective actions and methods. In this respect, the Marine Strategy Framework Directive (MSFD, 2008/56/EC) guarantees, together with the Common Fisheries Policy, a robust political and legal framework for the fulfilment of international commitments related to the protection of marine biodiversity, representing an important tool for the governance of the marine system, promoting the adoption of complex strategies aimed at safeguarding the marine ecosystem to achieve good environmental status. Like the other two maritime areas, the "Adriatic" area is naturally affected by cross-border environmental effects. One of these concerns fishing. Most of the countries that fish in the Mediterranean Sea and share international waters with our fishermen are not members of the EU.

Therefore, the forum for joint decision-making, having legal force, is the GFCM (FAO), which is the regional fisheries body for this Sea. And also in this context, multi-annual management plans and sub-regionalism serve as the basis for implementing common strategies. Multi-annual management plans under the CFP (Common Fisheries Policy, EU Reg. No. 1380/2013) are adopted per stock and per GSA (or set of GSAs). The fisheries sector is contextualised within the three-year National Programme for Marine Fisheries and Aquaculture 2022-2024, highlighting the structure of the CFP, the means and measures needed to achieve its objectives, in connection with the theme of maritime spatial planning, within which fishing in its own right is considered one of the activities of interest for the national and transnational blue economy. Italy's commitment concerns both strategic-level and multi-sectoral cooperation initiatives, such as the EU strategy for the Adriatic and Ionian Region (EUSAIR), and sectoral cooperation mechanisms, such as those of the Regional Fisheries Organisations (RFOs; among them the General Fisheries Commission for the Mediterranean – GFCM – of the FAO). Furthermore, the Adri.SmArtFish Interreg Italy-Croatia Projec project envisages the establishment of a consortium between Italian and Croatian operators to enhance artisanal and sustainable fishing, capable of

[89] See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021XC0218(01)

laying the foundations for the co-ordinated management of marine biological resources aimed at the balanced, rational and oriented sustainability of small-scale fishing in the Adriatic area.

The "Adriatic" area, which includes Geographical Sub Areas (GSA) 17 and 18 (FAO-GFCM), is bounded in the east by the limits of the continental shelf, as formally agreed with the neighbouring countries (Yugoslavia, 1969; Albania, 1992; Greece, 1977 and 2020). This area is sub-divided into nine sub-areas, six of which lie within the territorial waters. The three sub-areas A/7 - Northern Central Adriatic Continental Shelf, A/8 - Southern Central Adriatic Continental Shelf, and A/9 - Southern Adriatic Continental Shelf fall within international waters. The Adriatic Sea is a hot spot of Mediterranean biodiversity, especially considering the endemism of fish species. Important fish breeding and growing areas (Essential Fish Habitats) of high commercial value also lie within the basin. This makes this area an area of strategic importance at national level for the fishing sector, and determines, as in the entire Eastern Mediterranean, a fish stock situation that is far from being exploited within sustainable levels. In the cross-border context, the effects of maritime anthropic activities on marine and coastal environments include:

- overexploitation of fish stocks, leading to a lack of available resources for local populations and loss of marine biodiversity;
- trawl fishing, which can release quantities of CO2 equal to those of the entire aviation sector, by virtue of the disturbance of seafloor sediments, which are a key reservoir for long-term carbon storage, thereby contributing to ocean acidification and harming marine productivity and biodiversity;
- illegal, unreported and unregulated fishing, which constitutes one of the most serious threats to the sustainable exploitation of fish populations;
- unfair competition to EU fisheries from other Mediterranean countries that are not bound by the rules, undermining efforts to rebuild stocks;
- pollution caused by maritime traffic (water and air pollution, emission of climate-altering substances, waste dispersion, underwater noise emission, collisions with marine megafauna);
- marine litter;
- introduction and proliferation of invasive alien species;
- warming of the Mediterranean Sea, at a rate 20 % faster than the rest of the world (according to MedECC data, climate change could lead to local extinctions of commercial fish and marine invertebrates of up to 50 % by 2050). Climate change is increasingly altering the distribution patterns and migratory regimes of different fish species and affecting small-scale fisheries in developing countries most vulnerable to its effects;
- industrial accidents.

To this end, the Plan highlights for the "Adriatic" area the relevant items for cross-border cooperation[90] to implement strategies for reducing and/or minimising potential negative impacts, which include:

- contributing to the cross-border management of the environment and natural resources, through the systemisation of the network of environmental protection tools (MPAs, Natura 2000 network, EBSAs – CBD, SPAMI, etc.), through planning decisions that are consistent with the measures agreed at transnational level for the protection of fishery resources (e.g. FRAs – GFCM) and through the adoption of decisions that are consistent with the common European goals defined for the quality of the marine environment (MSFD);
- promoting a systemic, Europe-wide and regional vision of maritime transport and multimodality. This vision is reflected in the Plan's objectives, which provide for the sustainable growth of Adriatic port systems also on the basis of the strengthening and extension of existing cooperation networks between ports, the further development of Motorways of the Sea, as a complementary solution to road transport, the integration of maritime transport with the land transport network in the trans-European perspective of TNT-T multimodal networks, the harmonisation of the Plan-based decisions with existing international planning tools (first and foremost those defined by the IMO as to navigation corridors).

[90] See Section 6.2.7 of the Adriatic Plan.

Another aspect to be taken into consideration, with respect to possible cross-border effects, is related to hydrocarbon exploration and production projects; reference should be made first of all to the contents of the SEA Environmental Report by PiTESAI (Plan for the Sustainable Energy Transition of Relevant Areas), which, in relation to the verification carried out on possible cross-border impacts, excludes the presence of cross-border impacts/effects, given the purposes of the PiTESAI, based on the rationale of the provision (art. 11-ter of Law No. 12/2019) underlying the drafting of the report, as a measure aimed at the pursuit of an effective "energy transition" contributing to the achievement of the environmental goals set by the European Union, mainly through the rationalisation of existing mining activities (therefore, considering that the PiTESAI is not a Plan for the further development of upstream activities).

Specifically, the SEA Environmental Report, prepared within the PiTESAI framework, highlights the application to the sea of a criterion that excludes the future *a priori* opening to upstream activities of new maritime areas of potential geo-mineral interest that are not already open to hydrocarbon exploration and production. In this regard, and in view of the decarbonisation objectives for 2050, the goal of expanding the network of marine protected areas to at least 30% of the marine area (and at least 10% of the strictly protected areas) established by the new European Biodiversity Strategy for 2030, and the environmental targets set out in Framework Directive 2008/56/EC on the Marine Strategy, the scenario of opening new marine mining areas, in addition to the current ones, does not appear feasible, while it would be feasible, according to the PiTESAI, to both exclude the future opening to upstream activities of new marine areas that have not already been opened to hydrocarbon exploration and cultivation, and stop exploration activities in marine areas that have already been opened and where no applications for hydrocarbon prospection, exploration and production have ever been submitted, in an attempt to "redelineate" the current marine areas on the basis of administrative criteria. Moreover, the possibility of carrying out hydrocarbon production activities in the areas straddling the delimitation lines of the Italian continental shelf, as defined by international agreement and, where absent, the median line with the bordering States, is excluded, as mentioned above, with reference to the goals of the plan.

This being the case, and while we would like to make a few brief remarks here on the potential cross-border effects of hydrocarbon exploration and production activities, reference should be made to the blowout phenomenon as the only potential risk in this respect. Blowout (i.e. loss of well control) is, in fact, the biggest risk to the marine environment and is a result of the uncontrolled release of hydrocarbons from a pressurised well, lacking any pressure control systems.

Blowouts can occur throughout the life cycle of a hydrocarbon extraction well, i.e. during the drilling and production phases or during workover activities.

There are different types of blowout, namely:

- surface blowout: hydrocarbons are released into the atmosphere and the surrounding environment together with other materials such as water, drilling fluid, sludge, sand, rocks and other substances;
- submarine blow-outs: these occur mainly due to failures of well pressure control equipment (Blow-Out Preventer, BOP) or pressure imbalances in the underground reservoir.
- underground blowout: a particular situation in which fluids flow from high-pressure zones (usually corresponding to deeper layers in the ground) in an uncontrolled manner to lower pressure zones within the well.

The effects of such phenomena, both in terms of their intensity and distance from the blowout well, depend on many factors, including the depth of the well, the pressure of the reservoir, the presence of oil or gas, the amount of materials discharged into the environment, etc.. Depending on these factors, the potential impacts of a blowout on the marine environment may cover an area of several hundred square metres to several hundred square kilometres, in the most severe cases. Based on the SEA procedure of the PiTESAI, and also considering the fact that, in Italian marine areas natural gas exploration and production is predominant over oil, it is believed that any cross-border impacts related to hydrocarbon exploration and production activities are in any case to be considered negligible.

5.6 Alternative planning options

5.6.1 "No Plan" scenario

The "zero option" or "no plan" scenario is a representation of the likely evolution of the environmental status in the absence of the Plan, analysed according to the relevant time horizon. Although the preparation of a MSP is required by both Directive 2014/89/EU and Legislative Decree 201/2016, the absence of the Plan would imply the failure to identify the framework criteria for sustainable planning and management and for the reasonable organisation of the use of the maritime space and the interactions between uses, for the purpose of balancing the demand for development with the need to protect the marine ecosystems and achieve the desired social and economic objectives in a transparent and planned manner.

According to this scenario, all national marine and coastal areas, including the continental shelf areas, and in particular the Marine Protected Areas and areas within the Natura 2000 Network, except for those subject to regulatory exclusion, would be without rationalisation, organisation and planning, thus allocating the coordination of activities in the marine and coastal areas, in the energy, maritime transport, fisheries and aquaculture, tourism and maritime transport sectors and the exploitation of all types of marine resources, to the local authorities without a coherent vision.

The "No Plan" option would consequently translate into the potential emergence of a great deal of inconsistencies between the different sea uses, which, lacking a spatial reference framework within which to tackle interferences, would overlap and disproportionately increase pressures on the marine and coastal environment. This situation would also lead to the likely impossibility of achieving the goals set by both the European Directives on biodiversity, water, the marine and coastal environment, and the national transposition regulations, such as the favourable conservation status of habitats and species of Community interest, water quality objectives and the "Good Environmental Status" of the marine environment.

The MSP is, therefore, a fundamental tool for the management and governance of national marine and coastal areas, marking a turning point in environmentally sustainable maritime spatial development policies in relation to all the different uses towards the achievement of the Integrated Maritime Policy (IMP) goals.

In preparing the Plan, only one alternative option was considered, namely, non-intervention, defined as the "No Plan" option, which envisages how conditions could evolve in the absence of a MSP, and is described starting from the scenario set out in Chapter 4 and considering the expected territorial transformations and interventions as based on and resulting from the plans and programmes proposed by the higher authorities, plus the implementation of interventions and projects already planned and expected to be implemented in the short and medium term. This scenario does not achieve the development and sustainability objectives required by the IMP and the MSP but shows the possible development of the maritime and land-sea system without any further policies and/or planning other than those previously defined and already in place. In fact, the issues of sustainable development and governance are the cornerstones for implementing the MSP and have been included in the Plan formation process from the start. The MSP has been designed, on the basis of the transposition of the Directive, as a superordinated plan, compared to all other plans and programmes capable of affecting its scope, whether concerning marine waters or land-based activities that may affect marine waters, which shall be absorbed by and harmonised with the provisions of the MSP.

The Plans, therefore, provide for the coordination of the different policies through a single act of management, in the form of an "integrated plan" and a "comprehensive plan", for identifying all the different uses of the maritime space. Moreover, it is envisaged that, once the Maritime Spatial Plan has been prepared, it will become a benchmark and reference for the individual sectoral plans, constituting the framework within which the sectoral plans will be able to define their sectoral objectives and actions.

This means that it will not be possible to disregard the Plan, by implementing alternative plans or programmes or through administrative measures, thus ensuring clarity and legal certainty with regard to the uses of the maritime space by economic operators, through the coordination of different administrative acts concerning activities taking place at sea or which are in any case capable of impacting on the maritime space.

The territory included in the scope of the planning is very extensive and includes many valuable areas, Natura 2000 sites, MPAs, as well as other specific areas located within a very complex system defined by all the uses of the sea, which makes the environmental management framework even more complex. Thus, the failure to achieve the objectives underlying the Plans under assessment, in relation to the promotion of the sustainable growth of maritime economies, the sustainable development of marine areas and the sustainable use of marine resources, ensuring the protection of the marine and coastal environment through the application of the ecosystem approach, taking into account land-sea interactions and the strengthening of cross-border cooperation, in accordance with the relevant provisions of the United Nations Convention on the Law of the Sea, would inevitably lead to the "uncontrolled" development of the marine space, without being able to ensure its future development in a clear, reasonable and defined manner, in compliance with the basic principles underlying the MSP. In conclusion, and in light of the facts emphasised and reiterated above, we can easily infer that a “No Plan” scenario would obviously determine the continuation of all the critical aspects highlighted as existing in the marine areas and described and addressed in Chapters 4 and 5 of the ER. It is further emphasised that the lack of rational programmed strategic planning would lead to the evolution of the marine space without any superordinate monitoring whatsoever capable of ensuring a coherent, transparent and sustainable decision-making framework for the effective management of maritime activities and the sustainable use of marine and coastal resources.

Thus, in a business-as-usual scenario, the “No Plan” option would entail the continuation of current socio-economic activities causing the impacts described in the previous paragraphs to steadily build up, with all the related consequences on the environmental balances and eventually necessarily leading to the further deterioration of the environmental critical factors and a dire future for the human community. Going into the specifics of the energy and climate-related factors, we can see how, in each national homogeneous marine climate macro-region (1M and 2M), the possible anomalies identified with regard to potential future climate changes affecting the various Italian marine areas, would be as follows

- the Adriatic Sea features the most significant change in average temperature of about +1.5 °C (cluster H), with variations in the winter and spring period of up to +2 °C; in contrast, this basin shows a smaller sea level rise of about 7 cm;
- the Ligurian and Tyrrhenian seas, although separated into two different macro-regions, present the same characterisation of future anomalies, with an expected increase of 1.2 °C for temperature and 9 cm for sea level;
- the Ionian Sea and the Strait of Sicily belong to the same macro-region and feature an average increase in temperature and sea level (cluster G) of 1.3 °C and 7 cm, respectively.

With regard to atmospheric pollution, the current and forecast trends show that the marine sector will become the driving sector for decreasing emissions of sulphur oxides and nitrogen oxides, whose greatest emission is related to road transport; instead, in the case of the other pollutants considered ($PM_{2.5}$, NMVOC and NH_3), downward trends are still observed, albeit to a smaller extent.

Overall, according to the Directive 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (NECD), which sets out for each Member State emission reduction targets in the target years 2020 and 2030, compared to the base year 2005, for anthropic emissions of SO_2, NOx, $PM_{2.5}$, NMVOC and NH_3, it appears that based on current emission projections, all targets should be met in 2020 while additional measures should be taken for the 2030 targets. With respect to energy, trend assumptions were made on the basis of the PNIEC (Integrated National Energy and Climate Plan), the strategic plan for the sector. Energy efficiency measures are developed not only on the topics of supply, dependency and security, but also energy costs and, above all, the decarbonisation of the entire energy system.

According to this plan, Italy intends to pursue an indicative consumption reduction target to 2030 equal to 43% of primary energy (PE) and 39.7% of final energy (FE), with respect to the reference scenario; in terms of the absolute level of PE and FE consumption in 2020, it is estimated that the indicative targets set will be exceeded, while in terms of the absolute level of energy consumption in 2030, Italy pursues a target of 125 Mtoe of PE and 103.8 Mtoe of FE, starting from the consumption estimated in 2020. Taken together, the Plan's objectives and recent consumption trends determine a configuration of the energy system to 2030 that fully meets the PE reduction target set at 32.5%. With respect to the reference scenario related to human health, linked to the safety of seafood products, the “No Plan” alternative scenario would result in the absence of specific criteria for the definition of a framework for the sustainable management of the Plan's activities. The effect of the "No Plan" option would therefore result in the potential continuation of current activities without a spatial reference framework within which to tackle interferences. Specifically, human health is linked to the food safety of fishery and aquaculture products, and the non-implementation of the Plan would result in new impacts emerging and shifting away from the achievement of the priority objectives set by the EU food hygiene policies, aimed at ensuring a comprehensive and integrated approach to food safety based on risk analysis.

Current assessments (2019) for metals, organochlorines and PAHs in samples of fishery products show a qualitative improvement compared to the past (ISPRA 2018). Regarding nano-plastic pollution, EFSA recommends further implementation and standardisation of analytical methods for detecting micro- and nano-plastics in order to assess their presence and quantify their levels in food. The implementation of the plan could allow the implementation of studies for monitoring the various types of pollutants, at both maritime area and sub-area level, for which data are currently totally lacking. Generally speaking, we can state that failure to implement the Plan would not allow the implementation of interventions that would determine positive effects on human health. Promoting the sustainable growth of maritime economies is the reference goal that can be traced back to the socio-economic aspects of fishing and aquaculture. The last Sea Economy Report (2021) showed that, in the maritime economy, added value and employment grew by 0.1% between 2014 and 2019. Italian aquaculture production remains stable, while growth would be desirable to reduce dependence on imported seafood and limit fishing pressure on fish stocks.

The expected growth and development of the sector in Italy, by 2025, could be achieved by implementing the Plan, which could allow the definition and allocation of Marine Areas for Aquaculture (known as AZAs). Another fundamental goal of the MSP, in accordance with the CFP, is the valorisation of artisanal fishing, which offers the best results, from the perspective of the value chain, for the consumption of fish products. The implementation of the plan could allow the valorisation of artisanal fishing and the allocation of AZAs to reduce dependence on the import of fish products and limit fishing pressure on fish stocks, as well as the implementation of measures aimed at the maximum sustainable yield of fish and control of illegal fishing. Generally speaking, it can be said that the non-implementation of the Plan would not allow the implementation of interventions with positive effects on the economy and social aspects of the regions.

Biodiversity and the marine environment are the most exposed and vulnerable elements, as things stand now, to changing conditions in a "No Plan" scenario; in fact, the report on the Habitats (92/43/EEC) and Birds (2009/147/EC) Directives confirms the negative trends and critical conditions of protected species and habitats in our country, with a high number of unfavourable assessments:

- ✓ 54% of the terrestrial and inland flora (of which 13% feature a poor conservation status);
- ✓ 53% of the terrestrial and inland water fauna (of which 17% feature a poor conservation status);
- ✓ 22% of marine species (17% of which feature a poor conservation status);
- ✓ 89% of terrestrial and inland water habitats (of which 40% feature a poor conservation status). Marine habitats, on the other hand, feature a favourable conservation status in 63% of cases and unknown in 37%.

The main threats to biodiversity that cause damage to the extent of complete loss of natural ecosystems are:

- ✓ the loss and fragmentation of habitats;
- ✓ climate change, over-exploitation of resources (e.g. fish stocks);
- ✓ the introduction of invasive alien species;
- ✓ pollution.

Therefore, marine ecosystems are clearly constantly under anthropic pressure due to a variety of stressors, including the anthropisation of coastlines, pollutant inputs from rivers, overfishing, and difficulties in managing international waters, which continue to undermine the preservation of important natural resources. In particular, currently designated MPAs cover 9.68% of the Mediterranean Sea, but those effectively managed through implemented management plans are only 1.27%, thus highlighting a delay in planning and management and the enormous work that still needs to be done to promote the protection of marine protected areas. Failure to implement the MSP would therefore mean missing the opportunity to produce an overarching instrument capable of incisively protecting the Mediterranean Sea.

5.6.2 Alternative planning options: "Plan Implementation" scenario

Marine Spatial Planning (MSP) is a fundamental tool that marks a major turning point in policies for managing the coastal and marine environment and the economic uses and activities that interfere with it. The MSP, therefore, introduces a more rational organisation of the use of the maritime space and of the interactions between its uses, balancing the needs related to the demand for development with the need to protect, safeguard and increase marine ecosystems, and to achieve social and economic objectives, representing a fundamental element for a sustainable development of the sea economy. By implementing a MSP Italy not only complies with the European Union provisions set out in the Marine Strategy Framework Directive (MSFD), it also clearly expresses a commitment and contribution towards the achievement of all the sustainability and development objectives defined by international and EU environmental policies (decarbonisation, protection of biodiversity and habitats, sustainable development, reduction of marine pollution, coastal erosion, climate change, protection and enhancement of underwater cultural heritage, etc.).

As previously defined, the only alternative option considered was the "No Plan" scenario (i.e., without the implementation of an MSP), which highlights the failure to achieve the goals envisaged both by the Plan and by all the policies that involve the Plan, thus removing a fundamental pillar in the management of national and international environmental policies. As seen in the previous paragraph, the current environmental conditions point to the constant degradation and impoverishment of marine ecosystems, therefore, it has become absolutely necessary to implement all the actions, interventions and policies capable of slowing down this trend; through the analysis of models developed back in 2018, it has been possible to verify how the current trend can be reversed through the implementation of conservation policies aimed at decarbonisation, reducing pollution or increasing the extent of protected areas. The implementation of these actions, as a means for achieving the objectives, is provided by the Marine Strategy Framework Directive (MSFD), which has boosted the protection and restoration of the marine environment through an integrated approach that encompasses all other instruments and directives somehow affecting the marine environment, and constitutes the environmental pillar of the European Union's maritime policy, the ultimate goal being the achievement by the Member States of Good Environmental Status for their marine waters. A target that had originally been set for 2020. Considering that the Italian coastline comprises no less than 3 of Europe's 6 marine areas, we can understand how the implementation of the MSP is of key importance not only for Italy but for the entire EU.

