

# Relationship between LSI and ICZM

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Supporting Implementation of Maritime Spatial Planning  
in the Western Mediterranean region

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Coordinator	Marina Marković, PAP/RAC
Authors	Emiliano Ramieri Martina Bocci Marina Marković
Contributions	Castellani, C. (Thetis) Addis, D. Mourmouris, A.  <b>Project partners:</b> Barbanti, A., Farella, G., Sarretta, A. (CNR-ISMAR) Campillos-Llanos, M., Cervera Nunez, C., Gómez-Ballesteros, M. (IEO) Bassan, N., Gissi, E., Innocenti, A., Manea, E., Musco, F. (IUAV) Braidà, M., Celli, A., Montanaro, O. (MATTM) Borg, M. (PA Malta) Carval, D. (SHOM)
Editing	Barić, B. (PAP/RAC) Pavasović, S.
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## List of Acronyms

BPZ	Biological Protection Zone
CAMP	Coastal Area Management Programme
CBD	Convention on Biological Diversity
CNR-ISMAR	Italian National Research Council - Italian National Institute of Marine Sciences ( <i>Consiglio Nazionale delle Ricerche/Istituto di Scienze Marine</i> )
CO <sub>2</sub>	Carbon Dioxide
COP	Conference of the Contracting Parties
d.lgs.	Legislative Decree ( <i>Decreto legislativo</i> )
DPCN	Department of Civil Protection ( <i>Dipartimento della Protezione Civile</i> )
EC DG MARE	European Commission's Directorate General for Maritime Affairs and Fisheries
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ESaTDOR	European Seas and Territorial Development, Opportunities and Risks
ESPON	European Spatial Planning Observation Network
EU	European Union
GES	Good Environmental Status
GIS	Geographic Information Systems
ICM	Integrated Coastal Management
ICZM	Integrated Coastal Zone Management
ICM	Integrated Coastal Management
IEO-CEDEX	Spanish Institute of Oceanography – Commercial Autonomous organism Ascribed to Ministry of Public Works ( <i>Instituto Español de Oceanografía – Centro de Estudios y Experimentación de Obras Públicas</i> ) Independent Evaluation Office-Civil Engineering Research Agency (Spain)
ISPRA	Italian National Institute for Environmental Protection and Research ( <i>Istituto Superiore per la Protezione e la Ricerca Ambientale</i> )
IUAV	University in Venice, Italy
Km	Kilometre
LSI	Land-Sea Interaction
MAP	Mediterranean Action Plan
MATTIM	Italian Ministry of Environment, Land and Sea Protection
MPA	Marine protected Area
MSP	Marine/Maritime Spatial Planning
MSFD	Marine Strategy Framework Directive
MSSD	Mediterranean Strategy for Sustainable Development
Mt	Metric ton
NM	Nautical mile
NSSC	National Strategy for the Sea and Coasts
PA	Planning Authority, Malta
PAP/RAC	Priority Actions Programme Regional Activity Centre
PGRA	Management Plan of Flood Risk ( <i>Piano della Gestione del Rischio Alluvione</i> )
PBTs	Persistent, Bioaccumulative and Toxic Chemicals
RBMP	River Basin Management Plans
SCI	Site of Community Importance
SCOT	Territorial Coherence Scheme ( <i>Schéma de Cohérence Territorial</i> )
SDG	Sustainable Development Goal
SEA	Strategic Environmental Assessment
SHOM	Service Hydrographique et Océanographique de la Marine
SIMWESTMED	Supporting Implementation of Maritime Spatial Planning in the Western Mediterranean region
SPZ	Special Protection Zone
SPED	Strategic Plan for Environment and Development

SUPREME	Supporting Maritime Spatial Planning in the Eastern Mediterranean
TAP	Trans-Adriatic Pipeline
UN Environment	United Nations Environment Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WFD	Water Framework Directive

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## Foreword

The preparation of this document overlaps with the parallel activity and preparation of the document *“How to perform analysis of land-sea interactions, combining MSP and ICZM in the considered project area”*, undertaken within the framework of **SUPREME** project.