The implementation of the measures and actions envisaged in the MSP, with the achievement of the strategic and environmental goals, will clearly bring numerous positive effects compared to the "No Plan" option, directing planning and policy decisions towards the sustainable growth of maritime economies, the sustainable development of marine areas and the sustainable use of marine resources. The analysis and elaboration of the values obtained from the **Environmental Compatibility Index** (**defined in chapter 5)**, which indicates the intensity, on all the environmental components considered in an aggregate way, of the impact generated by the planned interventions, provide us with analytical data that clearly and comprehensibly stress how the implementation of the MSP will entail – in the medium to long term – a far-reaching and distinct improvement of the environmental conditions, as opposed to the conditions resulting from the application of the "No Plan" option. The following table shows the different values of the environmental compatibility indices with respect to the "No Plan" and "Plan Implementation" scenarios and, finally, the difference in values between the two scenarios with the relative increase in environmental quality. What clearly emerges from the comparison of the two scenarios is that the implementation of the MSP is unequivocally the scenario to be preferred.

sub-area	Environmental Compatibility Index "Plan Implementation" scenario	Environmental compatibility index "No Plan" scenario	Difference of the Environmental Compatibility Index between the "Plan Implementation" and the "No Plan" scenarios
A/1	159	-202	361
A/2	33	-270	303
A/3	131	-265	396
A/4	99	-798	897

A/5	**10**	**-320**	**330**
A/6	**672**	**-713**	**1385**
A/7	**-22**	**-724**	**702**
A/8	**93**	**-332**	**425**
A/9	**185**	**-446**	**631**
TOTAL	**1360**	**-4070**	**5430**

Table 5.6: Environmental compatibility index values relative to the Adriatic sub-area for the “Plan Implementation” and “No Plan” scenarios and difference between the two

To facilitate the understanding of the table, a graphical representation of the above data is given below:

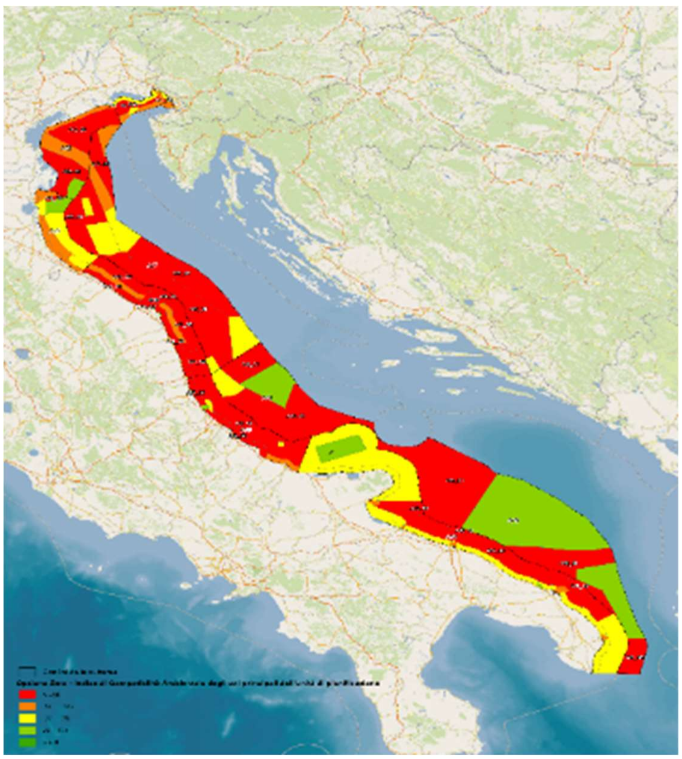
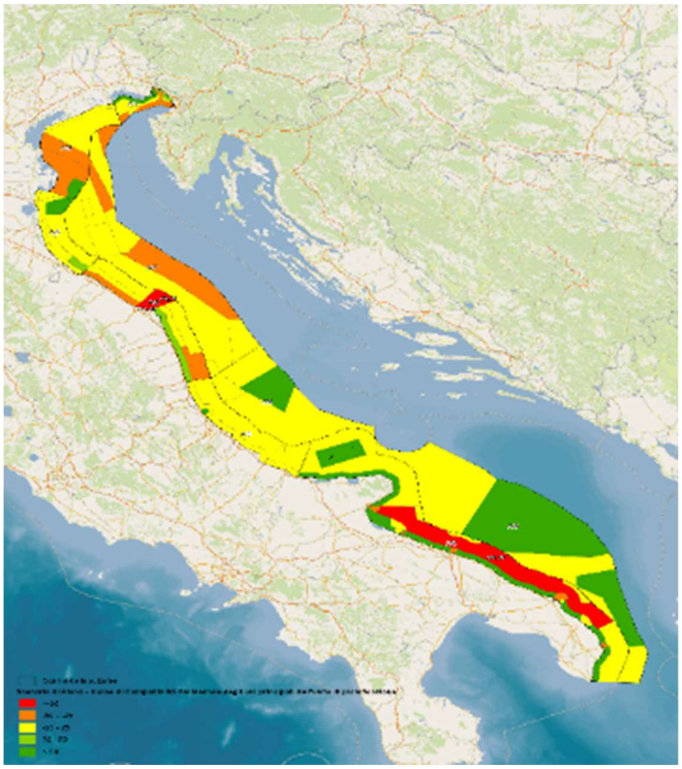


Figure 5.5: “No Plan” option

Figure 5.6: “Plan Implementation” option



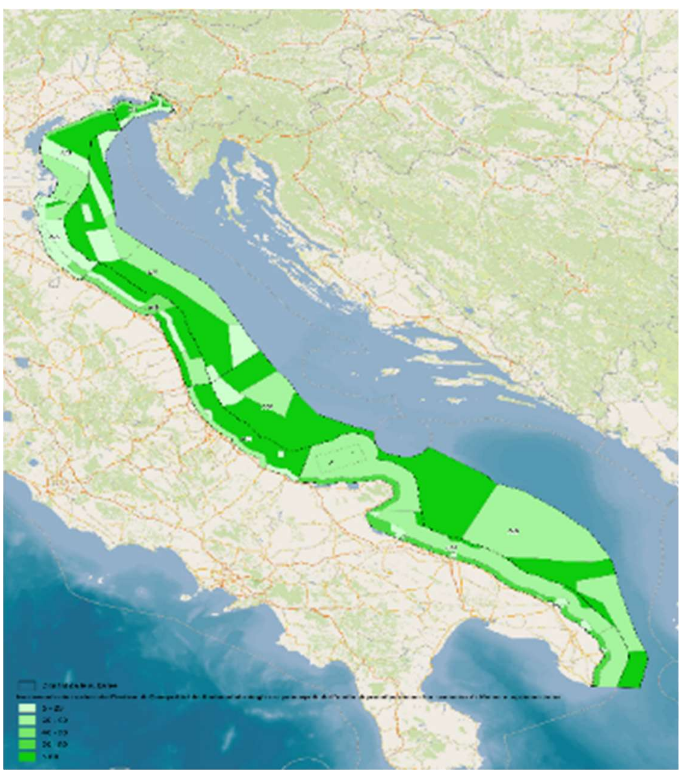


Figure 5.7: Increase in the Environmental Compatibility Index values

6. Further integration, mitigation and environmental monitoring measures for the implementation phase

6.1 Indications on possible measures to mitigate the effects

As already extensively discussed in the previous Chapter 5, maritime traffic and ports, fishing, aquaculture, coastal defense, coastal and maritime tourism and energy represent the uses envisaged by the MSP that can determine the most significant environmental effects. (both in a negative and a positive key). Some possible mitigation measures will therefore be presented below which, together with the measures of the Plan highlighted above, can contribute to reducing the potential negative effects during implementation:

6.1.1 Measures to mitigate the effects on the marine environment related to Maritime traffic and ports

Maritime traffic interacts with a variety of uses of the marine environment, ranging from interactions with coastal fishing to the emergence of large offshore energy infrastructure projects. The report on the environmental impact of European maritime transport, presented by the European Environment Agency and the European Maritime Safety Agency in 2021, provides for the first time a comprehensive analysis of the situation in the sector. The report highlights that ships produce 13.5% of greenhouse gas emissions from different modes of transport in the EU, ranking maritime transport right after road transport (71%) and aviation (14.4 %). The environmental compatibility index of the use envisaged by the MSP is the lowest.

From the environmental point of view, the ensuing set of pressures, such as CO2 emissions (approximately 18% of global emissions worldwide), sulfur dioxide (SO2) emissions, underwater noise pollution (doubled in EU waters between 2014 and 2019), the production of marine litter, the introduction of invasive non-indigenous species, can seriously affect marine and coastal biodiversity and any protection targets even at great distances from the sources of impact.

However, in economic terms, maritime transport represents a fundamental part of the international supply chain: 77% of European foreign trade and 35% of that between EU member states takes place by sea. Despite the decline due to the Pandemic in 2020, strong growth is expected in the coming decades, fueled by the growing demand for primary resources and containerized shipping. The maritime economy of the Adriatic system is historically linked to ports and maritime transport, be it commercial, passenger or the cruise sector.

The complex geographical and productive configuration of the Adriatic Sea makes the area one of the main maritime hubs in the Mediterranean and for this reason it is a priority, in line with the European programming in terms of TEN-T networks, to develop policies for the efficiency of its ports. The development of the sector is closely connected with the aspects of logistics, with the modernization of port infrastructures with the integration into the trans-European transport network and with the intermodal connection between sea and land transport. The strategy of the Plan provides for the spatial definition of the sustainable development objectives of maritime transport, aimed at reducing negative impacts (e.g. with the use of alternative fuels, reduction of discharges and waste, management of dredged sediments, mitigation of underwater noise emissions, etc.), also in the face of climate change, in order to allow a harmonious and sustainable systemic development.

With regard to safety, the Plan for the Adriatic maritime area incorporates the objectives: (i) to prevent pollution caused by ships and contribute to the implementation of the measures of the Marpol Convention; (ii) to help promote maritime safety, the implementation of UNCLOS standards and the EU Maritime Security Strategy. The second objective is expressed in activities aimed at guaranteeing the safety of navigation and in search and rescue activities for human lives at sea, with particular reference for the latter to the SAR areas present in the Adriatic Sea of Italian competence. Maritime transport is allowed and developed throughout the maritime area, with the exception of areas that, due to pre-existing constraints, limit / exclude access. In order to ensure the development of maritime commercial traffic affecting the Adriatic port system, it is necessary to maintain the infrastructural conditions and suitable seabed conditions for the waterways through periodic maintenance interventions and promoting the sustainable management of sediments (from port dredging, excavations , hydraulic arrangements, etc.), with the purpose of coastal nourishment for emerged and submerged beaches, also providing for a monitoring and management system of silting in ports.

The suitability of the areas will contribute to the reconversion of activities in persistent crisis within or near commercial ports into activities related to shipbuilding or the circular economy, encouraging logistical innovation and modernization of port infrastructures. In 2020, the MARPOL legislation came into force on a world scale, i.e. the new limit relating to the percentage of sulfur in naval fuels, applicable to ships of any flag, equal to 0.5%, significantly lower than the previously in force limit of 3.5%. This legislation constitutes an important response from the world of shipping to mitigate the environmental impact generated by maritime transport and to improve air quality in the port area. In the presence of unavoidable interactions, such as in the case of MPAs close to ports or straits or large MPAs, it is necessary to adopt solutions to avoid or mitigate impacts and thus protect the precious marine environments and fish stocks of the Mediterranean. .

The proposed measures to prevent or reduce these incidences are believed to be:

- the extension of spatial protection measures that could favor the protection of the bottlenose dolphin, and the areas / seasons in which it is necessary to activate specific mitigation actions of the main threats;
- the extension of the existing Natura 2000 sites in the area;
- implementation of the rules on the speed of ships, at least in the Particularly Sensitive Marine Areas (PSSA);
- actions aimed at mitigating the contribution of waste on a local scale, as well as the national implementation of the EU directives on plastics, with the related monitoring activities to be carried out in a collaborative framework.

Tools such as Particularly Sensitive Marine Areas (PSSA), Areas to Avoid (ATBA) and Traffic Separation Schemes (TSS) can be used to protect MPAs from the risk of maritime accidents and limit the opportunities for collisions with cetaceans. National authorities should coordinate monitoring programs for areas and routes frequented by marine mammals to support MSP processes. In the case of cross-border MPAs, States should actively participate in the IMO (International Maritime Organization) and in its offices formulate joint proposals to adopt traffic channeling systems and in PSSAs (Interreg-Mediterranean PHAROS4MPAs 2019).

Among the mitigation measures we recognize the national measures of the MSP (NAZ_MIS | 44 NAZ_MIS | 46, NAZ_MIS | 47, NAZ_MIS | 48, NAZ_MIS | 49, NAZ_MIS | 50 and NAZ_MIS | 51) which aim to fully contribute to the protection and the restoration of biodiversity and ecosystems in line with current national and international regulations. These measures, in line with the DSNH principle, aim at promoting sustainable development of maritime transport and reducing its negative impacts (OS_TM | 01), promoting the use of alternative fuels, reducing discharges at sea, improving port facilities for the collection of waste and cargo residues and / or encouraging the use of the aforementioned plants, improving the management of dredged sediments (OS_TM | 02), promoting European and regional collaboration on maritime transport and multimodality (OS_TM | 03) , to help increase the competitiveness of Italian ports by sharing "best practices" and implementing the National Strategic Plan for Ports and Logistics (PSNPL) (OS_TM | 04) and to promote integration and dialogue between current planning, in particular regarding the integration of strategic port planning, land planning and sea plans (OS_TM | 05).

Some regional measures also represent mitigation measures, aimed at minimizing the impact on biodiversity and ecosystems. Some of the (regional) measures of the MSP relating to the SUB-AREAS (A / 1_MIS | 2, A / 1_MIS | 3, A / 1_MIS | 4, A / 1_MIS | 5, A / 1_MIS | 6, A / 2_MIS | 1, A / 2_MIS | 2, A / 3_MIS | 8, A / 3_MIS | 9) have the objective of contributing to the protection and restoration of biodiversity and ecosystems in line with current national and international regulations.

These measures, in line with the DSNH principle, aim to ensure the development of maritime commercial traffic affecting the regional commercial port system, in the context of the TEN-T networks and international and global traffic scenarios, with a view to sustainable development (A / 1) OSP_TM | 01); to promote the infrastructural conditions of nautical accessibility for the strengthening of the maritime commercial traffic affecting the Veneto port system in support of the regional economy (A / 2) OSP_TM | 02; to relaunch the Venetian cruise economy through the resumption of traffic with O / D Venice through the solution to the problem of the terminal (A / 2) OSP_TM | 03; to activate a dredging program for waterways and lagoons, protecting habitats and through careful consultation with fishermen (A / 2) OSP_TM | 04; to favor the development of maritime (and / or tourist / fishing) commercial traffic affecting the regional commercial port system, in the context of the TEN-T networks and international and global traffic scenarios, with a view to sustainable development (A / 3) OSP_TM | 01; manage the periodicity of seabed maintenance interventions functional to the activities of the commercial and tourist port system by promoting the sustainable management of sediments (from port dredging, excavations, hydraulic arrangements, etc.), with the aim of coastal nourishment for emerged and submerged beaches (A / 3) OSP_TM | 02.

The National Strategic Plan for Ports and Logistics represents an important step towards the reform of Italian ports (ref. Legislative Decree 4 August 2016, n. 169), and aims to create a maritime system capable of benefiting from the position strategic geographical area of Italy. In this context, the maritime system must be considered as an engine for the country's economic growth and an active tool for improving the sustainability and development of cohesion in the Euro-Mediterranean scenario.

6.1.2 Measures to mitigate the effects on the marine environment related to aquaculture

In "designing a just, healthy and environmentally friendly food system", the Green Deal assigns a key role to aquaculture, recognizing the potential of the Union aquaculture sector, considered one of the most innovative, sustainable and high-tech economic sectors.

The Commission's proposals for the period 2021-2027 foresee that at least 30% of the new EMFF contribute to climate action and support for Member States to develop the potential of sustainable seafood as a source of low-carbon food. In line with the European Green Deal and in particular with the "From the producer to the consumer" (Farm to Fork) strategy, the Plan emphasizes the importance of aquaculture (shellfish farming in particular) in marine waters, highlighting for the sector a large potential for further development in the Adriatic Area, promoting the preparation and supporting the full implementation of the AZA plans and promoting the development of the sector compatibly with the objectives of protecting ecosystems and the landscape heritage. The environmental compatibility index of the intended use is among the lowest due to the not indifferent impacts such as the voluntary and involuntary introduction of invasive species (alien and non-indigenous species), the inputs of nitrogen and phosphorus with the level variation of nutrients in the water, the production of waste or the alteration of the food web with the consequent loss of biodiversity.

However, as already extensively discussed in chap. 4, the growth of aquaculture production would reduce dependence on the import of fish products and limit the pressure of fishing on fish stocks and therefore implement a more sustainable food policy, accelerating the transition to a food system that should have an environmental impact neutral or positive, able to adapt to climate change and at the same time contribute to climate change, guaranteeing food security and guiding EU citizens towards the choice of healthy diets. For this reason, it is necessary to strengthen aquaculture activities, as envisaged by the MSP, in line with EU strategies (eg Sustainable Blue Economy Communication, COM / 2021/240 final), to favor an intersectoral integration of supply chains. 'aquaculture, encouraging efficient connections of offshore production with land supply chains and managing potential conflicts with other uses in space. The assignment of Marine Areas for Aquaculture (AZA) provided for by the MSP represents the key measure for this purpose.

National measures NAZ_MIS | 39, NAZ_MIS | 40, NAZ_MIS | 41, NAZ_MIS | 42 and NAZ_MIS | 43 can be recognized as mitigation measures that pursue the objectives OS_A | 01 - Promote sustainable growth of the aquaculture sector and OS_A | 02 - Promote quality aquaculture and support the process of defining AZAs (Allocated Zones for Aquaculture - priority areas for aquaculture).

Some regional measures also represent mitigation measures, aimed at minimizing the impact on the coastal marine environment, such as measure (A / 1) _MIS | 18 "Support actions for the maintenance and productive diversification of state-owned maritime marine and lagoon areas already allocated to the crops of bivalve molluscs and fish (AZA), in compliance with the environmental, social and economic sustainability provisions of businesses; identification of mooring areas for vessels subservient to the plants, product unloading (PUD and PRGC) and preventive health and quality self-control activities by operators (protocols and certifications)".

In addition, other mitigation measures aimed at minimizing the impact on marine habitats include:

- the reduction of the use of plastics
- the creation of breeding facilities for native species
- the efficiency and adaptation of purifiers

- minimize possible phenomena of "accumulation" of pressure sources, assigning adequate distances between marine sites and identifying the "sanitary compartments"
- sustainable management of wastewater discharge (residues from sanitary treatments, antifouling agents and feed scraps)

As also reported in the Technical Guide for the Assignment of Marine Areas for Aquaculture (AZA), drawn up by ISPRA-SNPA-MIPAAF in 2020, some specific suggestions on the mitigation measures to be adopted for aquaculture systems are proposed in the Guidelines of the European Commission (2018), with reference to:

- systems of fences and cages in the sea: the control and limitation of stocking density and the improvement of feed digestibility can reduce the possible impacts caused by organic waste.
- shellfish farming systems: the appropriate location in areas with good water exchange and predictive models that allow you to estimate the impacts on benthic communities.
- systems in ground tanks: the mitigation measures are related to the wastewater that can be filtered through a circuit of lagoon basins to allow the absorption of nutrients through phytodepuration.

According to the Guidelines, by properly implementing EU and national legislation, most of the pressures potential impacts from aquaculture can be prevented or minimized and that aquaculture can also have a beneficial impact on Natura 2000 sites, providing environmental benefits and services and maintaining habitats for species of community interest, for example for waterfowl.

The 2020 Technical Guide contributes to determining "the criteria relating to the containment of the impact on the environment deriving from aquaculture and pisciculture activities", pending the drafting of the MITE decree relating to the impacts deriving from aquaculture activities.

6.1.3 Measures to mitigate the effects on the marine environment related to fishing

According to the Ispra Yearbook of environmental data of 2021, the Adriatic Sea in 2019 had 87.5% of stocks in overexploitation. The main environmental criticalities arising from anthropogenic uses and related pressures are related to excessive fishing pressure, determined by the consistency of the activity and in particular by the fishing effort and catches per unit of effort. In the context of the blue economy, Italy participates in the effort to contain the impact of fishing on fisheries resources and marine ecosystems pursued by the EU by acting on the reduction of the number of fishing vessels and fishing effort.

The Italian regions of the Adriatic retain ancient and relevant fishing traditions, therefore the vision of the Plan aims at sustainable management and development for fishing, favoring the implementation in the marine space of the forecasts of the multi-year Management Plans of the Sub-Geographical Areas (GSA 17 and 18), which represent the main management tools of the activity and ensure compliance with the rules of the Common Fisheries Policy (CFP). In this sense, the Plan contributes to strengthening the competitiveness and profitability of companies in the sector, the improvement of safety and working conditions and the appropriate support for technological development and innovation policies towards long-term sustainable fishing. Although the environmental compatibility index of the intended use is, together with aquaculture, among the lowest, there are numerous mitigation measures envisaged. In particular, the Plan recognizes and enhances the social, economic and cultural importance of artisanal fishing, practiced with sustainable techniques, defining specific measures. In fact, with regard to artisanal fishing, the Plan also aims to encourage income integration activities, facilitating synergy with other sectors (such as tourism, food and wine, quality supply chains for the transformation of fish products, enhancement of fishing traditions in respect of environment and territory).

The Plan identifies national mitigation measures such as: NAZ_MIS | 28, NAZ_MIS | 29, NAZ_MIS | 30, NAZ_MIS | 31, NAZ_MIS | 32, NAZ_MIS | 33, NAZ_MIS | 34, NAZ_MIS | 35, NAZ_MIS | 36, NAZ_MIS | 37 , NAZ_MIS | 38, which aim to promote the sustainable development of the fish supply chains (OS_P | 01), to favor the implementation of the forecasts of the European and National Management Plans in the Sub-Geographic Areas (GSA) (OS_P | 02), to promote, develop and manage small-scale coastal fishing practiced with sustainable techniques (OS_P | 03), to encourage the creation of areas aimed at the reconstitution and protection of fish stocks and protection of Essential Fish Habitats (EFH) (OS_P | 04), to foster cooperation between States in order to reach concerted measures for the sustainable management of the activities of the respective national fisheries sectors (OS_P | 05) and to control and combat illegal fishing (OS_P | 06), in line with the DNSH principle. Some regional measures also represent mitigation measures, aimed at minimizing the impact on the coastal marine environment, such as the MSP measures relating to SUB-AREAS (A / 1) _MIS | 16, A / 1) _MIS | 17, (A / 1) _MIS | 19, (A / 2) _MIS | 5, (A / 2) _MIS | 6, (A / 2) _MIS | 7, (A / 3) _MIS | 5, which, in line with the DSNH principle, aiming at: promoting the sustainable management of small-scale fishing, through the regulated management of fishing areas (A / 1) (A / 2) (A / 3) OSP_P | 01; promote the sustainable management of fishing, through specific local regulation of the use of gear, other than those of artisanal fishing, within the national management plans for target species (small pelagics, demersal and bivalve molluscs) (A / 1) (A / 2) OSP_P | 02; encourage the adaptation of structures and processes that allow the development of economic activities of fishing and aquaculture, including complementary activities, such as fishing tourism and fish tourism (A / 2) OSP_P | 03.

The Plan provides for the promotion of agreements between small-scale fishing operators and entities / bodies responsible for the management of marine protected areas, coastal and marine sites of the Natura 2000 Network, national or regional parks, in order to promote the sustainable development of the sector in recognition of the quality, including environmental quality, of the products and services offered by artisanal fishing. Of great importance are the measures that will support the establishment of new areas for the protection of stocks and areas for various fishing activities, taking into consideration, above all, the conservation areas that already exist and / or are in the process of being established.

The efficient inclusion in the Plan of protected areas, reserves and areas for the reconstitution and protection of fish stocks (eg ZTB) aims in fact to support the reduction of the impacts of fishing on juveniles and spawners, thus guaranteeing, long-term sustainability for the sector. Complementary economic activities will also be enhanced (in particular with regard to artisanal fishing), such as fishing tourism and fish tourism, promoting the traditions of fishing, maritime culture and respect for the environment.

The development and innovation of the sector will aim at sustainable fishing from an ecological, economic and social point of view, while favoring synergies with other sectors (e.g. tourism and food and wine, food sector, local distribution chains, processing industry) in order to increase the added value of the caught product. The most important mitigation measures also include the control and fight against illegal fishing, also through the monitoring and surveillance of the activities carried out by fleets in coastal areas, in the territorial sea and in international waters. In this sense, considering that illegal fishing is one of the activities that clearly endanger the marine ecosystem and fish resources, it is deemed necessary to combat this practice through the integration of spatially explicit management measures.

Other mitigation measures concern recreational fishing in Marine Protected Areas (MPAs).

The following actions aim to mitigate as much as possible the harmful effects of recreational fishing on species and habitats, to reduce conflicts with other sectors, and to increase the economic benefits of the sites, and are aimed above all at the managing bodies of the MPAs. They are:

- the elimination of illegal activities, still too widespread in the MPAs, through the allocation of greater economic resources. To this end, it should be noted that the "Madia" Decree has entrusted the responsibility for the control action in the Mediterranean to the Guardia di Finanza. In June, the first green-propelled, zero-emission patrol vessel entered service, with undoubted benefits related to the reduced environmental impact, including the absence of exhaust fumes and noise emissions. It is a real ship of over 60 meters in length that will operate throughout the Mediterranean for the fulfillment of institutional tasks, and for the protection of ecosystems., With undoubted benefits related to the reduced environmental impact, including the absence of exhaust fumes and noise emissions.
- Regular surveillance by MPA Managers and adjacent areas is the most effective way to enforce laws and prevent illegal fishing. It would be useful to involve recreational fishermen and other stakeholders such as divers and, above all, artisanal fishermen in the management. MPA managers have taken several measures to counter excessive fishing effort, such as night fishing bans, limitation of catches (e.g. number of individuals or weight, number of fishing rods per fisherman or boat, longer diving times short), minimum landing size (other than that of fish caught outside the MPA), prohibition on using certain tools that damage vulnerable species (such as spears, lures and electric reels), and prohibition of organizing competitions.

- essential controls for the identification and quantification of recreational fishermen and the negative effects they exert. Regular evaluation of these factors is essential to understand not only their impacts on marine communities but also the economic and social benefits they bring. Such data can enable the bearing capacity of sites to be determined in order to develop science-based measures to ensure sustainable exploitation of the sea by recreational fishermen.
- environmental awareness campaigns aimed at interested fishermen, especially recreational fishermen associations but also specialized shops and public administrations. One way to encourage the involvement of recreational fishermen is to draw up statutes or codes of good practice in a participatory way and distribute them, perhaps having them signed as "moral" commitments.
- careful management, regulation and control of anthropogenic activities, activities that must be carried out in a sustainable way in order to avoid environmental losses and damage to marine ecosystems.
- develop national licensing systems to accurately determine, among other factors, the number of practitioners. Such systems should include documentation of catches, which is essential to make estimates of fish stocks and catches for this sector more accurate than for the commercial sector.
- monitor the ecological, social and economic impacts of recreational fishing. It would be useful to evaluate the effectiveness of a paid licensing system as a tool for participating in sustainable management. Its proceeds could contribute re to reduce the environmental impacts of recreational fishing by financing management costs and, most importantly, control measures.
- Introduction of control measures at national level and MPAs, especially in the case of excessive fishing effort, with the limitation of catches or the prohibition of the use of certain methods that have a negative impact on vulnerable species such as groupers (*Epinephelus spp*. and *Mycteroperca rubra*) and corvina (*Sciaena umbra*).

6.1.4 Measures to mitigate the effects on the marine environment related to coastal defense

Most of the Adriatic coasts, especially those of the northern and central portion of the area, are particularly vulnerable to storm surges and related flooding phenomena, as well as being subject to erosion. This vulnerability is bound to increase due to the expected effects of climate change and sea level rise.

The environmental compatibility index of the intended use is among the lowest due to the not inconsiderable impacts such as the construction of rigid defense systems with consequent changes and loss of habitat, nourishment with the consequent alteration of the funds on which the populations are located, by-pass systems with an increase in resuspension and therefore in the turbidity of the water in the vicinity of the intervention area. The MSP of the Adriatic Area intends to promote an integrated approach to the management of the coastal strip, which includes the defense of the coasts in the broader objective of increasing the resilience and progressive adaptation of these systems to climate change. To this end, the Plan promotes the updating, further development and integration of existing strategic and planning tools, such as the Flood Risk Management Plans pursuant to the Floods Directive (2007/60 / EC) and the Coastal Plans or Plans ICZM prepared by numerous regions. The Plan for the Maritime Space also underlines the need to proceed with the development of regional adaptation plans, which contribute precisely to overcoming the purely defensive logic.

Coastal defense, and more generally, increasing the resilience of the Adriatic coasts is an essential prerequisite for the protection in the medium and long term of some of the economic activities that characterize this area, primarily tourism and port. It is also important that coastal defense measures are implemented in compliance with the protection of environmental and landscape emergencies of the Adriatic coasts.

Among the naturalistic and engineering mitigation measures are the maintenance and restoration of the beach system and the protection and recovery of dune systems.

In fact, some (national) measures of the MSP (NAZ_MIS | 61, NAZ_MIS | 62, NAZ_MIS | 63, NAZ_MIS | 64, NAZ_MIS | 65) are fundamental to support the evaluation processes for coastal defense works, in line with the DNSH principle, aimed at favoring the development, harmonization and implementation of strategies and measures for the defense of the coast and the fight against erosion (OS_DC | 01), to ensure the best coherence between the uses and the vocations of use of the sea envisaged in the PSM Plans and coastal uses (OS_DC | 02) and to consider and adequately address the issue of the use and protection of submarine sands for nourishment, to be considered as a strategic resource for coastal defense and adaptation plans (OS_DC | 03).

Some regional measures also represent mitigation measures, aimed at minimizing the impact on biodiversity and ecosystems. Some of the MSP measures relating to the SUB-AREAS of the Adriatic maritime area (A / 2) _MIS | 10, (A / 3) _MIS | 1, (A / 3) _MIS | 2, aim to contribute to the restoration biodiversity and ecosystems in line with current national and international regulations.

These measures, in line with the DSNH principle, contribute to: (i) update the document "Integrated Management of the Coastal Zone - Study and monitoring for the definition of interventions to protect the coasts from erosion in the Veneto Region - Guidelines" approved with DGR 898 of 14 June 2016; (ii) Identify a chapter of expenditure for the financing of coastal defense interventions and inclusion in the three-year program of the LL.PP. of interventions for the recomposition of coastal dune systems associated with maintenance / structural nourishment with naturalistic engineering techniques (A / 2) OSP_DC | 01.

They also contribute to the establishment of a working group aimed at regulating the uses of 'Coastal defense' and 'Aquaculture / Fishing' in some coastal stretches where there is a need for the withdrawal or spillage of sediments for coastal defense and protection of nursery areas (A / 3) OSP_T | 01 and to improve the knowledge of the offshore sand deposits which, for the Emilia-Romagna Region, represent the main source of external sand supply to the system and to enhance the data management tools (regional geoDB in_SAnd) in compliance as foreseen by action C1.4 of the GIDAC regional strategy (Integrated management for the defense and adaptation of the coast to climate change) (A / 3) OSP_DC | 01).

6.1.5 Measures to mitigate the effects on the marine environment related to coastal tourism

Another important factor for the maritime economy of the coastal system is tourism, which requires sustainable management and strategic development of landscape and environmental resources capable of guaranteeing long-term environmental, economic and social sustainability.

Although the environmental compatibility index of the intended use is among the lowest, coastal tourism, together with the supply chains connected to it, represents a current and future reference economic sector for the Adriatic region and for this reason the Plan pursues, in line with the Strategic Tourism Plan 2017 - 2022, the implementation of actions to: promote sustainable tourism development by creating the conditions to ensure the necessary space for natural marine dynamics and the growth of other anthropogenic uses, without compromising the conservation of resources natural areas on which tourism depends (water, nature, landscape); promote the conservation and protection of coastal and marine ecosystems, pursuing the balance between the maintenance and conservation of natural environments and the development of anthropogenic activities; favor the protection and enhancement of the landscape and cultural heritage, as fundamental assets for the development of tourism itself.

With a view to a long-term sustainability of tourist use, it is necessary to diversify and deseasonalize the tourist offer (also through offers for experiential tourism), the integration of marine use with that of the hinterland, the activation of synergies with other maritime activities typical of the Adriatic coast (such as fishing and aquaculture), the development of synergies with the needs of environmental protection and cultural heritage (eg ecotourism). Among the other impacting effects of coastal tourism is the removal of *Posidonia oceanica* leaves. The stranding of *Posidonia oceanica* leaves is a natural phenomenon, which is observed annually along the coasts of the Mediterranean Sea. The use of the beaches for tourist purposes involves the removal of these deposits which are considered a negative externality by beach operators and bathers.

This phenomenon, increasing, can have a different intensity in relation to the distance from the mouths of the rivers, the regime of tides and currents and the extension of the *Posidonia* meadows present near the coasts or the coastal unit. reference (physiographic unit), with consequences that can compromise the vitality of marine-coastal habitats. About 83% of municipalities, every year, remove posidonia deposits from beaches with heavy machinery such as excavators which are the number one choice in 40% of cases (Med POSBEMED - 2017).

In order to avoid the modification of the beach system with consequent retreat of the shore line, and the use of heavy vehicles (mechanical shovels and excavators) for the removal of the banquette, a factor that negatively affects the nesting and therefore the reproductive success of the species *Caretta caretta*, the only technologies capable of reducing significant incidences are:

- the seasonal displacement of biomass, ie the removal before the bathing season;

- their reuse along the coastal strip;
- repositioning on the beach at the end of the tourist season.

Even the activities of removing bulky waste and leveling the beaches with the use of heavy equipment (mechanical shovels and excavators) by the beach operators have significant impacts on marine species and habitats. The use of beach or hand cleaning machines, which are used only in limited cases, could help reduce these impacts. The measures specifically aimed at preventing or reducing the incidences of heavy vehicles are:

- - Bulky waste removal with the tractor combined with the skip or a trailer. All bulky materials, selected by type, must be brought to the collection points that the municipalities usually arrange. Weeds or algae removal: depending on the case, this is done by using the tractor combined with the rake with 10-12 cm teeth. The collected material is loaded onto the tractor trailer or with the front loader of the tractor itself (if equipped) or with a mechanical shovel, or, if necessary, with a spider-fork type grapple.
- Leveling the beach with the tractor and the rake and / or the leveling blade. The intervention must serve to move the sand in depth (40/50 cm), bringing out any waste that is still submerged.

Of particular importance in the Adriatic area is the development of recreational boating, which in recent decades has seen significant development throughout the Mediterranean. In order to provide an effective basis for the management of problems related to recreational boating, environmental monitoring programs should be adopted to understand its ecological and socio-economic impacts and a national spatial strategy for recreational boating in coastal areas should be defined. Among the mitigation measures to be implemented with respect to the harmful effects due to anchoring there are:

- introduction of voluntary buffer zones, adopting zoning plans that highlight sensitive areas and those suitable for anchoring and marking the boundaries of MPAs and areas sensitive to damage from anchors on nautical charts. Space rules should also be introduced, such as a ban on ships carrying dangerous goods from crossing important marine areas, in order to prevent serious accidents, or the obligation to adopt technical solutions to prevent collisions with cetaceans (e.g. positioning systems in real time), in full compliance with the Convention for the Control and Management of Ballast Water and Ships Deposits (BWM), which for example provides for inspections and control activities.
- cross-border actions for the control of navigation and safety in order to avoid or reduce environmental impacts as much as possible. Such actions could include coordinated governance systems (joint action plans) and innovative surveillance methods (e.g. new high frequency radar antennas, data sharing and interoperability). Participation in coordinated cross-border emergency response plans on a basin and local scale is also essential to manage emergencies related to the release of hydrocarbons and other pollutants into the sea.

Important for the tourism and port development of the regions, the cruise sector is confirmed, which counts on reference ports with a widespread and growing demand in all ports. Measures specifically aimed at preventing or reducing the incidences of cruising on the marine environment should establish minimum distances from the MPA boundaries for navigation, mooring and parking of cruise ships by establishing strict limits and buffer zones. This would mitigate the harmful effects and stimulate the interest of this industry to visit these areas. In addition, continuous monitoring of sector activities should be promoted in close cooperation with MPA managers and participating public authorities (e.g. regarding recording of operational data, emissions and discharges, type of fuel). The authorization to navigate in highly sensitive natural areas must be a reasoned process where the direct involvement of MPA managers helps to limit the risks (eg. Of stranding and collisions). Maritime authorities should impose speed limits to reduce the risk of collisions, a measure that would also mitigate noise pollution and emissions into the atmosphere.

Basin-scale regulations are needed to promote greater controls on atmospheric emissions by cruise ships (eg Sulfur Emission Control Area SECA), to limit the impacts on ecosystems both in MPAs and at the level of the ecoregions and seas of the basin.

The Barcelona Convention should be used as a guide to implement, even in larger areas, measures that can prevent or minimize the harmful effects of cruise ships on MPAs in larger areas, stimulating cooperation on a basin scale and should be approved, adopted and urgently implemented a specific plan on a basin scale within the framework of the Barcelona Convention, to improve the regulation of cruising in relation to the protection of the sea. The national mitigation measures of the MSP (NAZ_MIS | 66, NAZ_MIS | 67, NAZ_MIS | 68, NAZ_MIS | 69, NAZ_MIS | 70) have the objective of substantially contributing to the protection and restoration of biodiversity and ecosystems. These measures, in line with the DSNH principle, aim to promote sustainable forms of coastal and maritime tourism (OS_T | 01), to favor coherent planning actions on land and at sea, including for tourism purposes (OS_T | 02) and to contribute to diversification of tourism products and services and contrasting the seasonal demand for inland, coastal and maritime tourism (OS_T | 03).

Some regional measures also represent mitigation measures, aimed at minimizing the impact on biodiversity and ecosystems. Some of the regional measures of the MSP relating to the Adriatic maritime SUB-AREA A / 1_MIS | 20, A / 1_MIS | 21, A / 1_MIS | 22, have the objective of contributing to the protection and restoration of biodiversity and ecosystems in line with current national and international regulations.

These measures, in line with the DSNH principle, aim at the characterization of the marine sedimentary deposits belonging to the regional territory and at the creation of "functional beaches" for the purposes of the safety of coastal territories and the conservation of the specific features of the coast and the implementation of measures on coastal defense in the local area in order to address the Integrated Coastal Belt Management (ICZM) for the regional territory in an integrated and coordinated way, providing for an adaptive management which is an iterative process in which management actions are carefully planned, applied and check at set intervals. A solution guided by natural tendencies should be preferred, as a fundamental guideline for correct human use, favoring responsible and sustainable development and limiting the possible impacts of definitive choices (A / 1) OSP_T | 01. Take advantage of technological innovations to direct tourist flows deriving from yachting to expand the offer, improve customer satisfaction and create new opportunities for discovery by linking coastal tourism to the hinterland (A / 1) OSP_T | 02).

FOCUS: ECOLOGICAL RESTORATION

Despite current efforts to preserve coastal ecosystems, recent research conducted on a global scale shows that the rate of habitat loss and biodiversity is high (Butchart et al., 2010; Cardinale et al., 2012).

Their recovery is a priority in the context of ecological restoration (Paling et al., 2009; Duarte et al., 2020), which today appears to be an effective strategy to integrate the conservation and management of the current actions undertaken for these ecosystems (Perring et al., 2015). Basic knowledge, synergistic interventions together with mitigation and conservation, and the involvement of all possible stakeholders, including socio-economic and political ones, are fundamental for the success of ecological restoration in the marine environment. To this end, the experience of the EU H2020 MERCES (Marine Ecosystem Restoration in Changing European Seas, 2016-2020) project is mentioned, which explored the potential of restoration interventions in different coastal ecosystems (both on soft and hard bottoms) and profound on a pan-European scale. This made it possible to use the ecosystem approach (in accordance with the Marine Strategy Framework Directive) to provide tangible answers to the issues of the Green Deal for the climate (mitigation, adaptation and reduction of the risk of environmental disasters) , biodiversity, health and well-being, including socioeconomic. Up to now, ecosystem restoration has been carried out through pilot actions on fragile habitats vulnerable to global climate change, such as seagrass meadows, macroalgae and coralligenous forests.

Studies have also been launched on deep-sea corals, habitats in canyons, seamounts and fjords damaged by trawling activities (Report CN 2021).

By way of example, some of the techniques used so far for the habitat of Posidonia meadows are shown:

- The transplantation technique used which involves the transfer of Posidonia oceanica clods of 4 m2 of surface, removed from the seabed with a hydraulic bucket with the removal of clods without fragmentation and their subsequent positioning (eg Civitavecchia-Lazio);
- The anchoring technique on a sandy bottom of the Posidonia cuttings to the substrate with the use of reinforced concrete frames with galvanized iron mesh. The structures are positioned in underwater immersion by inserting the rhizomes in the meshes of the polygonal network, so that the rhizome itself or the roots are in contact with the sediment (eg Island of Ischia-Campania).
- The ex-situ seeding-culture technique in controlled mesocosms until reaching the optimal size for adhesion on ad-hoc produced supports (usually two months) and subsequent transfer to the sea, in selected sites, for

the intervention of restoration. The anchoring of the seedlings to the supports is obtained by exploiting the natural adhesive properties of the roots on rocky substrates, a characteristic documented in several recent scientific studies (eg Bagnoli-Campania)

- The technique of using a duct with a radial device prepared out of the water, made of biodegradable plastic, anchored to the bottom using a quick-fixing stake. The cuttings taken for transplantation are inserted with the help of divers into the tweezers of the arms, characterized by a profile suitable for the plant species to be transplanted and by appropriately shaped tear-proof straps (eg Augusta-Sicily)

Despite the success in some areas of transplantation, in others the engraftment was nil due to the total loss of the transplant modules. The success of a transplant therefore seems to be linked:

- the evaluation of the feasibility of a proposed transplantation activity;
- to the relative control during the phases of realization of the transplant itself;
- the selection of the most appropriate technique with respect to the local environmental conditions;
- the choice of the transplant site.

FOCUS: CHOKING CAUSED BY PLASTICS

A problematic aspect, which is raising growing concern in several areas of the Mediterranean, is the phenomenon of suffocation due to marine litter (plastic) which occurs very often in sea turtles and marine mammals. These areas play a key ecological role of passage between the main Mediterranean sub-basins and are at high risk for marine litter. (Source Ispra 2021). Plastic objects were found to make up over 80% of marine litter, of these in particular plastic bags and sheets are among the objects most attributed to the risk of ingestion or entanglement for animals, causing obstruction of the digestive tract or preventing their movements . Considering the importance of the area for the fishing industry, it is not surprising the high concentration of polystyrene buoys and boxes, with a seasonal presence of FAD (Fishing Aggregating Devices).

The main measures proposed to avoid and / or reduce significant impacts are:

- the characterization of waste through which additional useful elements are provided for the identification of effective measures;
- the identification of the areas / seasons most at risk for marine species, which provide additional elements to identify effective measures for the mitigation of impacts;
- the conservation of species.

These actions do not intervene on the production and abandonment of plastics, but contribute directly to reducing waste at sea and indirectly and partially to safeguard biodiversity and monitor the ecological, social and economic impacts of recreational fishing. It would be useful to evaluate the effectiveness of a paid licensing system as a tool for participating in sustainable management.

Its proceeds could help reduce the environmental impacts of recreational fishing by financing management costs and, most importantly, control measures.

6.1.6 Measures to mitigate the effects on the marine environment related to Energy use

A careful choice of the site where to build a plant for the production of energy from renewable sources, and in particular a wind farm, is the most effective way to avoid potential conflicts with Natura 2000 sites and with species and habitats protected by the EU. Other mitigation measures aimed at minimizing the impact on marine habitats include choosing the least disturbing methods for carrying out activities such as cable laying and seabed preparation. For example, discharging dredged material near the seabed through a pipeline allows the material to be placed more accurately within the disposal area and may result in lower levels of suspended solids than if the material was discharged near the surface.

The choice of sediment disposal areas can also i) take into account the proximity of sensitive areas where typical seabed habitats are present and ii) ensure that the material returns to contribute to the sediment transport routes with an adequate territorial flow regarding items such as sandbanks. Good practices for the prevention of water pollution and the control of invasive alien species are widely available in the Member States and internationally (for example in the International Convention for the Prevention of Pollution from Ships -

MARPOL 73/78). These aspects will therefore not be further analyzed. As regards measures specifically aimed at preventing or reducing the impact of offshore installations on fish species, only limited experience is available. In the case of wind farms, seasonal restrictions on pile driving have been taken into consideration in some cases in order to avoid potential effects on salmonids during their migration. This measure was adopted as a precaution, given the uncertainty regarding the probable extent of any disturbance effects. There are further examples of seasonal post-driving restrictions adopted to protect fish species during the spawning season. These restrictions mainly concerned species of commercial interest, such as herring, which are also of food importance for other EU protected species, as they are for example prey to marine mammals.