*Performing and finalisation of these outputs will be undertaken and presented in a synergic way, for the overall benefit of SUPREME and SIMWESTMED project partners.*



# 1. Introduction

The term “land-sea interactions” (LSI) is usually used in the context of planning and management of marine and coastal areas. The interactions between the terrestrial and marine areas may include, for example, the outflow of contaminants from a terrestrial agricultural area to a freshwater body, which is in contact with the coastal waters, as well as the laying of a submarine cable in the intertidal area to connect an offshore wind farm to the national power grid.

Most of the activities taking place in the marine environment also have a terrestrial component or connection. The coherence and integration between the planning of marine and terrestrial spaces are important and should be achieved through consistency of policies, plans and decisions.

Almost all maritime uses require ground support installations. Some uses, mostly on the ground (for example, beach tourism, water-front, ports), extend their domain also at the sea. These interactions should be identified and mapped, in order to assess their cumulative impacts and potential conflicts and synergies.

With the rapid expansion of maritime economy these connections are becoming more and more relevant. In fact, significant increase in maritime activities has already determined relevant consequences on land and future trends of the sectors are expected to cause additional impacts. For example, hydrocarbon exploration projects and associated drilling activity have become more and more common in the Mediterranean in recent years, and several new gas pipelines, such as the Trans-Adriatic Pipeline (TAP) or the projected pipeline between Cyprus and Greece, are planned to respond to the need for an increased gas supply to Europe. Also, shipping is expected to increase in the Mediterranean Basin, both in number of routes and traffic intensity, for example due to the doubling of the Suez Canal. Particularly, a significant increase in tanker traffic is expected in the Eastern Mediterranean Sea due to new export routes for crude oil from the Caspian region, the development of new pipelines bypassing the Bosphorus, and the expansion of current pipeline capacity. Oil transport is set to rise to 750 Mt by 2025, with 6,700 tankers/year likely to navigate, unless the implementation of renewable energy policies succeeds in scaling down this scenario. Fast growth rates in cruise tourism have been observed in recent years and this sector is likely to continue to increase significantly in the future, driven by a growing European market demand. While past growth for the tourism sector was concentrated in the north-western Mediterranean Sea, future growth will be experienced throughout the Mediterranean Basin with a rapid growth forecast for Croatia, Greece, and Morocco, and for areas with a wealth of biodiversity (Piante & Ody, 2015).

Being aware of these trends and of the above-mentioned interlinks, the land-sea interactions and related processes constitute one of the three core themes **of the Mid-Term Strategy 2016-2021 of UN Environment /MAP** adopted with Decision IG. 22/1 (COP 19, Athens, Greece, 2016), and correspond to the **first objective** of the Mediterranean Strategy for Sustainable Development (MSSD) 2016-2025, adopted with Decision IG 22/2 (COP 19, Athens, Greece, 2016) and to the **Sustainable Development Goals 14** (*Conserve and sustainably use the oceans, seas and marine resources for sustainable development*) **and 15** (*Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss*). Indeed, the goals of “Life below water” (SDG 14) and “Life on land” (SDG 15) are strictly interconnected though LSIs. For example, the need to halt and invert the deterioration of coastal waters due to pollution and eutrophication is a key issue for SDG 14. SDG 14 also deals with challenges related to fisheries management and marine protected areas; these activities represent some of the key

elements of LSI, as illustrated in the next chapter. As all maritime activities have impacts on land and particularly on coastal areas, LSI analysis and sustainable management are key to achieve SDG 15 goals as well (protection of key biodiversity areas, halting of biodiversity loss, also through halting wildlife poaching and trafficking). Indeed, knowing better the LSI and taking them in due consideration during planning and management in sea and coastal areas contributes considerably to the achievement of these SDGs.