Mitigation measures aimed at reducing the underwater noise level for the benefit of marine mammals are also believed to be effective for fish. Concerns related to the effects of electromagnetic fields are generally addressed by burying cables at depths of one meter or more.

The reduction of electromagnetic fields is mostly achieved by burying or covering the cables with protective materials such as rock armor, since the strongest fields occur on the surface of the cables. The mitigation and mitigation measures of the potential impacts of offshore plants on birds, in addition to the careful choice of the site where the plant and the related infrastructures are to be built (macro-siting) which obviously represents the most obvious mitigation measure to avoid any negative impacts on birds (and on flora and fauna in general), the measures that have been proposed or implemented for this specific purpose can be reported below. However, it should be noted that, in some cases, these are measures on which there is still some uncertainty as to their real effectiveness. The main measures aimed at avoiding and / or reducing the significant effects on birds, after a careful choice of the place where to build the wind farm, can be summarized below. Infrastructure design, eg. in terms of the number of turbines and technical specifications, including lighting, it can help reduce the risk of collision, but it can also influence the barrier effect and the displacement effect.

Using basic data collected through field surveys or data obtained through operational monitoring with predictive modeling techniques (e.g. collision risk models), it is possible to examine the influence of turbine design and number: this can help formulate an optimal design with low environmental risk. Also, increasing the height of the rotor hub and using fewer but larger turbines are effective measures to reduce the risk of collision. Among the various possible measures, among those presumably most suitable for reducing the risk of bird collision, are the "deterrent towers": these are towers placed along the perimeter of a wind farm to discourage birds from entering it. It was however noted that the construction of such towers would be probably effective only in areas with high concentrations of alkyds and gavids.

Regarding the attraction of birds to lighting, the evidence emerging from the literature suggests that the most effective mitigation measures are i) switching from fixed red lights (conceived as a signaling tool for aircraft or boats) to lights. intermittent or ii) use fixed blue / green warning lights. However, the possibility of implementing these measures must be verified with reference to national and regional regulations. The planning of activities to avoid, reduce or stagger them during ecologically sensitive periods is aimed at avoiding or reducing the disturbance and movement of birds during critical periods. Programming can be useful mainly during construction, repowering and decommissioning, rather than during plant operation.

Programming involves the suspension or reduction of activities during ecologically sensitive periods. Another possible planning is to stagger the activities so that they can continue, but only in less sensitive places. For this purpose it is possible to use i) existing ecological knowledge about the species presumably present at the wind farm, ii) basic data collected through field surveys or iii) data obtained through operational monitoring.

Compared to onshore wind farms, this measure is likely to be applied to a lesser extent to offshore wind farms. There are no known examples of offshore wind farms to which this measure has been applied. In offshore installations, the possibility of implementing planning to avoid incidents is very limited, largely due to the size of the infrastructure and the likely timing of construction. Increasing the capacity of construction vessels also implies that weather conditions are generally the only constraint for construction at sea. The limitation of the operating times of the turbines, eg. through their temporary shutdown, it can also be effective in preventing or reducing the risk of bird collision, especially during mass migrations (and in particular in the event of adverse weather conditions and poor visibility) and orienting the rotor rotation plane in so that it does not hinder migration. The implementation of these measures requires good predictive models of migration and surveys on the intensity of migration in the immediate surroundings of wind farms.

Finally, another measure to prevent or reduce the risk of bird collision is the installation of acoustic and visual bollards on the systems. The use of bollards generally involves the installation of devices that emit acoustic or visual stimuli in a constant or intermittent manner, or when activated by a bird detection system. It is also possible to apply passive bollards, such as paints, to towers or turbine blades. However, evidence of the efficacy of such techniques remains limited, and it is likely that it strongly depends on the place of use and the species. The possible mitigation measures that have been proposed or implemented in relation to offshore wind farms and marine mammals are summarized below:

- exclusion of specific areas (macro-siting);
- exclusion of sensitive periods such as the breeding season (programming);
- measures related to the type of turbine foundations (low noise foundations);
- noise limitation measures aimed at mitigating the underwater noise levels emitted during the construction phase;
- monitoring (visual and acoustic) of the presence of marine mammals in the exclusion areas;
- measures to actively dissuade animals from entering these areas.

A careful choice of the site (macro-siting), considering the possibility of excluding an area if the presence of essential habitats for marine mammals is recognized, allows to avoid significant effects on them. Planning to avoid or suspend construction activities (related to driving poles and detonating unexploded ordnance) during sensitive periods of species life cycles (e.g. breeding and lactating seasons) is considered a measure extremely effective as it can prevent disturbance of species due to noise and other incidences during such periods. Programming is an adequate measure in some European marine areas, including in particular in the Mediterranean, as some of the marine mammals that inhabit it, such as the fin whale (Balaenoptera physalus), are notoriously sensitive to human disturbances, but show marked patterns of distributional. There are also infrastructure design measures that aim to avoid noise impairments and to reduce the effects of perturbation and displacement due to the high levels of underwater noise deriving from the driving of the piles of single or lattice foundations. In fact, there are alternative foundations that do not cause equally high levels of noise and that have been used in many projects: these are, for example, wind farms that use gravity foundations or pneumatic foundations, which have been used for several decades in other offshore industrial sectors. .

More recent, alternatively, is the technique of floating foundations, which has been tested in the wind energy sector in plants for example off the coasts of Scotland (Kincardine and Hywind), France (Floatgen) and Portugal (Windfloat Atlantic). This technology offers the possibility to build wind farms in deeper waters and to significantly reduce underwater noise emissions during the construction phase. The laying of gravity foundations, pneumatic foundations or floating foundations is not exempt from the emission of underwater noise, as it may be necessary to prepare the seabed by dredging; the noise of the boats is inevitable.

However, these techniques do not involve the emission of impulsive noises (unless it is necessary to clear the area of unexploded ordnance), and the noise levels associated with such alternative foundations are believed to be relatively very low. There is no doubt, in any case, that the noise reduction achieved through the use of non-fixed foundations is advantageous for marine mammals. However, in projects using non-fixed foundations, it is necessary to take into account some practical and commercial aspects and to consider the unintended consequences of the decision to use these foundations. Gravity foundations, for example, have a larger footprint than any fixed foundation and can therefore have potentially greater impacts on benthic habitats, due to both habitat loss and hydrodynamic changes. These effects must be carefully evaluated, where appropriate, in the context of appropriate assessments.

Additional noise attenuation systems that can be applied to reduce the disturbance and movement of animals and avoid causing them acoustic impairments consists, for example, of "soft start". The smooth start-up of the pile driving aims to reduce the underwater noise levels emitted during the construction phase.

Generally, it results in a gradual increase in the typing energy and a hit rate of more than 20 minutes. Soft starting is generally included among the "common sense" measures (the underlying reason is to allow sufficient time for the animals to move away from the immediate vicinity and avoid harmful noise levels), although no studies have systematically confirmed the efficacy. of this method.

Soft starting is also required from an engineering point of view, at least during initial operations, until the poles stabilize and higher energy levels are required to penetrate the ground. It is of fundamental importance that all mitigation measures adopted prove effective and are not in themselves harmful or problematic in any way: although soft start-up and gradual increase in post driving activity can reduce the risk of injury of the auditory system, it is possible that they can increase the magnitude of the effects of perturbation and displacement.

This could happen if the process involved an increase in the overall duration of the pile driving operations and the cumulative energy required. However, this risk could be limited by imposing time limits (such as in Germany) and by using acoustic bollards. Two examples of noise attenuation systems are air bubble curtains and hydraulic post drivers. To generate a curtain of air bubbles, a pipe equipped with nozzles must be laid on the seabed surrounding the pole, at a distance of more than 50 m. With the help of a compressor, air is pumped through the hose and released through the nozzles. This generates a continuous curtain of air bubbles around the insertion site, reducing noise as a result of the dispersion and absorption effects of sound. The hydraulic pile drivers have an insulating coating consisting of two acoustically separated walls by an air-filled cavity. Other noise attenuation measures can be considered as follows:

- Hydro Sound Damper (HSD): fishing nets attached to small filled balloons iuma which are tuned on resonant frequencies.
- Cofferdam: rigid steel tube that surrounds the pole. Once the pole is inserted into the cofferdam, the water is pumped out.
- IHC / NMS: double layer screen filled with air. Between the pole and the screen is a multi-level, multi-dimensional bubble injection system.
- Noise reduction tunable resonator system, inspired by Helmholtz resonators, using a simple foldable structure containing several acoustic resonators with two fluids (air and water).

A further measure to reduce the effects of perturbation and displacement and prevent hearing impairments from marine mammals is the demarcation and surveillance of exclusion zones. Surveillance is a frequently implemented measure and consists of instructing marine mammal observers to visually, and often acoustically, monitor an area surrounding a noise source for at least 30 minutes. This is intended to ensure, as far as possible, that there are no marine mammals (and possibly other protected species such as sea turtles) before starting operations of driving poles, detonating unexploded ordnance, etc.

The area in question can be identified by defining a fixed distance from the source (for example 500 m) or on the basis of forecasts of the received sound levels. In areas where the depth of the waters in the exclusion zone exceeds 200 m, the observation time should be at least 120 minutes to increase the likelihood of detecting species diving to great depths. The exclusion zone is intended to reduce noise exposure in the vicinity of the source and to protect animals from direct physical harm. The measure is unlikely to be effective in attenuating behavioral responses over long distances, as disturbances are likely to occur in remote areas anyway.

It is important to note that the effectiveness of the measure may be limited by adverse weather conditions and darkness (factors limiting visual observation), by factors such as limited propagation of the vocalizations of some species and the general absence of vocalizations in the species. pinnipeds relevant to many offshore wind farms. Finally, we recall the deterrent measures that can reduce the effects of perturbation and displacement and avoid hearing impairments. Fish farmers have long used devices designed to scare off certain marine species and remove them from farms. However, the usefulness of such devices has also been recognized to reduce the risk of injury to marine mammals during the construction of wind farms. In the context of the construction of wind power plants, these devices are generally called "acoustic deterrents" or "acoustic attenuation devices". Such devices emit an unpleasant, but not harmful, underwater noise to the target species, deterring them from approaching further. Bollards can potentially be used to temporarily move animals from areas prone to harmful noise levels due to activities such as driving pile foundations.

The use of an acoustic bollard is therefore useful for protecting marine species from hearing loss due to the noise produced by driving poles. However, a strong reaction to the bollards was observed and there is a concrete fear that it could overcome the reaction to the noise generated by the driving itself when it is carried out with the aid of air bubble curtains. This suggests that there are reasons to re-evaluate the specifications of these acoustic deterrents. Measures should therefore not unnecessarily increase disturbance / displacement effects, and the use of acoustic bollards must be proportionate and duly justified in the light of existing evidence. No information is available on mitigation measures to prevent or reduce significant impacts on plants, algae or invertebrates. Mitigation measures for the habitats described above could also be useful to protect these groups. In light of the limited empirical data available on the presence and behavior of bats at sea, experience with bat mitigation measures in the offshore wind energy sector is much more limited than in the wind energy sector on the mainland.

It is possible that micro-siting and infrastructure design measures are effective for migratory bats at sea, but no evidence is currently available. It is likely to adopt higher insertion speeds and minimize blade rotation below the speed of inclusion would be effective measures in favor of migratory bats at sea (as well as on land). This is hypothesized as the main element that allows us to predict the presence of the Nathusius bat in the sea and on the coasts in the autumn period seem to be the winds with low or moderate speeds.

6.1.7 Measures to mitigate the effects on the landscape related to energy use

The impact on the landscape of offshore energy production plants must be based on the knowledge and reading of the context and the specific landscape characteristics of the places affected by the intervention, in order to identify the elements of value, vulnerability and risk and to evaluate corrected the transformations resulting from the implementation of the intervention. In this sense, to properly assess the visual impact, an analysis of the landscape is required through all its fundamental components:

- natural component;
- anthropic-cultural component: inherent in the social perception of the landscape in the sense of belonging and rootedness, the identifiability and recognizability of places, and which includes all aspects related to the activities produced by man on nature;
- perceptual component, both in its visual component (perception of the landscape depends on multiple factors, such as depth, width of the view, lighting, exposure, position of the observer, etc.) and in its aesthetic component (which includes both the conception of the landscape understood as "panoramic beauty, natural framework", and the interpretation that identifies it as "visible expression, external appearance, sensitive feature of nature").

In the case of wind farms, consisting of structures that develop essentially in height, there is a strong interaction with the landscape, especially in its visual component. To define in detail and measure the degree of interference that the works can cause on the landscape component, it will be necessary to identify, through one of the possible methodological approaches available in the literature, the set of elements that make up the landscape, and the interactions that can be develop between the components (natural, anthropic-cultural and perceptive) and the design works that are intended to be carried out. In general, in any case, the main mitigation measures to effectively prevent the significant effects on the marine landscape and the related visual impacts concern the selection of the planting site and the layout configuration. The choice of the site for an offshore wind farm is probably the most important phase of the project process: in this phase the limits of the area concerned and the relationship with the coast, the main points of view, the receptors and the uses affecting the sea space. Once a site has been identified, and the main settlement criteria have been established (limits, alignments, visual goals), further mitigation is implemented through an accurate design of the layout and the control of the new visual relationships that will go to establish itself with the context.

In a nutshell, the choice of layout must be based on:

- considerations of a landscape nature and respect for the environment;
- considerations related to the rationalization of the use of marine space and interactions with other uses;
- technical and anemological considerations aimed at optimizing energy production.

6.2 Specific regulatory framework and purpose of the Environmental Monitoring Program of the Italian MSP

Art. 9, paragraph 1 letter. c) of Art. 10 of Directive 2001/42 / EC (SEA Directive), imposes the obligation to monitor the significant environmental effects (positive, adverse, direct and indirect) deriving from the implementation of plans and programs implemented in the area, especially in order to promptly identify any unforeseen adverse effects and, if necessary, take appropriate remedial action.

The SEA Directive, however, does not identify specific technical requirements in carrying out this monitoring, making the person responsible for its implementation autonomous to describe, in the phase of publication of the Environmental Report, the methodological approach adopted for the purposes of monitoring the significant environmental effects, in order to identify and adopt, during the implementation of the MSP, any corrective measures deemed appropriate. The national application of EU provisions is guaranteed by Part Two of Legislative Decree 152/2006 and subsequent amendments and ii. in addition to the provisions of art. 10 of the Directive, art. 18 of the Consolidated Environmental Law identifies in the Proceeding Authority the subject responsible for carrying out the monitoring, in collaboration with the Competent Authority and with the possibility of supporting the system of environmental agencies, therefore of the Regions, and the Higher Institute for Protection and Environmental Research.

The Environmental Monitoring Program in the SEA procedure is the final piece of the whole procedure as it is in itself the purpose of ensuring control over the significant impacts on the environment deriving from the implementation of the approved plans and programs and the verification of the achievement the sustainability objectives set, so as to promptly identify unexpected negative impacts and to adopt the appropriate corrective measures. The SEA procedure provides for the preparation and proposal of measures to be adopted in relation to the monitoring referred to in Article 18 of the TUA during the Environmental Report stage and subject to the assessment process in accordance with the provisions of Articles 14, 15, 16 and 17 of the TUA.

A fundamental element of the SEA is that relating to the control of the Plan and therefore to the contents and methods of implementation of the monitoring, which is extremely important as it allows to verify, in the evaluation phase subsequent to the application of the Plan, whether or not minus the expected effects and to what extent. An appropriate monitoring system makes it possible to verify whether, during the implementation phase of a Plan, there are effects on the environment not foreseen in the SEA phase, and therefore through this technological and procedural tool, it is possible to verify the achievement of the sustainability objectives set. .

The Environmental Monitoring Program, in order to guarantee the possibility of intervening in an aware and effective way on the MSP, provides for:

- observe the evolution of the reference environmental context, to highlight any environmental criticalities that may arise or worsen during the implementation period of the MSP and which the Plan must take into account;
- identify and evaluate the environmental effects, positive and negative, of the planned actions to verify, if and how, any environmental impacts contribute to achieving the environmental quality targets defined by the Plan;
- define and adopt the appropriate corrective measures that become necessary in the event of significant environmental effects.
- verify the degree of implementation and effectiveness of the mitigation and control measures in the implementation of individual interventions / actions.
- verify the compliance of the MSP with the environmental protection objectives identified in the Environmental Report;

It should be emphasized that the results of the monitoring must also be considered in the event of any changes to the Plan and in any case always included in the cognitive framework of subsequent planning or programming acts. Therefore, the possible general purposes of the MSP Monitoring Plan can be, by way of example, identifiable in the following targets or actions:

- inform on the evolution of the state of the territory;
- check the state of implementation of the indications of the Plan;
- periodically check the correct sizing with respect to the evolution of needs;
- assess the degree of effectiveness of the Plan objectives;
- provide the elements necessary to activate timely corrective actions in a timely manner;
- provide elements for the initiation of an update process for the Plan;
- define a system of territorial reference indicators representative of the phenomena for the municipality;

- allow broad public participation in the implementation and updating of MSP based on official, objective and verifiable indicators (Open data)

The Environmental Monitoring Program is coordinated and consistent with the monitoring system of the Plan to be referred to for specific common indicators, and therefore the control and evaluation will be implemented using some of the indicators already present at the Plan level supplemented by further sets of indicators specific, in a limited number, however, and updated according to the observations received during the scoping phase from the SCA, and having the purpose of measurement only where deemed necessary in terms of a single Plan, detailing the territorial reference scale in cases in which the information of local level is more representative of changes in the state of the environment, both in terms of context and result.

These indicators, in order to meet the needs of environmental monitoring and its purposes in the context of the implementation of the MSP, can be updated at appropriate temporal and spatial resolutions with resources and information available from national and European information sources. The indicators will therefore be easily communicable for public consultation, as a basis for discussion for the activation of actions and tools for extended participation in the implementation and updating of the MSP.

6.3 Conceptual and temporal framework of the Environmental Monitoring Program of the Italian MSP

This paragraph aims to describe the conceptual and temporal framework in support of the EMP as a proposal for indicators and monitoring methods relating to some of the themes / sectors inherent to the MSP.

The fundamental purpose of the EMP is to allow the monitoring of the effectiveness of the Plan (achievement of the declared qualitative or quantitative objectives) through periodic environmental monitoring of the progress of the Plan actions and its effects (positive and negative) on the environment and the territory. coastal and national marine. As part of the preparation of the Italian Maritime Space Management Plan drawn up by the Scientific Pole, consisting of CNR-ISMAR, CORILA and the IUAV University of Venice, in section 5 a proposal for a Monitoring Program for the Maritime Space Management Plan was developed (MSP), together with the proposal for the Environmental Monitoring Program (EMP), elaborated and published in the Preliminary Environmental Report, subjected to public consultation and integrated by the relative observations received. It is essential to consider the strong geographic (national) and therefore spatial connotation of the MSP and the consequent need to produce and collect data and information, in the European, national and regional context, which can be represented as spatially as possible regardless of their nature.

Therefore, in order to be adequately effective and informative, the EMP must have adequate spatial and temporal connotations, in order to be able to produce timely information, which reflects the real trajectory towards which the measures of the individual plans of the MSP tend. and therefore, the efficiency of the individual Plans themselves. This is guaranteed by the integration of information flows from different sources, considering both those already existing on the national territory in terms of monitoring actions (e.g. PdM MSP, Marine Strategy, etc.), and by promoting and setting new specific environmental monitoring strategies where they are not present or inadequate for the control of certain environmental conditions or criticalities.

This last aspect is inserted where the objectives of the Plan are not expressed in the formula of an environmental goal to be achieved (declared in quantitative or qualitative terms) and therefore the usefulness of the EMP is also to identify appropriate indicators that can make the trend manifest. (trend) of the phenomena related to the objective in question to understand if the evolution of the situation is positive or negative.

The EMP is therefore a tool that aims to track the efficiency of the implementation of the MSP in space and time and to suggest improvement measures in the event that these are deemed necessary through medium-term reviews. The approach adopted follows the breakdown by themes / sectors of Chapter 5 relating to Phase 3 - Vision and strategic objectives and refers to the strategic objectives identified in this phase, as well as to the specific objectives at the level of sub-areas identified in Phase 4 - Strategic level planning. The approach proposed through this tool is of an integrated type, since the implementation of the Plans can be monitored only when the data and information collected and relating to the various themes / sectors are integrated according to geomatic methods in a GIS environment to obtain a complete information framework. and linked to the individual sectors that must act temporally and simultaneously with their level of development.

For each theme / sector, a set of selected indicators is proposed here, and connected with the Strategic Environmental Assessment (SEA) process capable of monitoring the implementation of thematic / sectoral plan measures according to the objectives set. This set of indicators has the added purpose of guaranteeing that each objective, regardless of its degree of specificity, is as quantifiable and measurable as possible, as well as the approach or departure from its achievement, in fact the national guidelines for Art. 24, define that "For each Plan, a monitoring and control system must be provided, as well as measurement of results, to be implemented through specific procedures and indicators provided for in the drafting phase of the Plan". While it is true that a separate monitoring system must be provided for each Plan, the tool presented here is proposed for all national MIPs as, by its nature, it is a tool applied in different thematic and spatial contexts (Areas, Sub-areas, UP) according to their peculiarities, while allowing the construction of a homogeneous monitoring framework of the MSP on a national scale

Therefore, the same monitoring indicators proposed are arranged for all three Plani according to needs, making the EMP a flexible tool, capable of adapting to the different sectoral areas and to the different spatial and temporal scales of detail on which the Plans operate.

For this reason, a conceptual framework has been established (Figure 6.1), which directs and guided, through the development of six main STEPS, the process necessary in order to establish the integrated EMP for the PSM, subsequently detailed in the following paragraphs 6.2.1 to 6.2.7.

Figure 6.1 Conceptual framework consisting of 6 STEP that guides the construction of the Monitoring Program (EMP) integrated of the Maritime Space Plans (PSM)

The environmental monitoring of intervention plans and programs is developed according to the definition of temporal and spatial levels of the information necessary to populate the selected indicators over time and ensure timely information on the state of the environment in which the actions / measures of the Plan are developed.

It is important to emphasize here that many of the outcomes of coastal marine space management plans are visible and measurable as positive or negative effects on the environment in terms of years, if not decades, and therefore interim monitoring objectives are important to ensure that the management actions of the Plan are measurable according to incremental steps towards the final result. This approach is in line with what is reported in the national guidelines in Art. 26: "*The Plan will have a duration of 10 years, with the possibility of a mid-term review, or if deemed necessary following the monitoring of the implementation of the Plan or of events that require its review*". Therefore, the temporal development of the Environmental Monitoring Program (EMP) is foreseen with a ten-year duration (extendable to the following three years from the conclusion of the MSP) through the drafting and production of medium-term Environmental Reports (RAm), every three years, linked to the implementation, progression and review of the Plan, and of specific Environmental Reports (Ras), on an annual or monthly basis referring to unforeseen and / or rapidly changing conditions or events that may influence the objectives of the Plan and require their review at the PU or Sub Area level (e.g. oil spill events, damage from extreme weather events, etc.). The proposed approach is therefore the key to making the MSP able to adapt over time to respond to emerging needs, and not necessarily to do so at the end of the first decade of its implementation, taking from environmental monitoring the necessary information for medium reviews. termination or the simultaneous updating of the Plans following particular rapid changes in the context. Following is the description and development of each step of the proposed conceptual framework.

6.3.1 STEP 1 - Resume the objectives of the Plan

The preparation of the program arises on the basis of the strategic objectives (SO) and specific objectives of the MSP, respectively defined during Phase 3 and Phase 4 of the Plan process.

Step 1 allows, starting from each objective considered, regardless of whether this is strategic or specific and its level of detail, to effectively orient the EMP by preliminarily identifying the spatial and temporal scale on which the monitoring is developed for the purpose of adequately inform the Plans. This approach allows to increase the effectiveness of the EMP by favoring its ability to provide the necessary information to the MSP and to the individual Plans respecting the different spatial and temporal scales in which they are divided.

The spatial scale varies according to the territorial extension involved by the different objectives set; the largest is that configured by the size of the basin as well as by the three maritime areas covered by the plans: Adriatic, Tyrrhenian and Ionian. Going into greater detail, especially in relation to the specific objectives, the monitoring will be performed at the sub-area level and in specific cases at the level of the single Planning Unit (PU).

The choice of the spatial scale to which to apply the monitoring directly depends: on the objective that the monitoring program aims to achieve, on the coherence and completeness of the data that the sector in question presents (for the definition of coherence and completeness of the data, reference to paragraph 7.3.1.2 of the MSP Monitoring Plan). These same factors also condition the choice of the time scale, which assumes a key role within the Plans since, downstream of the environmental monitoring activity, they will be subjected to medium-term reviews (Article 26) according to the results of identification and assessment of negative impacts on the environment for certain actions or measures of the Plans.

The temporal dimension is linked both to the variability of the phenomena considered and to the monitoring capacity: it can vary from multi-year monitoring (three years) to an update with greater frequency (annual, half-yearly, etc.) depending on the timing with which the collection is significant and data analysis with respect to the selected monitoring indicators and the objectives set.

The monitoring program is divided into two levels of geographical priority:

- Priority 1 with reference to the strategic objectives of phase 3 and to the Maritime Area scale (possibly with aggregation of data on a larger scale)
- Priority 2 with reference to the specific objectives of the individual sub areas and to the Sub-Area scale
- Priority 3 with reference to PUs or specific environmental issues
- Priority 3 acts on those PUs (described in par.4.3) of greater environmental sensitivity identified downstream of the characterization of the context of the territory affected by the Plan which due to their intrinsic characteristics and the associated levels of environmental protection present themselves as areas of particular vulnerability environmental relating to the marine environment and biodiversity, the soil and landscape and cultural heritage.

6.3.2 STEP 2 identification of the actors

The Proceeding Authority is responsible for the management of the data flows from the various competent bodies on environmental monitoring, it is also responsible for the treatment and processing of the data, for their management and system implementation, guaranteeing a data sharing flow with the Competent Authority and the public. For each indicator necessary for the implementation of the EMP, the Authority responsible for producing the data is therefore identified as the source and information (see Indicators Table).

The Bodies responsible for the production of data and indicators in spatial format are represented by the MiTE, MIPAAF, MIBACT and the system of Agencies (ISPRA, SNPA, ARPA, etc.) as well as by the individual Regions, also through the regional ARPAs, and last but not least from available European information resources (eg Copernicus, Emodnet, etc.).

In the following paragraph 6.5.2 Governance of the Environmental Monitoring Program further details are provided relating to the Bodies responsible for the production of data and indicators in spatial format.

6.3.3 STEP 3 definition of the indicators

In step 3 the indicators for the individual strategic and specific objectives were defined, attributable to 6 environmental components, such as:

1. Biodiversity
2. Marine environment
3. Waters
4. Air and climate change
5. Soil
6. Landscape and cultural heritage

The indicators present are related to one or more environmental sustainability objectives with respect to which they express the positive or negative impact in the implementation and advancement of the Plan, and all identified as priorities, allowing the degree of environmental sustainability of the Plan measures implemented to be monitored over time. The diachronic analysis of the various indicators, updated temporally according to the scheduled intervals, therefore allows to produce the information necessary for the activation of any corrective actions, in order to integrate the environmental considerations in the implementation phase, pursuant to the General Regulations for the implementation of structural funds (art. 8 of EC Reg. 1303/2013).

The environmental monitoring activity, as envisaged in this Environmental Report, will result in constant updating of the system of indicators and the logical framework of the environmental sustainability objectives, in relation to both the themes (components) and the individual objectives of the measures of implementation foreseen by the MSP. All this in a logic of acquisition, processing, analysis and dissemination of information relating to the impacts of the Plan on the marine and coastal environment with the ability to update the database and evaluation results, in compliance with the contents of the SEA Directive.

The indicators that will be used in the environmental monitoring activity are aimed at characterizing the environmental and territorial condition and monitoring the program process, allowing to quantify:

- the initial state of the environmental systems with reference to the most representative variables;
- the pressures on the main environmental resources and matrices (soil, water, biodiversity, etc.);
- the responses (performance) in terms of positive or negative changes in investments and agricultural and management practices that affect the quality / state of environmental resources.

6.3.4 Indicators for monitoring

The ecological-environmental indicators, together with the pressure ones, defined for individual strategic and specific objectives, allow the degree of environmental sustainability of the implemented Plan measures to be monitored over time. Governance indicators, ie those that measure the performance, progress and quality of the management actions of the sector in question and of the MIPs themselves, can also effectively contribute to the direct and indirect assessment of effects on the environmental context. These indicators are of particular importance for the purpose of monitoring the sectors not yet developed, which are therefore not yet productive but for which an initial development plan must be prepared. The main areas of operation of the EMP were therefore defined within the relationship between the objectives of sustainability and environmental protection, and the expected results and actions of the Maritime Space Management Plan with respect to each environmental component considered. The following paragraph 6.4.1 Characteristics of the indicators and quality of the associated data and 6.5 Monitoring proposal of the environmental sustainability objectives of the MSP describes the indicators that will be used in the environmental monitoring of the Plans.

A further contribution to the environmental assessment may come from the in-depth study of the effects already identified in the context analysis and assessment. The information framework will be supplemented by the monitoring of other planning tools in force or deepened by additional groups of indicators that can be found following the implementation of the individual interventions as part of the contextual EIAs, with the aim of including the following information:

- the Environmental Sustainability objectives of the Plan;
- the environmental indicators to be monitored in order to achieve the aforementioned objectives;
- the existing knowledge sources and the information databases to draw on for the definition and population of the indicators;
- the methods of data collection, processing and presentation;
- space-time planning of monitoring activities.

The set of data necessary for environmental monitoring acquires information from the following reference frameworks:

- Planning context of the MSP;
- Environmental context of the MSP;
- State of implementation and progress of the Plans;
- Environmental Assessments: SEA and Monitoring Plans of other Instruments, EIA procedures, Assessments of impact on protected areas.

These data, based on the territorial level investigated and the type of event measured, flow into the following monitoring areas:

- o Monitoring of the environmental context affected by the MSP, which overall describes the evolution dynamics of the state of the environment and the sustainability objectives to be achieved. Starting from the environmental protection objectives, the set of context indicators has been identified that describes the state of each environmental component and highlights its sensitivity and criticality
- o Monitoring of the MSP implementation process which measures the degree of achievement of the Plan's objectives and actions. It is defined, starting from the indications contained in the SEA and from the provisions for the physical and procedural monitoring of the MSP.
- o Monitoring of the contribution of the PGMS to the variation of the environmental context concerned, verifies how much and how the implementation of the interventions provided for in the Plan contributes to the variation of the environmental context.

In order to facilitate better management and storage of the data and information necessary for the population of the EMP indicators, these will be described in specially prepared cataloging tables, to be filled in during reporting and also as a tool for archiving the data necessary for sharing. indicators.

6.3.5 STEP 4 integration of existing programs or new surveys

The EMP potentially acts as a collector of the various existing national monitoring programs.

In this phase, the existing sectoral monitoring strategies and tools were considered and their possible integration into the EMP was assessed, based on the qualitative and quantitative indicators adopted by them and on the coherence and completeness of the data collected. In the event that the sector being monitored is developed, the existing monitoring plans are identified, the data sources and their production chain are defined, to assess their adequacy to support the EMP. On the contrary, if the sector is in an initial development phase and there are no programs aimed at its monitoring, the EMP aims to monitor its preparation and its early development phases also through the use of indicators of governance.

6.3.6 STEP 5 Sources of data and information

After identifying the state of progress of the sector taken into consideration and analyzing the main monitoring programs already in place at national level, the adherence and adequacy of their monitoring indicators were assessed, as well as the consistency and completeness of the data collected as part of these programs to verify their consistency with those identified by the EMP. Furthermore, we proceed to characterize the primary source and further secondary sources, to establish whether the data collection is carried out automatically within an existing program or whether it is a new program to be established or if it is necessary to deepen the existing surveys, for example example by changing the spatial domain, resolution or sampling period.

The following table provides the essential picture of the data sources and the type of information required.

Sources of data	**Type of information**
Integrated portal for the planning of state property and maritime space SID "Portale del Mare" - MiMS	Population indicators of the Descriptors
Geoportale nazionale - MiTE	*Environmental indicators*
Centralized Information System Monitoring Data MSFD - ISPRA	*Environmental Indicators from Descriptors*
SNPA-ISPRA environmental indicators database	*Environmental indicators* *core set: environmental conditions - protection and prevention*
ISTAT database	Statistical indicators
Regioni ARPA	*Environmental indicators (SNPA FESR FEAMP)*

6.3.7 STEP 6 Periodic reporting

The national legislation on SEA provides that the results of environmental monitoring, or the identification of the negative environmental effects of the Plan and any corrective measures, are made public and available for consultation (Legislative Decree 152/2006 art.14, paragraph 3).

Therefore, the publication of periodic reports is expected to communicate the state of health of the environment, the impacts caused by the monitored work and the necessary corrective measures. The EMP, through its periodic reporting, will provide information relating to the characteristics and methods of data processing, which will be based on geomatic approaches, therefore objective and repeatable, and on the sharing of spatial input data, which will be made visible on the WebGIS system dedicated and available to users according to OGC services, in compliance with the INSPIRE Directive.

The selected indicators will therefore be updated on time and published in the reporting, providing for the construction of a necessary baseline of information on each of the selected indicators; this action is necessary before actual environmental monitoring as a fundamental datum at time 0 both for the analysis and for the evaluation of the individual actions of the Plans before, during and after their implementation.

The geomatic analysis of the indicators, organized according to a multilayer digital cartographic database, will lead to mainly quantitative assessments on the monitoring targets which can be followed by a qualitative assessment with respect to the environmental objectives.

The reporting will define particular aspects related to the spatialization of the data, especially in the presence of numerical and tabular input information (eg geographically uneven point samplings, differences in the data acquisition scale, etc.), also describing the actions and solutions taken to the overcoming of such situations of non-homogeneity of the data, however already faced in the elaboration phase of the RA for the construction of the multilayer digital cartographic database.

As specified and anticipated in paragraph 6.2 of this Chapter, the production of medium-term Environmental Monitoring Reports (RAm) is envisaged, every three years, linked to the implementation, progression and revision of the Plan, and specific Environmental Monitoring Reports (Ras), annually referring to unforeseen and / or rapidly changing conditions or events that may occur in the implementation time of the Plan, influence its objectives and therefore request a review at the PU or Sub Area level. The EMP reporting, either as RAm or as Ras, will present and make physically available the T0 indicators (baseline), the updates made on the Tn indicators, the geomatic analyzes and the summary data, together with the assessments by component concerned. In summary, in the information construction phase, the results of the assessment of the significant environmental effects monitored through the implementation of the Environmental Monitoring Program will be systematically collected and made public with the aim of highlighting and sharing information regarding:

- The description of the environmental monitoring and assessment activities carried out during the year and the main outcomes;
- The criticalities that emerged (both in terms of environmental effects and in relation to the monitoring activity itself: eg. Difficulty in retrieving data ...);
- The corrective indications to be implemented to reduce the impacts encountered (environmental mitigations…).

The preparation of monitoring reports is essential to create that level of public participation (citizens, public administrations, stakeholders, etc.) which is essential for the pursuit of the objectives of involvement and participation shared by the MSP and in the SEA procedure, allowing to promptly inform and exhaustively on the results of the monitoring and thus make the process of controlling the environmental effects of the Plan transparent and participatory.

In this regard, the possibility of using the IT and information tools already adopted for the purposes of planning and drafting the Environmental Report (i.e. portal of the sea SID) will be verified.

6.4 Implementation of the conceptual framework for the development of the environmental monitoring program of the MSP

The implementation of the conceptual framework has therefore made it possible to:

- implement the Phase 3 and specific SOs of Phase 4 (Step 1);
- identify the authorities responsible for monitoring each sector / topic (Step 2);
- develop a set of indicators suitable for environmental monitoring of the MSP implementation (Step 3);
- identify the main sectoral monitoring programs in place on a national scale (Step 4);
- verify the adequacy of the indicators adopted by the existing monitoring programs with those proposed for the MIPs for the purpose of their integration into the EMP (Step 5);
- Reporting (Step 6).

According to art. 18 of Legislative Decree 152 of 2006 and subsequent amendments the person responsible for the implementation of the environmental monitoring of the Plans is identified in the proposing Authority (Ministry of Sustainable Infrastructures and Mobility), while the evaluation of the results contained in the periodic environmental reporting is the responsibility of the competent Authority (Ministry for Ecological Transition). In analogy with the operational organization for the construction of the MSP, the EMP could be managed by the Technical Committee, with the operational contribution of three Monitoring Teams for each maritime area, also in support or integrated into the Working Groups provided for by the physical monitoring of Plans. The three Monitoring Teams, dedicated to the individual maritime areas, will have to provide:

a. the definition of the methods of spatialization and integration of information;
b. the collection and sharing of indicators on a national and regional scale (T0 or baseline);
c. the periodic updating (Tn) of the indicators according to the needs and information requirements of an environmental nature for the development and control of the impacts of the Plan actions;
d. the implementation of the reports on the physical progress of the Plans;
e. the evaluation of the effects of the progress of the Plans with respect to the environmental objectives and the results of the update;
f. the production of reporting.

The three Monitoring Teams will be supported by an adequate IT infrastructure that allows the collection of a large number of incoming flows, according to different types of data, allowing for quality control, substantial (information) and formal (structure and spatial completeness of the data), allow the geomatic elaborations aimed at producing summary information useful for the environmental assessment of the performances of the Plans according to the Components. This infrastructure, envisaged as a robust and efficient centralized Hw system operating according to homogeneous procedures on a national scale, ("SID Portale del Mare" or

Integrated System of the Ministry of Sustainable Infrastructures and Mobility (Mims), will be able to archive, in a single multilayer geodatabase, connected to the MSP information system, a substantial amount of data (periodic updates) and guarantee the use of interoperable OGC IT services towards users and other public viewing and consultation systems (eg National Geoportal).

The *Portale del Mare* is the unitary point of access, sharing and reuse of the information made available online by the Public Administrations, Central and Territorial concerned with the use of coastal and marine areas and has also been designated as the "institutional site" for the implementation of the directive. European Union for maritime spatial planning (Legislative Decree 17.10.2016. n. 201).

This Integrated System, intended as a shared national tool for the exchange, integration and reuse of data, generated by different Administrations and / or from different countries, allows the dynamic consultation of digital levels which, in addition to the spatialization of the uses of the sea and planning units with the relative definition of priority uses, will provide for a specific section for the environmental monitoring of the Plans.

Telematic access to digital monitoring information (reports, thematic and summary indicators tables, digital maps, etc.) will allow other subjects who have contributed to planning (eg Regions) to generate their own thematic reports and maps, even for individual sub-areas by drawing on the periodically available information material. The IT infrastructure will also have to provide Hw and Sw of individual production (professional level and not Open source), to the three Monitoring Teams, to collect, process, spatially analyze the data that the monitoring program requires from the individual Plans. As represented by the flow chart in Figure 6.2, a procedure supported by an adequate IT infrastructure is established for each group of indicators of the Plan's EMP of the SEA and of the nature of the different types of data:

- digital map data
- raw or semi-processed data available from sensors (remote sensing, fixed control units, sampling points, etc.)
- elaborations available in continuous flow (eg Copernicus Marine and Copernicus Land, Emodnet, etc.)
- periodic campaigns for the collection of ecological, environmental and landscape data
- periodic statistical survey campaigns

The Monitoring Teams proceed annually and every three years to submit the environmental monitoring report to the Proceeding and Competent Authorities for publication and integration in the Plan portal.

6.4.1 Characteristics of the indicators and quality of the associated data

The proposal of indicators starts from a consistent list derived from the monitoring proposal of the MSP also in consideration of the fact that in the case of existing monitoring programs it is more efficient to implement the entire set of indicators rather than managing the selection of the most relevant ones: moreover, during the implementation of the monitoring program, composite indicators will be refined which are the result of the combination of several data flows. The proposed indicators have been placed in relation to the individual objectives. The degree of specificity of each individual indicator is established according to the level of detail of the objectives formulated and can be adapted to the definition of new specific objectives.

The indicators have been divided into priorities and accessories. The priority indicators are defined as such as they meet the following criteria:

- sensitivity: the ability of the indicator to reflect changes in the status of the monitored systems or mechanisms and consequently to inform the PSM on the progress or effectiveness of the measures with respect to the objectives of the MSP;
- technical feasibility (granularity): the ability to collect data with respect to the indicator in technical terms and in compliance with the required timelines
- availability of the data flow, as there is already a data collection mechanism in relation to the indicator.

The sensitivity criterion is the most important as sensitive indicators are more effectively able to inform MSP of their progress and effectiveness. For this reason, some indicators can be indicated as priorities even if they do not respect all three of the criteria mentioned above. It is therefore important to verify, through medium-term reviews, that the indicators remain adequate over time from an adaptive plan perspective.

6.4.4.1 Integration of existing data

The analysis of existing monitoring programs on a national scale (eg. MSFD, ERDF, EMFF, etc.) provided for in Step 4 aims to promote the integration of these programs within the EMP. This integration has the meaning of avoiding overlapping of effort of time and resources and of promoting the use of series of temporal data coming from existing and useful monitoring activities in order to build a starting cognitive framework, or baseline, the most possible complete in order to inform the EMP. Furthermore, defining the existing monitoring programs favors the identification of the different actors involved in the implementation of the EMP itself.

6.4.4.2 Data Suitability

Step 5 provides for the assessment of the suitability of the adopted indicators produced by existing monitoring programs. This assessment is based on the consistency criterion and the completeness and adequacy criterion.

- The data produced by the existing monitoring programs relating to the indicators adopted by them are consistent if they effectively describe (directly or indirectly) the phenomenon to be monitored in order to respond to a SEA indicator. If a data is consistent, it is integrated into the Plan's environmental monitoring. If a data, while highlighting the trend of an indicator, is not coherent or is only partially coherent with the phenomenon (for example because the correlation is not proven) it can be used as an additional indicator or it can be decided to integrate it with other data or templates for creating composite indicators.
- The data produced by the monitoring programs and linked to the indicators adopted by them are complete when they are able to provide the information requested over the entire spatial area and with respect to the entire time frame of interest in monitoring that indicator. If a data is complete it is integrated into the monitoring; if it is not complete, the possibility of completing it is evaluated by estimating the content on the basis of other variables.
- While completeness concerns the extension of the information request with respect to an indicator / objective in the spatial and temporal dimensions, the adequacy of the data concerns the resolution required to understand the phenomenon. For example, an aggregate data in annual form is not adequate to describe phenomena with strong seasonal variations. If a data is adequate, it is integrated into the monitoring; if it is not adequate, it is evaluated to fill in the gaps with an estimate or interpolation according to the available models.

6.4.4.3 Data production chain

For each existing monitoring program, the source of the data is identified, intended both as the subject responsible for the collection and as the lender and owner of the data. In reality, the data production chain almost always includes different subjects and numerous steps of collection, validation, publication.

To these are added any operations to make the data suitable for monitoring MSP. Since these are official data, each step is also burdened by administrative requirements that can take time and generate unforeseen events.

For successful monitoring, the data production chain should be as short and efficient as possible, possibly making the data available to other interested parties in advance of formal validation and approval and introducing downstream correction mechanisms. In the absence or pending official data, the opportunity to collect and use unofficial data must be provided, taking care to report the differences in terms of suitability and reliability (step 4): it is therefore useful to establish direct contacts between the competent authority of the PSM and the person closest to the collection (or production) of the data. This actor should be able to provide the most updated data in a shorter time, making the monitoring data usable for the purpose of their re-elaboration to inform the monitoring indicators and the trend of achievement of the Plan objectives.

The goal to aim for is to move from an "ad hoc" collection to a continuous flow of data that is produced in the ordinary activities of the authorities involved.

6.4.4.4 Data spatialization and spatial relations

For an effective relationship with the objectives and forecasts of the Plan, all data must be spatialized with clear, uniform, repeatable methodologies and possibly with reference to the same geometries, the differences in geographical approach between different domains must be reported. Differences in geographic approach between different domains will be reported and, where possible, resolved. Each indicator is associated with the available scale but can be aggregated or deepened to the most appropriate scale by intervening on the data collection process. Finally, the detail of the environmental monitoring action will also be linked to the detail with which the planning units are defined, by their suitability and environmental sensitivity. The geographic management of all the data of the Environmental Monitoring Program within a GIS system integrated with the Plan publication portal (SID MiMS) will also allow verifying the effectiveness of the Plan forecasts over time, ensuring that the geometries to which certain vocations and sensitivities have been assigned to be spatially linked to the objects that identify the corresponding uses. To define the cumulative effects of multiple uses or the synergistic or conflicting nature of certain combinations, it is possible to use the decision support software tools already developed on individual case studies within the MSP projects implemented to date.