Considering the elements above, LSI analysis shall be understood as an important component in the preparation of a coastal and/or marine plan. Anyway, LSI itself is not a new discipline, nor represents an additional requirement for coastal or marine planning activity. In the context of maritime spatial planning (MSP), the analysis of land-sea interactions is expected to inform MSP through the identification of the key elements linking the land and marine components of the coast that need to be taken into account when planning the sea space, i.e. LSI problems to be addressed and opportunities to be exploited. The same applies to land-use planning, where LSI analysis is part of ICZM. Overall, LSI analysis aims to provide the needed information for a coherent land-marine planning across the coast interface.

This document aims to provide a methodological guideline for LSI analysis within MSP, also exploring how such analysis can be embedded in the wider ICZM context. In this perspective, this document intends to support MSP planners with a possible operative framework for the LSI analysis, identifying specific actions to be carried out in close connections with the maritime spatial planning process. Finally, with specific regard to addressing the MSP Directive requirements, the ultimate scope of this document is to provide some guidance on how to (re)organise topics, information and effort, including those eventually already available from formal or informal processes (e.g. ICZM).

In addition to this introduction, the document includes other 5 chapters. Based on the analysis of the available literature, chapter 2 provides the description of some key concepts for LSI analysis, including its definition (section 2.1), different possible categorization of LSI typologies (section 2.2), and criteria that might delimitate the area of LSI analysis (section 2.3). Chapter 3 illustrates examples of LSI definitions included in the national legislation and of interactions considered particularly relevant in the countries participating to the SIMWESTMED project. Chapter 4 reflects on the step-by-step methodological guideline to perform LSI analysis within the MSP process, as proposed within SUPREME project. Links between LSI and MSP are in detail explored in chapter 5, which also discusses how outcome of the LSI analysis can be transferred in the ICZM context, referring in particular to the ICZM Protocol, as well as in other planning processes. Finally, chapter 6 provides some reflections on LSI analysis coming from the pilot cases implemented by SIMWESTMED project.

## 2. Concept

### 2.1 Definitions of LSI

Despite its high relevance, a unique definition and conceptualization of LSI has not yet been established or formalized in literature (see the list of references and the other literature consulted at the end of the document). In addition, the full picture of the process and the interactions system involve, beyond land and sea, also the air component (Mourmouris, 2017; Burns, 2017). However, for methodological issues and since the Directive 2014/89/EU on MSP is referring specifically to LSI, for the purposes of the current project focus is put on interactions between land and sea.

**The EU Directive 2014/89/EU on Maritime Spatial Planning** specifies that the planning process should take into account land-sea interactions and promote the collaboration between Member States. Without providing a definition, the Directive makes several references to the concept of LSI in:

- Art. 1, referring to the subject of the Directive;
- Art. 4, which refers to the development and implementation of maritime spatial planning. Paragraph 2 provides that, during the entire MSP process, the Member States shall take account of land-sea interactions; Paragraph 5 states that, when drawing up the maritime spatial planning, Member States shall take into account the peculiarities of the marine regions, the related activities and present the future uses and their effects on the environment, as well as natural resources, and land-sea interactions;
- Art. 6, Paragraph 2 (a), according to which one of the minimum requirements for the maritime spatial planning is that Member States take into account land-sea interactions;
- Art. 7, Paragraph 1 (“Land-sea interactions”), which describes the nature of the LSI and the relationships with the other formal or informal processes, such as integrated coastal zone management;
- LSI is also referred to in recitals 9, 16 and 18 of the MSP Directive.

Although the **ICZM Protocol** does not expressly include an LSI definition, this can be indirectly derived from Article 2 through the interpretation of the given definitions of “coastal zone” and “integrated coastal zone management”. ICZM is defined (Art. 2, lett. f) as a “*dynamic process for the sustainable management and use of coastal zones, taking into account at the same time the fragility of coastal ecosystems and landscapes, the diversity of activities and uses, their interactions, the maritime orientation of certain activities and uses and their impact on both the marine and land parts*”. Furthermore, the coastal zone is “*the geomorphologic area either side of the seashore in which the interaction between the marine and land parts occurs in the form of complex ecological and resource systems made up of biotic and abiotic components coexisting and interacting with human communities and relevant socio-economic activities*” (Art. 2, lett. e). The analysis of the interactions between land and marine components of the coast is therefore a key element of the ICZM process and includes ecological processes crossing the coastline delimitation, interactions among land and sea-based socio-economic activities and between human communities.