6.5 Proposal for the Environmental Monitoring Program of the MSP integrated with the proposal for the Plan monitoring program

Pursuant to art. 18 of Legislative Decree 152/2006 and subsequent amendments "*Monitoring ensures control over the significant impacts on the environment deriving from the implementation of approved plans and programs and the verification of the achievement of the set sustainability objectives, so as to promptly identify unexpected negative impacts and adopt the appropriate corrective measures. The monitoring is carried out by the Proceeding Authority in collaboration with the Competent Authority also using the system of environmental agencies and the Higher Institute for Environmental Protection and Research*".

To ensure an adequate monitoring system, it is advisable to organize these measures in a specific Monitoring Program that defines the methods for:

- the verification of the environmental effects related to the implementation of the program, conducted with respect to both changes in the state of the environment (context indicators) and the efficiency and effectiveness of the measures of the Plan (performance indicators);
- verification of the degree of achievement of the environmental sustainability objectives identified in the Environmental Report;
- the timely identification of unexpected environmental effects;
- the adoption of appropriate corrective measures capable of providing indications for a possible remodeling of the contents and actions provided for in the program;
- information to subjects with environmental expertise and the public on the periodic results of program monitoring through the drafting of specific reports.

Therefore, the Monitoring Program will include:

- the description of the evolution of the environmental context (monitoring of the context), through context indicators, directly related to the environmental sustainability objectives. The monitoring of the evolution of the context takes into account all the transformations taking place in the area, draws their evolution starting from the moment in which the context analysis was carried out for the environmental report;
- the recording of the environmental effects of the implementation of the Plan (environmental monitoring), through updated context indicators and process or pressure indicators. They describe the actions implemented by the Plan also in relation to the sustainability objectives; in this way it will be possible to verify the degree of implementation of the Plan and therefore the consequent pursuit of the sustainability objectives defined therein;
- the description of the methods of correlation between context indicators, where populated, and of the Plan.

6.5.1 Methodology to be used

The monitoring system set up in this Environmental Report has as its main objective the activation of an iterative control and verification process, which is able, once activated, to provide recursive information on the implementation of actions and projects of the individual MSP.

The methodology used will cyclically process the determinants, evaluative and programmatic, for which it must prepare the tools useful for the evaluation of the environmental determinants on which the single Maritime Space Management Plan acts and the outputs it determines (process indicators) and create the conditions for any remodeling actions of the sector plan.

This process supports and accompanies the implementation of the Plan itself through the following phases.

1. Analysis:

- Selection of the most relevant and useful types of information for the purposes of calculating the indicators, identifying sources and acquiring data.
- Design and generalization of the significant indicators with respect to the achievement of the specific environmental sustainability objectives selected by the Plan.
- Any in-depth focus on critical issues, territorial peculiarities that require a supplement of analysis regarding the evaluation of the effects produced by the implementation of the Plan or the state of the environmental components concerned.
- In-depth study of the potential / possible negative effects related to the implementation of the Plan in order to identify mitigating and / or compensatory measures.

2. Diagnosis (can be environmental or methodological):

- It consists in identifying and describing the causes of any discrepancies recorded with respect to expectations, attributable both to changes in the environmental context and to problems in implementation.
- It can detect methodological distortions with respect to the ability of the tools prepared by the SEA and the Environmental Monitoring Program to detect and evaluate the significant effects.

3. Therapy:

- It identifies whether, and which reorientation actions, relating, for example, to the objectives, actions, conditions and timing of implementation of the Plan, it is necessary to undertake to make it consistent with the sustainability objectives set.

6.5.2 Governance of the Environmental Monitoring Program

The first of the preparatory activities for defining the operational phases of the environmental monitoring of the Plan consists in identifying the subjects and their respective roles and responsibilities that will be actively involved in the environmental monitoring process. One of the key objectives relating to the implementation of the EMP is the definition of a coordination and management scheme capable of ensuring and harmonizing the different levels of cooperation between the multiple parties involved. The implementation of the EMP will follow a coordination and management scheme capable of ensuring and harmonizing the different levels of cooperation between the multiple parties involved.

ACTORS	DISTRIBUTION OF ROLES AND RESPONSIBILITIES
MiMS	MiMS Proposing Authority Responsibility for implementing the Plan
MiMS	Proceeding Authority Responsibility for implementing the ESA and Environmental Monitoring and Reporting
MiTE	Competent Authority Evaluation Reporting Environmental Monitoring SEA *Provider of data and information for populating and updating indicators*
ISPRA	*Sistema Nazionale delle Agenzie Ambientali SNPA - Provider of data and information for populating and updating indicators*
Regions	*ARPA, AdG FESR e FEAMP Provider of data and information for populating and updating indicators*

6.5.3 Resources and costs

As required by the national legislation on SEA (Legislative Decree 152/06 and subsequent amendments, the Authority responsible for the environmental monitoring of the Plan has foreseen the necessary resources, in terms of time, costs and personnel, to guarantee its implementation. The following table describes the resources and costs according to a three-year schedule:

	Number	Skills	Delivery time	Budget in Euro
Human Resources	5	Environmental Monitoring Team Coordination (Senior)	Triennial	90.000
		GIS and geographic DB analyst (Senior and Junior)		90.000
		Image analyst and remote sensing DB (Senior)		45.000
		Thematic experts on demand		30.000
Hw Resources	**5**	Mid-to-high-end graphics workstation	Triennial	8.000
Sw Resources	2	Sw for GIS analysis (eg ESRI ArcMap)	Triennial	25.000
		Sw for satellite image analysis (Erdas)		30.000

The Environmental Monitoring Teams are foreseen on a three-year time frame in order to guarantee in the initial phase of implementation of the Plan: i) the construction of the DB of the EMP, ii) the elaborations and assessments for the first three years - first Environmental Monitoring Report of medium term (RAm) or specific Environmental Monitoring Reports (Ras), annually referring to unforeseen and / or rapidly changing conditions or events that may occur over the three-year period.

The Environmental Monitoring Teams will therefore have to provide:

- the collection of information from the various institutional subjects and from the various official data sources;
- the feeding, standardization and updating of the multilayer digital map database;
- the construction of the baseline of indicators for environmental monitoring activities:
- to the elaboration of summaries for the evaluations;
- carrying out evaluations and reporting

The three Coordinators of the Environmental Monitoring Teams play the role of liaison with the Technical Committee and the Plan Working Groups, producing and providing the periodic reporting of the EMP.

6.5.4 Proposal for monitoring the environmental sustainability objectives of the MSP

The measurement of the achievement of the Plan objectives is implemented through the measurement of context indicators that describe the overall dynamics of variation of the environmental components and allow to analyze the evolution of the state of the environment resulting from the planning policies implemented on the maritime space identified . These indicators are defined by environmental component starting from the environmental protection and sustainability objectives assumed for the environmental assessment of the MSP and quantified in relation to the identified contexts. The environmental sustainability objectives to which the indicators will refer have been defined starting from the analysis of:

- national and community plans, programs and strategies;

- existing regional programming and planning tools, where available;
- analysis of the environmental context, which made it possible to highlight criticalities and potentialities with respect to the various issues and territorial systems of the regions affected by the Plan.

Once the context indicators have been defined, we proceed with the integration of the territorial dimension identified in the Plan as a Sub-Area in order to make them more sensitive to the peculiarities of the affected areas. Following the outcome of the observations and consultations with the Entities with Environmental Competence on this Environmental Report and on the Monitoring Program, in order to define the scope and level of detail of the information to be included in the list of indicators identified, this list may be modified, while maintaining firm the concept that few but significant indicators are easy to manage both in terms of information-evaluation and in terms of summary geomatic processing. The following tables describe the indicators selected for the EMP according to Environmental Components and with reference to the Sustainability Objectives, information is also provided relating to the Source of the data, as well as for the Unit of measurement, the frequency of data collection and the scope. geographical reference.

BIODIVERSITY

	Environmental indicator (context)	Monitoring Evaluations	Parameters to be evaluated	Unit of measurement	Frequency of data detection	Reference area	Data source	Reference Target Objective Sustainability	Plan Indicator ID reference [91]
BI.01	Presence / absence and state of health of Posidonia oceanica	Conservation status of the habitat (leaf density, substrate cover, type of the lower limit of the P. oceanica prairie)	▪ Morphobathimetry ▪ Distribution of the prairie ▪ Condition of the habitat ▪ Value Ecosystem services generated by Posidonia oceanica	Morphobatimetric variations (mt) sqm State Number	Triennal	Maritime area Sub Area	MiTE - ISPRA	OA 1.a – OA 1.d	2.18
BI.02	Coralligeno e Maerl[92]	Conservation status of the habitat (number of species, substrate coverage)	▪ Distribution and characteristics of the habitat ▪ Habitat condition (number of species and substrate coverage)	number of species, substrate coverage	Triennal	Maritime area Sub Area	MiTE - ISPRA	OA 1.a – OA 1.d	
BI.03	Species protected by national legislation, international conventions and EU directives (cetaceans, sea turtles, etc.)[93]	Conservation status of the species (population assessment through the census of the number of individuals present in the study area, assessment of reproductive fitness, by catch of protected species by commercial fishing activities)	▪ Marine mammal distribution ▪ N. cetacean strandings ▪ Conservation status of the species ▪ Presence of threatened / vulnerable species (IUCN Red List) ▪ Cetacean sightings	Number	Triennal	Maritime area Sub Area	MITE, Programma Monitoraggio Strategia Marina (D1)	OA 1.a - OA 1.b - OA 1.d - OA 1.e - OA 2.a - OA 2.b - OA 2.c - OA 2.d - OA 3.a - OA 3.b	1.11 - 1.16 - 1.17 - 1.18
BI.04	Protected areas (Rete Natura 2000, AMP, ZTB e FRA)	Habitat and species conservation status	● Marine environment protection level[94]: o Number and area of MPAs o Number and area of ZTB	Numerical areal distribution Number	Triennal	Sub-Area	MiTE - ISPRA	OA 2.b - OA 2.d	1.23 – 1.24 - 1.25 - 5.5

[91] Cap. 7, fase 5

[92] Rif. MSFD Descriptor 1. The classification of this EQB takes place where, for reasons of geographical distribution, the prairie is present, that is in the Tyrrhenian regions and in Puglia. (Source ISPRA 2021)

[93] Rif. MSFD Descrittor 1

[94] Surface of coastal territorial waters falling within the AMP, pursuant to laws 979/1982, 394/1991, 426/1998 and subsequent amendments. and other types referred to in the list of protected areas (EUAP)

	Environmental indicator (context)	Monitoring Evaluations	Parameters to be evaluated	Unit of measurement	Frequency of data detection	Reference area	Data source	Reference Target Objective Sustainability	Plan Indicator ID reference [91]
			o Number and area of FRAs ▪ Value of ecosystem services generated by MPAs						
BI.05	Number and spatial distribution of non-indigenous and invasive species already established	Number of invasive species, substrate coverage, rate of diffusion and interference with local biodiversity	▪ Presence / absence of newly introduced alien species before 2012 with the exception of cryptogenic species. ▪ Voluntary and involuntary introduction of invasive species ▪ Expansion of invasive non-indigenous species (NIS)	Number	Triennal	Maritime area	MITE - ISPRA	OA 1.a	1.21 – 1.22
BI.06	Conservation status of habitats and benthic communities [95]	Conservation status of benthic communities subjected to fishing activities	▪ Granulometry of the superficial sediment ▪ Morphology ▪ Extension of moving bottom biogenic substrates	Numerical areal distribution	Triennal	Sub-Area	MITE, ISPRA, ARPA	Oa 1.d - OA 4.a	2.18
BI.07	Fish stocks overfished	Evaluation of fish stocks, species subject to commercial fishing, concentration of contaminants in fish products	▪ Evaluation of the percentage and number of fish stocks overfished in relation to maximum sustainable yield (MSY)	Number	Triennal	Maritime Area /GSA (FAO)	ISPRA	OA 1.a - OA 1.b - OA 1.c - OA 2.d	1.26 – 1.27 – 1.42
BI.08	Fishing effort (E)		▪ Fishing pressure: Tonnage of the fishing vessel (expressed in GT "Gross Tonnage") ▪ Average fishing days (as per EC Regulation 2091/1998)	Number	Triennal	Maritime Area/Regions	CNR ISPRA MIPAAF	OA 1.b OA 1.c OA 2.d	1.27- 1.37-
BI.09	*Catch Per Unit of Effort* - CPUE		▪ Fishing pressure: Number of catches obtained for one effort unit.	Number	Triennal	Maritime Area/Regions	CNR ISPRA MIPAAF	OA 1.b OA 1.c OA 2.d	1.15 - 1.27- 1.37-

[95] Ref. Seabed Integrity (MSFD Descriptor 6)

MARINE ENVIRONMENT

	Environmental indicator (context)	Monitoring Evaluations	Parameters to be evaluated	Unit of measurement	Frequency of data detection	Reference area	Data source	Reference Target Objective Sustainability	Plan Indicator ID reference [96]
AM.01	Underwater noise		Number of anthropogenic activities that introduce impulsive sounds in the range 10 Hz - 10 kHz in the marine environment entered in the register on the total of authorized plants		Triennal	Maritime Area/Regions	ISPRA – monitoraggio Direttiva 2008/56/CE MITE, Programma Monitoraggio Strategia Marina (D)	OA 1.e	**na**
AM.02	Marine waste		▪ Number / quantity of marine litter present on shorelines, at the bottom and in the water column, including those floating on the sea surface.	dd	Annual Triennal	Maritime Area/Regions	ISPRA – monitoraggio Direttiva 2008/56/CE MITE, Programma Monitoraggio Strategia Marina (D10)		1.30 .
			▪ Beached marine litter[97]	dd	Annual Triennal				1.31 - 1.9

[96] Cap. 7, fase 5

[97] https://annuario.isprambiente.it/sys_ind/960

WATERS

	Environmental indicator (context)	Monitoring Evaluations	Parameters to be evaluated	Unit of measurement	Frequency of data detection	Reference area	Data source	Reference Target Objective Sustainability	Plan Indicator ID reference [98]
AC.01	Bathing water quality	Concentration of nitrates and phosphates	▪ Concentration of pollutants and harmful organisms (eg Ostreopsis ovata) for human health ▪ Quality classes [99]		Annual Triennal	Sub-Area (regional level) UP	ISPRA su dati ARPA e Ministero Salute CCM, monitoraggio da Direttiva europea 2006/7/CE	OA 6.b	1.1 - 1.20
			▪ Concentration of microbiological parameters (intestinal enterococci and Escherichia coli) [100]		Annual Triennal			OA 1.e	1.1
			▪ Purification plants: discharge volumes and TRIX parameters [101]	Number	Annual Triennal				1.1
AC.02	M-AMBI [102] - Marine-coastal waters Synthetic ecological classification index of the ecosystem		▪ Structural parameters: diversity, specific richness and relationship between sensitive tolerant species of the underlying macrozoobenthic community		Triennal	Sub-Area (regional level) UP	ISPRA – monitoraggio Direttiva quadro acque	OA 2.c	1.5
AC.03	Chlorophyll 'a' EQB (biomass phytoplankton marine - coastal waters)		▪ Nutrient loads (N and P)	Numerical areal distribution	Annual Triennal	Sub-Area (regional level)	ISPRA – monitoraggio Direttiva 2000/60/CE	OA 2.c	1.6
AC.04	Indice Trofico TRIX [103]		▪ Concentration of Chlorophyll 'a', dissolved oxygen in%, DIN and Phosphates ▪ Concentration of nitrogen and phosphorus from aquaculture	Numerical areal distribution	Annual Triennal	Sub-Area (regional level)	EMODNET CHEMISTRY	OA 1.e	1.7

98 Cap. 7, fase 5

99 based on the concentration of microbiological parameters: intestinal enterococci and Escherichia coli

100 SCA observation of the Tuscany Region Council (Tyrrhenian Plain)

101 SCA observation of ARPA Basilicata (Adriatic Plan)

102 *Multivariate-Azti Marine Biotic Index*

103 Ref. Eutrophication (MSFD Descriptor 5); used in Italy in the monitoring program for the state of the marine environment and not completely as an MSFD indicator

AIR AND CLIMATE CHANGE

	Environmental indicator (context)	Monitoring Evaluations	Parameters to be evaluated	Unit of measurement	Frequency of data detection	Reference area	Data source	Reference Target Objective Sustainability	Plan Indicator ID reference [104]
1	Air quality[105]	Concentration of atmospheric pollutants (eg SOX) in coastal marine environments	▪ Concentration of atmospheric pollutants (e.g. PM10, PM2.5, NO2, BaP, O3, SOx X) in coastal marine environments	Numerical areal distribution	Annual Triennal	Sub-Area (regional level)	ISPRA[106]	OA 1.e - OA 3.a - OA 3.b - OA 5.b	7.13 - 8.17
		CO2 emissions	▪ Pollutant emissions by the fishing and shipping sectors ▪ Greenhouse gas emissions by the fishing and shipping sectors ▪ Energy consumption by source by the fishing and shipping sectors	Numerical areal distribution	Annual Triennal	Sub-Area (regional level)			
AR.02	Climate changes	Sea storms and floods	▪ Length of the affected coast and flooded area	Numerical areal distribution	Triennal	Sub-Area (regional level) UP	MITE, ISPRA, ARPA	OA 4.b	**na**
		Rising sea temperature[107]	▪ Temperature ▪ recipitation ▪ Sea water surface temperature (SST) ▪ Sea level (SSH)	Numerical areal distribution	Annual Triennal	Maritim Area Sub-Area (regional level)	ISPRA	OA 5.a - OA 5.b	

[104] Cap. 7, fase 5

[105] Reference can also be made to the framework outlined in the "National Air Pollution Control Program" (PNCIA), approved in December 2021:https://www.mite.gov.it/sites/default/files/archivio/normativa/PNCIA_20_12_21.pdf

[106] https://annuario.isprambiente.it/sys_ind/macro/1, sezioni "Qualità dell'aria" e "Emissioni"

[107] favors the spread of alien species or in any case the southernization of the Mediterranean), acidification of the waters (it can lead to the death of benthic organisms due to higher temperatures or the spread of pathogens

SOIL

	Environmentzs<aaaaa aaaaaQQI WEQ34al indicator (context)	Monitoring Evaluations	Parameters to be evaluated	Unit of measurement	Frequency of data detection	Reference area	Data source	Reference Target Objective Sustainability	Plan Indicator ID reference[108]
SU.01	Coastal dynamics	Evaluation of coastal erosion and containment works	▪ Coastline changes	Numeric Km	Annual Triennal	Sub-Area (regional level) UP	ISPRA[109]	OA 4.b	9.11
			▪ ▪ Length of protected and defended coast ▪ Number of coastal defense works	Numeric Km Number	Triennal	Sub-Area (regional level) UP	ISPRA	OA 4.b	9.12
SU.02	Land urbanization	Soil consumption	▪ ▪ Percentage of urbanized land cover ▪ ▪ Soil consumed as a percentage in the coastal strip (2020)[110]	Numerical areal distribution Kmq- %	Triennal	Sub-Area (regional level) UP	ISPRA – Copernicus Land	OA 7.a	9.3 - 9.4 - 1.28
SU.03	Naturalness of the coast	Integrity of the coasts	▪ Length of the stiffened coast	Numeric Km	Triennal	Sub-Area (regional level) UP	PCN - Progetto coste ISPRA	OA 4.b	9.12
SU.04	Coastal subsidence	Subsidence rate	▪ Coastal municipalities subject to subsidence	Numerical area distribution velocity of displacement	Annual Triennal	Sub-Area (regional level) UP	ISPRA Copernicus Land	OA 4.b	9.15
SU.05	Hydrogeological hazard	Variations in hydrogeological hazard	▪ Surface of coastal strips (Coastal Zones Copernicus) affected by hydrogeological hazards	Numeric areal distribution	Annual Triennal	Sub-Area (regional level) UP	PCN - PAI/PGRA	OA 4.b	?

[108] Cap. 7, fase 5
[109] https://annuario.isprambiente.it/sys_ind/869
[110] https://annuario.isprambiente.it/sys_ind/697

LANDSCAPE AND CULTURAL HERITAGE

	Indicatore ambientale (di contesto)	Valutazioni di Monitoraggio	Parametri da valutare	Unità di misura	Frequenza rilevazione del dato	Ambito riferimento	Fonte dati	Riferimento Target Obiettivo Sostenibilità	Riferimento ID indicatori Piano[111]
PA.01	Presence of assets and restricted and / or protected areas[112]		▪ Soil consumed and annual land consumption in areas restricted for landscape protection [113]	Numerical areal distribution	Annual Triennal	Sub-Area (regional level) UP	ISPRA	OA 7.a	
PA.02			▪ ▪ Concentration of specific cultural constraints in the 300m range	Numerical areal distribution	Annuale Triennale	UP	Elaborazione dati MiC	OA 7.c	
PA.03			▪ Concentration of local cultural constraints [114] in the 300m range	Numerical areal distribution	Annuale Triennale	UP	Elaborazione dati MiC	OA 7.c	
PA.04			▪ ▪ Number of submerged cultural assets	Numerical areal distribution	Annuale Triennale	UP	Mic	OA 7.d	

[111] Chapter 7, fase 5

[112] BES Istat 9 indicators - referring to Landscape and Cultural Heritage - https://www.istat.it/it/files//2021/03/9.pdf as per SCA Observation Superintendence of Reggio Calabria and Vibo Valentia - Ionian Plan.

[113] https://annuario.isprambiente.it/sys_ind/696

[114] % area subject to areal constraint (archaeological and landscape) / UP reference area (calculated as a band within 300m from the coastline based on UP projection).

In the same way, the monitoring system will assess the environmental effects of the Plan and can be refined in order to have a greater focus on the aspects of the Impact Assessment.

For this purpose, once the areas of influence of the Plan have been identified, a summary table will be prepared that will relate the conservation and environmental protection objectives of the areas of the Natura 2000 Network and of the other Protected Areas, which from the Environmental Report will result in some affected by probable impacts due to the implementation of the Plan, with context indicators selected from the database of the agency system or designed ad hoc for the Plan. In particular, the monitoring must give evidence of the assessments made during the Impact Assessment and possibly monitor the effects of the compensatory measures implemented in the event of a negative impact.

6.5.4.1 Integration of the Environmental Monitoring Program with the monitoring of the Plan implementation process

Monitoring of the actions of the Plan that may have significant impacts on the environment is implemented through process or performance indicators. The type of indicators represented in the tables in paragraph 6.5 Monitoring proposal of the environmental sustainability objectives of the MSP was defined starting from the indications contained in the Preliminary Report of SEA and integrated with the indicators used in the activities related to physical and procedural monitoring of the plan. The definition of the set of process indicators for the EMP was based on the selection of the MSP actions that affect the Environmental Sustainability Objectives and the various sources identified for the physical and procedural monitoring of the Plan.

Therefore, a representative set of actions has been identified, the measurement of which has effects strictly related to the variation of certain elements of the environmental context, since in the specific case of a sector plan such as that of maritime space management, almost all of the performance indicators it could have a feedback in terms of direct or indirect effects on the environment.

The selection of a series of indicators of environmental interest from the set of physical indicators identified by the Plan will be used to design the indicators of the Plan's contribution to the achievement of environmental sustainability objectives. In the general plan report, a series of indicators has been identified for verifying the adequacy of the actions taken to pursue the planning objectives, which is integrated with those identified for the purposes of environmental monitoring. For the development of the monitoring methodology, a proposal is therefore made in the awareness of the growing complexity and articulation of an effective and efficient use of the indicators, taking into account a series of sets already proposed in international and national fora.

Given the extremely high number of potential monitoring indicators of the Plan, an appropriately motivated selection was made in the Environmental Report in order to identify a set that is actually capable of being implemented during the monitoring implementation process and the subjects in charge of their management. The set of indicators of the EMP described in the tables in paragraph 6.5 Monitoring proposal of the environmental sustainability objectives of the MSP will be supplemented by result indicators, aimed at providing general information on the monitoring of specific issues. The following paragraphs show the indicators of interest and additional identified for each of the strategic objectives identified by the MSP to further support the assessments of the Environmental Monitoring Program.

6.5.4.2 Cross-cutting principles - Sustainable development

The Sustainable Development theme is a transversal theme that embraces all sectors and uses considered by the Plans. The strategic objectives related to this theme are essential and act as an engine of action of the National Plans.

OS1 Develop a sustainable economy of the sea, multiplying the growth opportunities for the marine and maritime sectors	This is a transversal objective that is linked to the socio-economic indicators of the individual sectors. Below are some specific indicators of the fisheries and aquaculture sectors
OS2 Contribute to the National Strategy for Sustainable Development	The indicators envisaged by the SNSvS are integrated into the Plan monitoring program, in particular the environmental and pressure indicators from 1.1 to 1.12

OS3 Contribute to the European Green Deal	The objective is monitored by governance indicators such as 1.13 and 1.14
OS4 Fully grasp the economic and environmental sustainability opportunities that derive from the circular economy	The circular economy is a complex concept and must be related to specific uses, some indicators on the amount of waste can be useful such as 1.30, 1.31

Here reference is made to the indicators defined by the Iter Agency Expert Group (IAEG-SDGs) set up by the United Nations Statistical Commission that populate the monitoring program for the achievement of the objectives of the United Nations 2030 Agenda. At the Italian level, the National Strategy for Sustainable Development (SNSvS) has been established, consisting of 5 areas: People, Planet, Prosperity, Peace and Partnership. The government relies on the Ministry of Ecological Transition and the Ministry of Foreign Affairs to develop it. ISTAT is the institute that coordinates this monitoring program. The data produced by this program are consistent and complete even at a temporal level given the annual reporting frequency.

Table 6.1 Indicators selected from the MSP monitoring plan and information relating to the cross-cutting principle of Sustainable Development

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
1.1	Bathing water classification index	A	P	Eff	N of falling waters in each class	ANN	SA	Existing, ISPRA based on data from the Ministry of Health - CCM, monitoring by European Directive 2006/7 / EC, bilateral periodic flow	3
1.2	Percentage of bathing coasts	A	A	Eff	%	ANN	SA	Existing, ISTAT (processing on Ministry of Health data), periodic flow	3
1.3	Number of beaches classified as clean by the Clean Coast Index (CCI)	A	A	Av	N	ANN	SA	Existing, ISPRA on ARPA data, monitoring Directive 2008/56 / EC, periodic flow	3
1.4	Percentage Area of infrastructures / Area of marine-coastal water bodies defined in accordance with Directive 2000/60 / EC	P	P	Eff	%	6 ANN	AM	Existing, ISPRA, monitoring required by the Framework Directive on the 2008/56 / EC Marine Strategy for Descriptor 7, periodic flow	3
1.5	Biological quality element M-AMBI benthic invertebrate fauna	A	A	Eff	N tra 0 e 1	ANN	SA	Existing, Coastal Harp, monitoring pursuant to the Water Framework Directive (Legislative Decree 152/06) periodic IONET flow, EQB from European Directive 2000/60 / EC (implemented with Legislative Decree 152/2006 and subsequent amendments)	1 - 2

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
1.6	Chlorophyll-a biological quality element	A	A	Eff	mg/m^3	MEN	SA	Existing, coastal ARPA, periodic flow (6 times in a year survey) EQB from European Directive 2000/60 / EC (implemented with Legislative Decree 152/2006 and subsequent amendments)	1 - 2
1.7	Number of water bodies with "good" chemical status	A	A	Eff	N	ANN	Sub-Area (Regional level)	Existing, ISPRA, monitoring of Legislative Decree 152/2006, periodic flow	3
1.8	Number of water bodies with "good" ecological status	A	P	Eff	N	ANN	AM	Existing, ISPRA, monitoring of Legislative Decree 152/2006, periodic flow	3
1.10	Quantity of fishing and aquaculture waste in number of pieces per 100 meters of shoreline	A	A	Eff	N	SEM	SA	Existing, ISPRA - MATTM from coastal ARPA, bilateral periodic flow, monitoring by Directive 2008/56 / EC	2
1.12	Percentage breakdown in the IUCN risk categories of Italian marine flora species	A	A	Av	%	4 ANN	AM	New, ISPRA, periodic flow	1
1.13	Number of projects implemented for the conservation of ecosystems marine	G	P	Av	N	ANN	AM	New, ISPRA, periodic flow	1
1.14	Number of marine-coastal habitat restoration interventions	G	P	Av	N	ANN	AM	New, ISPRA, periodic flow	1 - 2
1.24	Area extensions% for new proposals for marine and natural protected areas	G	A	Av	%	ANN	AM	New, ISPRA, periodic flow	2

6.5.4.3 Cross-cutting principles - Protection of the environment and natural resources (Protection and protection of species, habitats and ecosystems)

The existing national environmental monitoring plans are mostly linked to specific legislative instruments, i.e., the Water Directive (2000/60 / EC), the Marine Strategy Directive (2008/56 / EC, Habitats Directive (1992/43 / EEC) and Birds Directive (2009/147 / EC) and arise from a long process of conceptualization and preparation, and therefore of coordination between the different parties involved in their implementation and implementation. These plans are important tools and of potential support to the monitoring of MSP in terms of conservation and environmental management. For example, the Water Directive sets up a monitoring activity that includes all surface and groundwater bodies. Surface water bodies include lakes, rivers, transitional waters or coastal waters, as well as man-made or heavily modified ones. The monitoring programs under the Water Directive are structured in hydrographic districts which are both land and sea areas.

This peculiarity makes these programs suitable for supporting the integration of data collected in the marine, coastal and lagoon environment within the PSM monitoring program. At the same time, however, the completeness of the data collected according to the subdivision into river basins must be verified, which may not be suitable for the purpose of responding to the monitoring needs of the MSP.

The data therefore provided by the monitoring carried out under the Water Directive are potentially consistent in relation to the objectives of the Plan, especially in relation to SO 33, but not complete from a spatial point of view considering their collection and aggregation. Their aggregation at the basin and sub-area level is suggested. Furthermore, the monitoring of the parameters considered by this directive is adequate as it is annual but the three-year reporting frequency is not adequate to promptly inform the effectiveness of the measures adopted by the PSM. It is therefore necessary to evaluate an adjustment of the timing of analysis and provision of data corresponding to priority indicators in order to inform the effectiveness of the Plan measures.

The monitoring programs prepared and implemented under the Marine Strategy Directive focus on monitoring the marine environment and present an extensive list of indicators associated with each of the environmental targets defined to achieve the objectives established by the Directive itself. . The 11 descriptors of the directive aim to guide monitoring programs through the observation of the state of the environment in terms of habitats and priority species for conservation (indicated in the Habitats Directive, Birds Directive and in the Barcelona Convention), and at the same time in terms of the effectiveness of the measures adopted in order to manage the pressures deriving from anthropogenic activities and impacting the environment itself. This connotation makes the monitoring programs of the Marine Environment Strategy largely consistent with different objectives of the MIPs. Furthermore, the division of these programs into the three sub-regions Western Mediterranean Sea, Adriatic Sea, Ionian Sea and Central Mediterranean Sea, makes data collection and their aggregation complete from a spatial coverage point of view with respect to the three MSP.

The monitoring of the parameters considered by this directive is adequate as it is annual but the reporting frequency every six years is not adequate to promptly inform the effectiveness of the measures adopted by the PSM. Also in this case it is therefore necessary to evaluate an adjustment of the timing of the analysis and provision of data on an annual scale in order to inform the effectiveness of the Plan measures.

- OS_N | 01 - Apply a coherent ecosystem approach (Ecosystem based approach - EBA) in the general setting and indications of the Maritime Space Plans. The achievement of this objective is monitored through the use of all the indicators that define the level of environmental sustainability achieved by the actions of the plan. It is closely linked to the achievement of the GES defined in the context of the National Marine Strategy which incorporates the MSFD. Each proposed indicator is useful to inform the MSP with respect to the level of actual implementation of the ecosystem approach
- OS_N | 02 - Promote the extension of the protection of the EU seas to 30%, of which 10% strictly, by 2030. Specific governance and socio-economic indicators are proposed
- OS_N | 03 - Transpose and promote the implementation of the main spatial measures provided for in the MSFD Program of Measures Environmental, pressure and governance indicators proposed provide information on the implementation of the spatial measures provided for in the MSFD Program of Measures. In addition, a specific indicator is proposed that monitors the number of spatial measures envisaged by the Program implemented
- OS_N | 04 - Integrate aspects of land-sea interaction and integrated management of the coastal strip, with particular reference to environmental aspects. It indicates the need to integrate the data collected by the monitoring activities set up under the Water Directive and under the descriptor 5 Eutrophication of the Marine Strategy
- OS_N | 05 - Taking into account in the medium - long term the process and objectives of restoration of marine ecosystems, as indicated in the proposed European Law on Environmental Restoration. Environmental and pressure indicators play a fundamental role, allowing to monitor the ongoing deterioration trends and act accordingly on the restoration.

Table 6.2 Indicators selected from the MSP monitoring plan and related information of the transversal principle Protection of the environment and natural resources

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
2.7	Percentage of Italian marine waters in which marine protected areas are established	A	P	Eff	%	2ANN	SA, AM	Existing, periodic flow - MITE	1 - 3
2.8	Number of marine protected areas that are managed in an equitable, ecologically representative and functionally interconnected manner	A	A	Eff	Reference to the evaluation criteria of the Marine Strategy	ANN	SA, AM	Existing flow, periodic, check timing - MITE / ISPRA / ARPA	1 - 3
2.10	Percentage of Italian marine waters in which other spatial protection / conservation measures are established - OECMs	A	A	Efff	%	ANN	SA,AM	Esistente MITE - UNEP WCMC	1 - 2
2.11	Integration of Water Directive monitoring plan indicators for integration of aspects related to land-sea interactions	A	P	Eff	Reference to the biological, physical, and physico-chemical quality elements of the Water Directives	ANN	SA	Existing, periodic flow, check timing and spatial coverage of the data - MITE / ISPRA / ARPA	3
2.12	All indicators used in MSFD monitoring in the context of descriptor 5 to integrate aspects related to land-sea interactions	A	P	Eff	Reference to the evaluation criteria of the Marine Strategy	ANN	SA	Existing, periodic flow, check timing and spatial coverage of the data - MITE / ISPRA / ARPA	1 -2- 3
2.13	Cumulative impacts are within precautionary limits (link with MSFD monitoring)	P	A	Eff	Reference to the evaluation criteria of the Marine Strategy	ANN	SA, AM	new - MITE / ISPRA	1 - 2
2.14	Update of management plans for protected areas. Where absent or not adequately updated, monitor their formulation or reformulation within 1 year	G	A	Av	n. Plans floor	3ANN	SA	new - MITE/REGIONI	1
2.15	Presence of adequate wastewater and waste management plans in ports. Where absent formulation within 1 year. Ref. ISPRA GRRinPORT project.	G	A	Av	n. Plans floor	3ANN	SA	new - System Authority	3
2.16	Abundance of populations of marine species listed in the Habitats Directive, the Birds Directive or the SPA / BD Protocol	A	P	Eff	Reference to the criteria of the Marine Strategy and related parameters	ANN	SA	Existing, periodic flow, check timing and spatial coverage of the data - MITE / ISPRA / ARPA	1

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
2.17	Demographic characteristics of populations of marine species listed in the Habitats Directive, the Birds Directive or the SPA / BD Protocol	A	A	Eff	Reference to the criteria of the Marine Strategy and related parameters	ANN	SA	Existing, periodic flow, check timing and spatial coverage of the data - MITE / ISPRA / ARPA	1

6.5.4.4 Cross-cutting principles - Landscape and cultural heritage

The theme of the landscape and the protection of cultural heritage within the Maritime Space Plan is not easy to define because it is closely related to other themes and due to its transversal characteristic. As defined by the European Landscape Convention (2000), the character of a portion of the territory is linked to the perception of the populations and to different natural and anthropogenic factors that interact with each other over time. The strategic objectives relating to this area are formulated as follows:

- OS_PPC | 01 - Support the landscape value of the coastal strip. The coastal strip is protected by legal and declared landscape constraints: the monitoring of illegal proceedings can provide information on compliance with these constraints even if for each power of attorney and municipality it is necessary to evaluate other variables that affect
- OS_PPC | 02 - Promote the recovery and redevelopment of buildings and areas subject to protection. It is not easy to develop qualitative indicators for the recovery and redevelopment interventions, in a first phase to monitor the projects on the subject at national and European level both in terms of number and budget
- OS_PPC | 03 - Promote and support the conservation of the underwater archaeological heritage. The national superintendency dedicated to underwater heritage has only been operational for a short time: the indicators with respect to the activity of this body are significant
- OS_PPC | 04 - Promote regional and international collaboration on the subject. Monitoring of ongoing projects on the topic
- OS_PPC | 05 - Promote and create awareness of intangible cultural heritage. Monitoring of ongoing projects on the topic
- OS_PPC | 06 - Tackling illegal building on coastal areas. Monitoring of ongoing projects on the topic

The coastal strip referred to in OS1 falls within the protected areas pursuant to art. 142 of Legislative Decree 42/2004 but also hosts numerous properties protected under art. 10 and assets of public interest ex. art. 136. In this system of protection, therefore, natural components (for which a good level of environmental indicators should mean an effectiveness of protection) and human works that necessarily require maintenance, conservation and enhancement interventions are intertwined. Very often the nature of the protected assets is also made up of intangible aspects from which, for example, derives the need to protect the activities traditionally linked to the coastal environment and land-sea interactions. The matter is subject to interventions and prescriptions both by the regions and by the state according to a division of competences that sometimes presents aspects still to be clarified, therefore an integrated management is also required of the control and monitoring process that cannot ignore the involvement of the Regions, in the implementation of the Landscape or Territorial Plans of their competence, of the Single Superintendencies, bodies competent to issue the landscape authorization and ultimately the same municipalities that are involved in the processes of authorization and control of building transformations that impact on the elements of the landscape. Given the difficulty of developing qualitative indicators on a matter of this complexity, it is proposed to monitor the control activity of the bodies in charge and the execution of judicial proceedings, despite the case of a limited number of complaints in the prosecutor's office could be due to the inaction of the supervisory bodies and not the scarcity of violations. Within the annual report on fair and sustainable well-being, ISTAT publishes an indicator on the rate of unauthorized building developed in collaboration with CRESME, which if available at the municipal level could offer a measure of the pressure on the coastal landscape and on restricted real estate.

Similarly, the ISTAT survey of the crimes for which the judicial authority has initiated the criminal action can return a number of violations to the Landscape Code even if the details should be deepened (currently by province). The Legambiente report used in the past a census of the demolition orders carried out and not carried out, a survey to which a few municipalities responded, but a similar revelation could be entrusted to the Regions as part of the actions relating to the landscape plan. Along the Italian coast there are also 4 Unesco sites: the natural site of the Aeolian Islands and the cultural ones of Portovenere and Cinque Terre, the Amalfi Coast, Venice and the Lagoon. Managing authorities can provide indicators on the status of the site and the pressures to which each area is subjected.

Another indicator proposed concerns the completeness of the staff foreseen for the various superintendencies. As for the underwater cultural heritage, the competent national Superintendency is recently established and is the owner of the interventions provided for by the UNESCO Convention on the protection of underwater cultural heritage according to the rules of the annex to the same agreement. The activity of this office itself represents an indicator of the effectiveness of the Plan or pressure on this particular aspect.

Table 6.3 Indicators selected from the MSP monitoring plan and related information of the transversal landscape and cultural heritage principle

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
3.3	Number of fixed infrastructures at sea and distance / visibility from the coast	P	A	Av	Num	ND	SA	New, platform data and Offshore Wind from MISE / MITE visual impact estimation methodologies to be developed	6
3.4	Regional Landscape Planning Update	G	P	Av	Num	ANN	AM	New, competence of MIC, punctual detection	6
3.5	Presence of coastal area plans	G	P	Av	Num	ND	AM	New, by the Regions and MIC Superintendencies for the landscape., Punctual survey	6

6.5.4.5 Sectors and uses - Safety of navigation, maritime safety and surveillance

This sector brings together three closely related activities, the safety of navigation linked to maritime traffic, safety for people and surveillance relating to the prevention of pollution. These matters are largely managed at community level through the European Union Agency for Safety at Sea (EMSA) which is also responsible for maintaining a monitoring program on pollution events from oil spills with the use of satellite data. .

On a national level, the General Command of the Port Authorities contributes to the European project and carries out aerial remote sensing activities with the means provided. For the part related to the safety of navigation of the safety regulations, it is believed to be able to rely on the control activity carried out by the individual harbor offices which carry out, among their institutional tasks, traffic control and SAR units.

Table 6.4 Indicators selected from the MSP monitoring plan for the navigation safety, maritime and surveillance sectors

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
4.1	Number of Oil Spill Events Detected - CleanSeaNet Program (surveillance)	P	P	Eff	Num events	ANN	SA	Existing, EMSA, requires a data verification and harmonization from MIMS / MITE data flow to be established	2

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
4.2	Number of Oil Spill events detected - MARICOGECAP Environmental Remote Sensing Program (surveillance)	P	A	Eff	Num events	ANN	SA	Existing, EMSA, requires a data verification and harmonization from MIMS / MITE data flow to be established	2

6.5.4.6 Sectors and uses - Fishing

The theme related to fishing presents six main SOs as follows:

- OS_P | 01 - Promote the sustainable development of the fish supply chains. The socio-economic and governance indicators proposed make it possible to collect data which, once integrated, give complete information on the state of growth and production of the sector, its level of development with a view to technological advancement and promotion of human capital with an eye to regarding the health and safety of fishermen
- OS_P | 02 - Encourage the implementation of the forecasts of the European and National Management Plans in the Sub-Geographical Areas (GSA). The socio-economic and governance indicators proposed make it possible to collect data which, once integrated, give complete information on the state of growth and production of the sector, its level of development with a view to technological advancement and promotion of human capital with an eye to regarding the health and safety of fishermen. The pressure indicators make it possible to monitor the level of environmental sustainability of the sector.
- OS_P | 03 - Promotion, development and spatial management of small-scale coastal fishing practiced with sustainable techniques. The socio-economic and governance indicators proposed make it possible to collect data which, once integrated, give complete information on the state of growth and production of the sector, its level of development with a view to technological advancement and promotion of human capital with an eye to regarding the health and safety of fishermen. The pressure indicators make it possible to monitor the level of environmental sustainability of the sector.
- OS_P | 04 - Promote the creation of areas aimed at the reconstitution and protection of fish stocks and protection of Essential Fish Habitats (EFH). The progress in achieving this SO is monitored through governance indicators relating to the implementation of cross-border agreements in favor of the restoration of biodiversity and the protection of fish stocks also in transnational areas, and effectiveness indicators through the definition of new areas used as ZTB and FRA
- OS_P | 05 - Encourage cooperation between States in order to reach concerted measures for the sustainable management of the activities of their respective national fisheries sectors The progress in achieving this OS is monitored through governance indicators relating to the implementation of cross-border agreements in favor of restoration of biodiversity and protection of fish stocks also in transnational areas
- OS_P | 06 - Control and fight against illegal fishing. Progress in achieving this OS is monitored through governance indicators relating to the presence and implementation of programs dedicated to combating illegal fishing.

The proposal of priority monitoring indicators linked to this theme integrates the indicators used by the three-year national program of the EMFF 2014-2020 as these have been assessed as consistent with the Plan's EMP.

However, there is a need to make the data produced by this national program complete from a spatial and temporal point of view. For this to happen, the data relating to the indicators shown in Table 3 must be collected and provided on an annual / three-year basis in order to have constantly updated data.

These data will then be further analyzed in correspondence with the mid-term review to verify the variation in the results of the measures implemented by the Plan over time and inform the Plan itself. The data must also be aggregated and provided on a basin and / or sub-area scale in order to make them complete in spatial terms.

Several indicators used in the monitoring sub-programs of the Marine Strategy were evaluated as suitable with those identified as priority and integrated. The data collected using these indicators are consistent but their completeness on a spatial and temporal scale must be ascertained.