In June 2017, Malta hosted the “Maritime Spatial Planning Conference: Addressing Land-Sea Interactions (LSI)”, organized by the European Commission’s Directorate General for Maritime Affairs and Fisheries (DG MARE) and the European MSP Platform (<http://msp-platform.eu/>, accessed in September 2018). The conference addressed the topic of LSI within the framework of MSP providing an opportunity for

discussion and knowledge exchange among participants. The discussion revealed the complexity of the interactions between land and sea and between the environmental, socio-economic and governance elements, highlighting the need to develop a broad basic understanding of LSI issues among terrestrial and marine stakeholders. The need of an integrated territorial approach to planning and management across land and sea emerged as an important primary message. Prior to the LSI conference, a General Framework for LSI was developed, which describes LSI *“as a complex phenomenon that involves both natural processes across the land-sea interface, as well as the impact of socio-economic human activities that take place in the coastal zone”* (EC DG MARE, 2017).

A slight modification to the above definition was proposed within the CAMP Italy project (<http://iczmplatform.org/page/italy>), suggesting that the term “impact” is implicitly mainly associated with the effects of human activities. According to that project, the term impact could be hence complemented with the more generic term “influence” to better encompass also the effects of natural phenomena which are an important component of LSI. Moreover, this modification is useful, in order to clarify that LSI considers both the negative effects and the positive/acceptable effects on the marine environment, resources and activities caused by natural phenomena or human activities. Following this approach, LSI can be therefore defined as *“interactions in which land-based natural phenomena or human activities have an influence or an impact on the marine environment, resources and activities and interactions in which marine natural phenomena or human activities have an influence or an impact on the terrestrial environment, resources and activities”*.

## 2.2 Interactions between the land and the sea

The analysis of consulted literature and the available definitions of LSI – in particular those provided by the Italian Decree on MSP (Legislative Decree 201/2016)<sup>1</sup> and CAMP Italy project – highlight the double direction of LSI, **land toward sea** and **sea toward land**. Table 1 provides an example developed by the CAMP Italy project of both marine and terrestrial human activities and natural phenomena that have or might have interaction across the coast border, divided in sea-land and land-sea interactions.

Analysed literature also points out two major interactions occurring between land and sea. These have been also taken in consideration in the “Conceptual Framework for MSP in the Mediterranean” adopted in December 2017 by the Ordinary Meeting of the Contracting Parties to the Barcelona Convention (UNEP-MAP PAP/RAC, 2017). These are:

- Interactions related to **land-sea natural processes**. Implications of such processes on coastal environment and on coastal socio-economic aspects shall be identified and assessed considering their dynamic nature, in order to include them into the planning and management processes. At the same time, human activities can interfere with natural processes. The analysis of the expected impacts of land and marine activities should include the evaluation of their effects on LSI natural processes and the potential consequent effects on natural resources and ecosystem services.
- Interactions among **land and sea uses and activities**. Almost all maritime uses need support installations on land (such as the ports for shipping, marinas for yachting or grid connections for offshore wind farms), while several uses existing mostly on the land part (e.g., tourism, recreational activities, land-based transport, etc.) expand their activities to the sea as well. These interactions shall be identified and mapped, assessing their cumulative impacts, benefits

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<sup>1</sup> Available at: <http://www.gazzettaufficiale.it/eli/id/2016/11/07/16G00215/sg%20>; accessed in September 2018.

and potential conflicts and synergies, from the point of view of their environmental, social and economic implications (UNEP-MAP PAP/RAC & University of Thessaly, 2015).

- Possible land-sea interactions of some typical maritime sectors are described in the brochure prepared by Shipman et al. (2018) for the Directorate General for the Environment of the European Commission. These guidelines consider the following sectors: aquaculture, desalination, fisheries, marine cables & pipelines, minerals & mining, ports & shipping, tourism & coastal recreation, offshore wind energy. Main LSIs relevant for each sector are identified, key data, potential analytical tools and mitigation management are suggested, together with stakeholders' categories to be involved and possible management options.