Table 6.5 Indicators selected from the MSP monitoring plan and information relating to the Fisheries sector

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
5.2	No. of projects relating to the protection and restoration of biodiversity and marine ecosystems	G	A	Av	No. of projects	ANN	AM, SA	existing data flow, periodic, check timing - MIPAAF - EMFF	1
5.4	Percentage of Italian marine waters in which ZTB and FRA are established	A	P	Eff	% area	ANN	AM	new -MIPAAF	1
5.5	Number of ZTBs and FRA established	A	P	Eff	n° di ZTB and FRA	ANN	AM	new -MIPAAF	1

6.5.4.7 Sectors and uses - Aquaculture

The theme of aquaculture has two strategic objectives listed below:

- SO 1 Promote sustainable growth of the aquaculture sector The combination of socio-economic and governance indicators, both progress and effectiveness, allows monitoring of the growth and sustainability of the sector
- SO 2 Promote quality aquaculture and support the process of defining AZAs (Allocated Zones for Aquaculture - priority areas for aquaculture). The combination of indicators- socio-economic and governance, including effectiveness, allows the monitoring of the growth and sustainability of the sector

Table 6.6 Indicators selected from the MSP monitoring plan for the Aquaculture sector

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
6.8	Change in the volume of organic aquaculture production	SE	P	Av	ton	ANN	SA	existing data flow, periodic, check timing - MIPAAF - EMFF	2
6.12	No. of projects to reduce the impact of aquaculture on the environment (eco-management systems and audits, environmental services related to organic aquaculture)	G	P	Av	n° progetti	ANN	AM, SA	existing data flow, periodic, check timing - MIPAAF - EMFF	2

6.5.4.8 Sectors and uses - Maritime transport

With regard to the theme of maritime transport, the SO (see Annex 1) of the Plan envisage an improvement in environmental aspects, greater collaboration with other sectors and integrated logistics and an improvement in performance in relation to the National Port and Logistics Plan.

The integration with other existing planning systems is more difficult to quantify.

- OS_TM | 01 - Promote sustainable development of maritime transport and reduce its negative impacts Objective linked to sustainability indicators promoted in the context of specific projects by the individual port authorities (eg. ECOPORTS 7.1-7.10). routine (7.13).
- OS_TM | 02 - Promote the use of alternative fuels, reduce discharges into the sea, improve port facilities for the collection of waste and cargo residues and / or encourage the use of these facilities, improve the management of dredged sediments. of collaboration are largely dictated by regulatory indications or by market needs: however difficult it is necessary to carry out a survey of the activities in progress and of the supra-national bodies.

- OS_TM | 03 - Promote European and regional collaboration on maritime transport and multimodality. Particular reference to governance indicators 7.29 and 7.30.
- OS_TM | 04 - Helping to increase the competitiveness of Italian ports, sharing "best practices" and implementing the National Strategic Plan for Ports and Logistics (PSNPL) The PSNPL contains a series of actions but few performance indicators: a careful reading of the numbers present in the statistics detected by ESPO and programming the data flow automatically to identify the trends
- OS_TM | 05 - Promote the integration and dialogue between existing planning systems, in particular regarding the integration of strategic port planning, land planning and sea plans These are planning tools that involve different actors: here too a survey is useful activities in progress and a reading of scientific production in the context of maritime spatial planning may be useful.

The sector is mature and highly digitized, numerous socio-economic indicators can be obtained from the periodic data collection of institutional subjects (ISTAT, EUROSTAT, ESPO) and from socio-economic surveys concerning the sector. In particular, the ESPO (European Sea Ports Organization) secretariat prepares a report on the performance of European ports from a sustainability perspective (Ecoports) to which not all Italian ports contribute but which can represent a reference point for identifying homogeneous indicators that they can be easily detected by the Port System Authorities. Also from the ESPO institutional website, the deliverables of the Portopia project are available, which give valuable methodological indications for performance indicators related to the integration of ports in the cross-border network. In addition, in many ports the PMIS (Port Management Information System) is implemented for the computerized management of the vessel from which it is possible to extract aggregate information according to the aspects of interest.

Table 6.7 Indicators selected from the MSP Monitoring Plan and related information from the Shipping sector

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
7.13	Port area air quality	A	P	Eff	Num sforamenti	MENS	SA (porto)	existing, competent ARPA, automatic data flow	2

6.5.4.9 Sectors and uses - Energy

The Plan orients the theme of energy towards the development of the sectors of the production of renewable sources of energy from the sea with particular reference to wave motion, tides and currents, solar, also through the identification of suitable areas. It pays attention to enhancing environmental, social and economic sustainability by identifying marine areas for the activity of CO2 capture and geological storage and defining, where permitted, the carrying out of prospecting, research and cultivation of hydrocarbons. It also helps to promote European cooperation. To follow the relative OS.

- OS 1 Contribute to promoting the energy transition towards renewable sources and low emissions through the development of renewable energy production offshore Through governance indicators capable of monitoring the progress of the respective sectors, accompanying them towards their birth and development. To support, pressure indicators were chosen from the MSFD monitoring program capable of identifying the effects of the installations on the marine environment in terms of noise pollution and the ecological status of the waters.
- OS 2 Pursue the environmental, social and economic sustainability of the prospecting, research and cultivation of hydrocarbons at sea
- OS 3 Promote the conversion of platforms and infrastructures associated with depleted fields and the synergies between compatible maritime activities
- OS 4 Promote European and regional cooperation in the field of energy Through governance indicators capable of monitoring the progress of the treaties to which Italy will be a part.
- OS 5 Promote the planning of areas suitable for CO2 capture and geological storage Through governance indicators capable of monitoring the progress of the respective sectors, accompanying them towards their

birth and development. To support, pressure indicators were chosen from the MSFD monitoring program capable of identifying the effects of the installations on the marine environment in terms of noise pollution and the ecological status of the waters.

Table 6.8 Indicators selected from the MSP monitoring plan and related information from the Energy sector

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
8.1	Definition of the "baseline level" for continuous low frequency sounds ("ambient noise") in the three marine sub-regions (Indicator 11.2.1 of the SPr. 7.2 MSFD)	P	A	Eff	decibel	ANN	AM	existing MITE - MSFD automatic flow program	2
8.5	Number of installations of offshore and wave wind turbines that favor the birth and growth of the energy production from the sea	G	P	Av	N° pale eoliche	ANN	AM	new MITE periodic flow action	2 - 6

6.5.4.10 Sectors and uses - Coastal defense

- OS1 Promote the development, harmonization and implementation of the strategies and measures for the defense of the coast and the fight against erosion envisaged in the Flood Risk Management Plans prepared at the Hydrographic District scale in compliance with the provisions of the Floods Directive (2007/60 / CE) and in the Coastal Plans / Integrated Coastal Management Plans prepared by numerous regions The combination of socio-economic and governance indicators, both progress and effectiveness, allows the monitoring and harmonization of the sector between the different Regions / Sub areas (9.1, 9.10- 9.16).
- OS2 Ensure the best consistency between the uses and vocations of use of the sea provided for in the PSM Plans and coastal uses, with reference to their protection in a scenario of necessary adaptation to ongoing climate change The identified pressure and environmental indicators allow monitoring the state of the coast and the progress / effectiveness in possible climatic scenarios (9.3-9.5).
- OS3 Consider and adequately address the issue of the use and protection of submarine sands for nourishment, to be considered as a strategic resource for coastal defense and adaptation plans The combination of pressure and socio-economic indicators allows to monitor the quantity and the nourishment interventions annually (9.2; 9.6).

Table 6.9 Indicators selected from the MSP monitoring plan of the Coastal Defense sector

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
9.1	Beaches subject to erosion	P	P	Eff	km	ANN	AM	existing ISPRA automatic flow program	5
9.2	Costal nourishment interventions	G	P	Eff	Mc	ANN	AM	existing ISPRA automatic flow program	5
9.5	Volume of waste collected for a given length of coastline	P	A	Eff	mc	ANN	SA	existing ISPRA automatic flow program	3
9.7	Percentage of coverage of protected areas along the coast	A	P	Eff	%	ANN	AM	existing ISPRA automatic flow program	1
9.8	Coverage of protected areas along the coast	A	P	Eff	ettari	ANN	AM	existing ISPRA automatic flow program	1
9.10	Undeveloped coastal area converted to developed area	A	P	Av	ettari	ANN	AM	existing ISPRA automatic flow program	1
9.14	Submerged beach slope	P	A	Eff	m	ANN	SA	existing ISPRA automatic flow program	5

9.16	Volume variation of the emerged and submerged beach	A	P	Eff	mc	ANN	AM	existing ISPRA automatic flow program	5

6.5.4.11 Sectors and uses - Tourism

With regard to the topic related to tourism, the SO of the Plan (see Annex 1) provide for greater attention to the different forms of tourism and the impact they have on the environment and coastal landscape.

The Plan also promotes the organic management of the coastal tourist offer, also by encouraging dialogue with other economic sectors of the sea.

- OS 1 Promote sustainable forms of coastal and maritime tourism With the same number of arrivals and presences, measure the seasonal concentration and impacts (indicators 7.1, 7.2…). The indicators make it possible to monitor aspects related to tourism such as the amount of waste and electricity in terms of both effectiveness and progress
- OS 2 Promote coherent planning actions on land and at sea, including for tourism purposes The combination of governance and socio-economic indicators makes it possible to monitor sustainable tourism actions promoted regionally along the coastal area.
- OS 3 Contribute to the diversification of tourism products and services and to contrast the seasonal demand for inland, coastal and maritime tourism The combination of governance and socio-economic indicators makes it possible to monitor sustainable tourism actions promoted regionally along the coastal area.

The existing indicators provide a variety of elements to monitor which allow to obtain an updated seasonal and annual framework capable of identifying the facets of which tourism, in its forms, is composed. The impact on the environment and on the local economy are certainly the two most influential issues on which monitoring is focused and numerous indicators are available from the periodic ISPRA data collection and from the Bathing Water Monitoring Plan (2006/7 / EC) which can provide useful information on the state of water quality in terms of physical, geographical, hydrological and biological characteristics, also identifying the causes of biological pollution if found suddenly.

Other indicators, focused more on sustainable tourism, can be obtained from the ETIS Toolkit.

Tabella 6.10 Indicatori selezionati dal Piano di monitoraggio MSP e relative informazioni del settore Turismo

ID	Indicator	typology	P/A	Eff/Av	Unit of measure	Frequency	Scale	Origin and characteristics	Environmental component concerned
10.9	Number of "blue flags" assigned to the various Italian regions for ISPRA-Ambiente's beaches and tourist ports	A	P	Av	N	ANN	NAZ, REG	existing ISPRA flow program	3
10.12	Percentage of beaches awarded with the Blue Flag (Additional indicator of the ETIS + ISPRA-environment Toolkit)	A	P	Eff	%	ANN	SA	automatic	3
10.15	Environmental pressure of the main tourist infrastructures: tourist ports	P	P	Eff	N° posti barca x Km costiero	ANN	SA	existing ISPRA flow program	2

6.5.5 Monitoring of the contribution of the PGMS to the sustainability of the environmental context

The assessment of the effects of the Plan on the sustainability objectives, or the environmental performance of the MSP, will be carried out starting from the estimate of the contribution of the Plan actions to the variation of the context indicators associated with the same sustainability objective. The estimate of this contribution will make it possible to evaluate, albeit qualitatively, the direction that the Plan is taking with respect to the achievement of the chosen sustainability objectives. The choice of the contribution indicators for monitoring will be determined, in consideration of the close connection between the specific objectives of environmental sustainability and the actions to be implemented through the MSP: the indicators must, therefore, be able to provide useful information to verify that the planned interventions contribute, at Plan level, to the achievement of the sustainability objectives, as described in the Environmental Report. In this sense, the EMP will be implemented over time on the basis of the contribution of the implementation of the Plan strategy to the achievement of sustainability objectives through the measurement of changes in the environmental context.

The methodological process consists of three activities: in the first, the implementation status of the Plan is described, selecting the performance / process indicators with respect to the actions of the Plan on which it has been chosen to focus monitoring. The second phase of environmental monitoring describes the contribution of the actions considered on the reference environmental context and on the specific sustainability objectives, through the use of contribution indicators, developed starting from the process indicators.

Finally, the data relating to context indicators are collected, to verify progress with respect to the achievement of sustainability objectives. It is essential to keep in mind that the definition of "context", despite the proposed Plan concerns the national and cross-border territorial context, could be dimensioned with respect to specific areas of influence of the probable environmental impacts. The monitoring of the indicators will be carried out only for a limited and representative set of actions, selected from all those foreseen.

The information proposed and identified that will be provided, processed and evaluated in the environmental monitoring reports are summarized in the following tables as a contribution to the implementation of the MSP in compliance with the objectives of environmental sustainability. Similarly, the contribution that the mitigation and / or compensation actions that may be highlighted in the Environmental Report, or that may become necessary during implementation, provide to the achievement of the sustainability objectives or to the neutralization of the impacts will be monitored. protected areas.

6.5.6 Environmental assessment and diagnosis

In the environmental report it will be represented how the phenomena capable of "moving" the values of the context indicators may have a more or less strong relationship with the actions of the Plan, some of the phenomena measured may receive impetus from other sector plans or be moved by similar and complementary plans. For these reasons, recalling the contents of the guidelines of the Ministry of the Environment and ISPRA, the diagnosis phase requires that in the analyzes all the possible causes, endogenous and exogenous, of any failure to achieve the objectives of MSP are taken into consideration. . These include, by way of example:

- Incorrectness of the forecasts regarding the performance of the indicators with which the reference scenario was constructed: this could depend on changes in the main trends caused by changes in the context or by the launch of specific policies and programming;
- Conflicts between those involved in the implementation process;
- Methods for implementing and managing the interventions of plans other than those planned;
- Unexpected effects resulting from the implementation of the interventions, or expected effects but with a different trend than that actually occurred;
- Introduction of new technologies and modifications of the reference objectives;
- Any implementation of other Plans, including those of a superordinate nature, or the completion (entry into operation) of particular operations for which the relative management phases have been activated;
- Changes to regulatory frameworks that could significantly change the context or operational needs (redefinition of threshold values, for example in the emissions sector or for ambient air quality).

The diagnosis should make it possible to define the correlations between the actions implemented by the MSP and the changes in context indicators, measuring the "share of changes" attributable or not attributable to the Plan, for this reason the following must be taken into consideration:

- actions not implemented;
- actions implemented but found to be ineffective;
- actions implemented, the effects of which can be measured over a long period;

- unexpected impacts resulting from the implementation of the actions;
- unexpected changes in the environmental context.

The diagnosis phase must also be represented schematically in the monitoring reports through a schematic representation of which an example is given in the following table 6.16:

POSITIVE IMPACTS ON THE CONTEXT	NEGATIVE IMPACTS ON THE CONTEXT
Direct:	To be completed during the implementation of the Monitoring Plan
Indirect:	To be completed during the implementation of the Monitoring Plan

6.5.7 Execution, correction and possible reorientation of the MSP

If the diagnosis phase highlights the existence of significant deviations between the forecasts of the MSP and the Environmental Report and the real environmental scenario, the causes of the ineffectiveness in pursuing the objectives or the non-sustainability of the effects will be identified, indicating whether whether or not it is necessary to carry out reorientation activities (therapy), which also includes any financial maneuvers aimed at guaranteeing the usability of resources. In the monitoring report, a simplified formulation will be used to illustrate any decisions to modify the Plan or its implementation rules; in the therapy phase, the need to carry out new environmental assessments or not is also indicated.

Therapy is aimed in this sense to indicate, on the basis of the results of the diagnosis, on which aspects of the Plan it is appropriate to intervene and how. The therapy phase could be concluded, in a nutshell, with the proposal to reprogram the planning forecasts based on the achievement of certain expected results.

In these cases, the context indicators will still be monitored and for any changes, the absence of correlation with the Plan itself will be acknowledged. If, on the other hand, there are problems of deviation from the reference scenario envisaged, it will be possible to reformulate the planning alternatives in the light of the changes in the scenario. The detection of the potentially negative effects and the possible related mitigation and / or compensation measures that the RA will provide, based on the objectives, actions and environmental effects envisaged by the Plan itself, will make it possible to express an ex post evaluation of the Plan that can reactivate a process of revision or updating of the tool, retracing, in an iterative way, the same phases that determined its implementation.

6.5.8 Implementation of the environmental monitoring program of the Italian MSP

The proposed environmental monitoring program of the Management Plans of the Italian Maritime Space is intended from a circular point of view (Figure 6.7), ie its structure allows it to be constantly updated with respect to the needs of the Plan. It is necessary that the EMP is in continuous communication with the implementation process of the MIPs with two main objectives:

1. adapt over time according to the level of development of each sector and the objectives of the Plan which may vary in number, content and level of detail over time and space;
2. support the development of an adaptive plan process by promptly informing the implementation of the PSMs on the basis of the knowledge acquired during their monitoring, thus ensuring the implementation of plan measures adequate to meet the objectives of those in charge.

The proposed MIP monitoring program foresees a period of time during which the integrated MAP must be prepared through the coordination of the authorities responsible for the existing sectoral monitoring programs. In this period of time, the creation of sectoral monitoring programs is foreseen if absent but necessary. Once the EMP has been implemented, annual or seasonal monitoring of all the proposed indicators is envisaged with the relative data collection that must be transmitted to the competent authority and the TC. Medium-term reviews are suggested that allow data to be analyzed within a suitable time frame to trace the trajectory of the PSM in terms of efficiency. A technical report is expected to be drawn up for each mid-term review.

6.5.8.1 Risk analysis and proposed mitigation actions for the Management Plans of the Italian MSP

To complete the monitoring plan, the possibility of unforeseen events must be considered according to the custom used in project management. The word "risk" in this discipline identifies any event which, if it occurs, can have an impact on the success of the monitoring, impacts that can be both negative and positive.

For each possible event, an attempt will be made to estimate the probability of occurrence, the impacts on the EMP and to prepare possible responses in advance. The resources to be assigned to the preparation of the answers are linked to the probability of the event and its estimated impact. Each hypothesis, therefore, can represent both a threat (in case of negative impacts) and an opportunity to improve the project.

The table below is included as an example and must necessarily be completed in the start-up and implementation phase of the monitoring.

Risk description (also with reference to existing monitoring programs)	Probability	Impacts on monitoring	Possible responses depending on the impact detected
Interruption of a data flow by a person in charge	Average	Neg	• modification of the monitoring plan and exclusion of the flow • replacement with coherent data at different spatial / temporal scales
Time discrepancy of data between different sources	High	Neg	• identification of a subject who integrates the data with reduction to the less detailed scale • competent authority intervention to align the data to the most detailed scale • interpolation / estimate by a qualified person
Disruption of a good monitoring program	Low	Neg	• absorption of the program by another competent person
Availability of remote sensing data at higher resolution	Average	Pos	• modification of the monitoring and integration plan of the new flow
Validity and authorization of the data	Average	Neg	• replacement of the data or exclusion of the indicator
Production of information that is neither spatialized nor spatializable	Average	Neg	• intervention on the competent subject to make him produce compliant information • correction and spatialization of information

Table 6.11 Possible unforeseen events (risks) capable of influencing the success of the EMP and proposal of related mitigation measures

List of annexes to the Environmental Report

Annex I	Feedback to the observations and recommendations of the competent environmental subjects (SCA)
Annex II	Response to the observations and recommendations of the Technical Commission for Environmental Impact Verification - VAS Subcommittee of the MiTE;
Annex III	Matrix of analysis of the external coherence between the strategic objectives of the PGSM and the objectives of the relevant Plans / Programs
Annex IV	Internal consistency analysis matrix between strategic objectives and national measures of the PGSM and environmental sustainability objectives and related targets
Annex V	Internal consistency analysis matrix between specific objectives and regional measures of the PGSM and environmental sustainability objectives and related targets
Annex VI	Correlation matrix between anthropogenic uses of the sea, pressures, effects and environmental components
Annex VII	Verification matrix of compliance with the DNSH principle for national measures of the PGSM
Annex VIII	Verification matrix of compliance with the DNSH principle for regional measures of the PGSM
Annex IX	Environmental Impact Study
Annex X	Analysis of the state of the art in the transposition of Directive 2014/89 / EU at a cross-border level (EU and non-EU countries)
Annex XI	Non-Technical Summary

List of drawings attached to the Environmental Report

Nr	Nome	Description
1	PGSM_ADR_AMBD001_AMP	Marine Protected Areas Charter
2	PGSM_ADR_AMBD002_EBSA	Charter of EBSA areas and Priority Areas with the value of environmental protection
3	PGSM_ADR_AMBD003_EBSA_A1	Map of the EBSA A / 1 "Northern Adriatic" area
4	PGSM_ADR_AMBD004_EBSA_A4	Map of the EBSA A / 4 "Central Adriatic" area
5	PGSM_ADR_AMBD005_EBSA_A6	Map of the EBSA area A / 6 "Southern Adriatic"
6	PGSM_ADR_AMBD006_Habitat fondo	Background Habitat distribution map
7	PGSM_ADR_AMBD007_Porti	Port distribution map
8	PGSM_ADR_AMBD008_Posidonia	Map of the distribution of Posidonia oceanica
9	PGSM_ADR_AMBD009_BeniCulturali_A1	Charter of cultural and landscape heritage in Sub-Area A / 1
10	PGSM_ADR_AMBD010_ BeniCulturali _A2	Charter of cultural and landscape heritage in Sub-Area A / 2
11	PGSM_ADR_AMBD011_ BeniCulturali _A3	Charter of cultural and landscape heritage in Sub-Area A / 3
12	PGSM_ADR_AMBD012_ BeniCulturali _A4	Charter of cultural and landscape heritage in Sub-Area A / 4
13	PGSM_ADR_AMBD013_ BeniCulturali _A5	Charter of cultural and landscape heritage in Sub-Area A / 5
14	PGSM_ADR_AMBD014_ BeniCulturali _A6	Charter of cultural and landscape heritage in Sub-Area A / 6
15	PGSM_ADR_AMBD015_Sensibilità_AMP-ZTB-FRA_SubAree	Sensitivity map of the System of Protected Areas, Biological Protection Zones and Fisheries Restricted Areas at the Sub-Area level
16	PGSM_ADR_AMBD016_Sensibilità_AMP-ZTB-FRA_UP	Sensitivity map of the System of Protected Areas, Biological Protection Zones and Fisheries Restricted Areas at UP level
17	PGSM_ADR_AMBD017_Sensibilità_Paesaggio	Environmental sensitivity chart for the landscape component
18	PGSM_ADR_AMBD018_Visibilità_eolico	Map of the potential risk of perception of offshore wind farms Sub-Areas A3-A4-A5-A7)