Table 1: Land-sea interactions according to the conceptualization proposed by the CAMP Italy Project (2017)

<b>SEA-LAND INTERACTION</b> <i>Economic activities / natural phenomena at "sea" interacting with "land"</i>	<b>LAND-SEA INTERACTION</b> <i>Economic activities / natural phenomena at "land" interacting with "sea"</i>
<p><b>SPECIFIC HUMAN ACTIVITIES</b></p> <ul style="list-style-type: none"> <li>▪ Aquaculture in seawater</li> <li>▪ Fishing</li> <li>▪ Mining activities from seabed (including sand and marine aggregates mining)</li> <li>▪ Industry (systems, including off-shore desalination, CO<sub>2</sub> capture and storage)</li> <li>▪ Energy industry (offshore /oil and gas] energy, offshore renewable energy [wind, waves, surge/)</li> <li>▪ Infrastructures (ports, civil works of marine / coastal engineering /artificial reefs, breakwaters, etc./)</li> <li>▪ Submarine cables and pipelines</li> <li>▪ Maritime activities in general, including dredging and storage of materials</li> <li>▪ Maritime transport (maritime traffic, commercial, including ferries)</li> <li>▪ Tourism and cruise boat</li> <li>▪ Recreation and sports</li> <li>▪ Biotechnology</li> <li>▪ Marine Protected Areas (MPA), Biological Protection Zones (BPZ) (and in general "area based management tools, including marine protected areas")</li> <li>▪ Defence and security</li> </ul> <p><b>GENERAL HUMAN ACTIVITIES</b></p> <ul style="list-style-type: none"> <li>▪ Waste (marine litter)</li> </ul> <p><b>NATURAL</b></p> <ul style="list-style-type: none"> <li>▪ Extreme events (storms, heavy tides, tsunami)</li> <li>▪ Sea Level Rise (global and local)</li> <li>▪ Risks to coastal areas (coastal erosion, marine flooding and saline intrusion)</li> <li>▪ Algae bloom</li> <li>▪ Volcanic and tectonic activities</li> </ul>	<p><b>SPECIFIC HUMAN ACTIVITIES</b></p> <ul style="list-style-type: none"> <li>▪ Coastal and lagoon aquaculture</li> <li>▪ River and lagoon fishing</li> <li>▪ Natural resource use (water abstraction, removal of aggregates /quarries/)</li> <li>▪ Farming and livestock farming</li> <li>▪ Industry (food, manufacturing, on-shore plant, including desalination plant, CO<sub>2</sub> capture and storage)</li> <li>▪ Energy industry (onshore energy /oil and gas/, onshore renewable energy /wind, sun, geothermal/)</li> <li>▪ Infrastructures (river ports, including dredging activities, engineering work, including dam, bridges, remediation activities, railways and roads), Port activity</li> <li>▪ Transports (river transport, road and rail transportation)</li> <li>▪ Tourism, sports and recreation activities (i.e. bathing stations, touristic facilities)</li> <li>▪ Biotechnology</li> <li>▪ Natural Protected Areas (Nature reserves, National Parks, Regional Parks, etc., on-shore or with offshore boundaries)</li> <li>▪ Defence and security</li> </ul> <p><b>GENERAL HUMAN ACTIVITIES</b></p> <ul style="list-style-type: none"> <li>▪ Urban plants (including pollution of water bodies that collect waste water)</li> <li>▪ Waste</li> <li>▪ Services network (i.e. sewage systems)</li> </ul> <p><b>NATURAL</b></p> <ul style="list-style-type: none"> <li>▪ Soil erosion (leaching, wind action)</li> <li>▪ Natural subsidence</li> <li>▪ Hydrogeological instability (including landslides)</li> <li>▪ Transport of river sediments</li> <li>▪ Flooding</li> <li>▪ Volcanic and tectonic activities</li> </ul>

The management of LSI should take into account the interactions of **planning processes and plans** for land and sea areas. It is important to ensure that legal, administrative, consultation and technical processes are coordinated (and hopefully linked) to avoid unnecessary duplications, incoherence, conflicts, waste of resources and/or excessive demand of stakeholders' efforts. The challenge is to plan and manage inshore and offshore activities in harmonized manner considering the functional integrity of the land-sea continuum. This also implies allocation of land space (and related infrastructure and services) to some maritime activities and/or the allocation of maritime space to some land-based activities. Finally, the achievement of this coherence also requires alignment/integration of the different approaches, methodologies and tools applied respectively on land and at sea.

According to Stoms et al. (2005), connections between land and marine ecosystems occur through transport vectors, and the direction of influence is mainly, although not exclusively, from land to sea. Land-based activities alter flow of material, energy or organism and affect the marine biota through effects on ecological processes (reproduction, mortality, growth, etc.). Examples of land-based influences on marine features are reported in Figure 1.

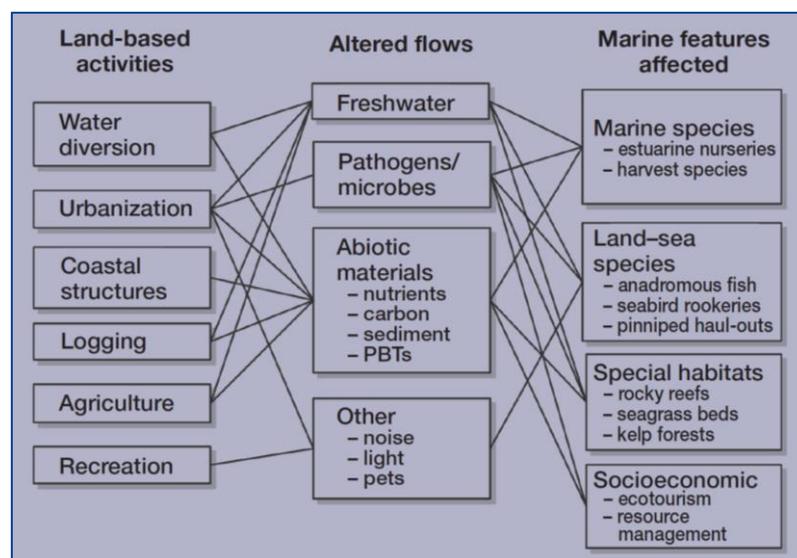


Figure 1: Examples of land-based influences on marine features. Source: Stoms et al. (2005)

Alvarez-Romero et al. (2011) analyse LSI within the specific context of conservation planning, identifying three typologies of land-sea interactions, partially overlapping with above ones:

- **Land-sea ecological processes**, in particularly related to the **flow of water and movement of organisms** between terrestrial, freshwater and marine ecosystems. These processes can be mediated by two types of linkages: **interfaces** – areas where two realms and their processes are intermixed – and **connections**, between two realms which are not adjacent. Intertidal zones or the mangrove habitats are examples of interfaces where a number of land-sea ecological processes occur, such as energy and nutrient exchange, trapping of sediment and prevention of coastal erosion. Connections can be well-established path (e.g. river input) or can diffuse (movement of organisms between breeding and feeding areas). The direction of the ecological process can be seaward or landward, depending on the specific considered process.
- **Cross-system threats**, including **economic activities** originating on land and affecting the marine environment or, *vice versa*, originating at sea and affecting terrestrial and freshwater realms.

Cross-system threats can be categorized according to: their source (e.g. point or diffuse source), the affected realms (terrestrial, freshwater, marine), the direction of influence (seaward or landward), the main effect (e.g. altered flow of water, pollutant transfer, exotic species contamination, etc.) and the sector to target for intervention (e.g. urban areas, industry, fishing areas).

- **Socioeconomic interactions**, considering that **people** are an important link between land and sea and most of world's population live in the coastal zone. Socioeconomic interactions can influence land-sea processes and drive cross-system threats.

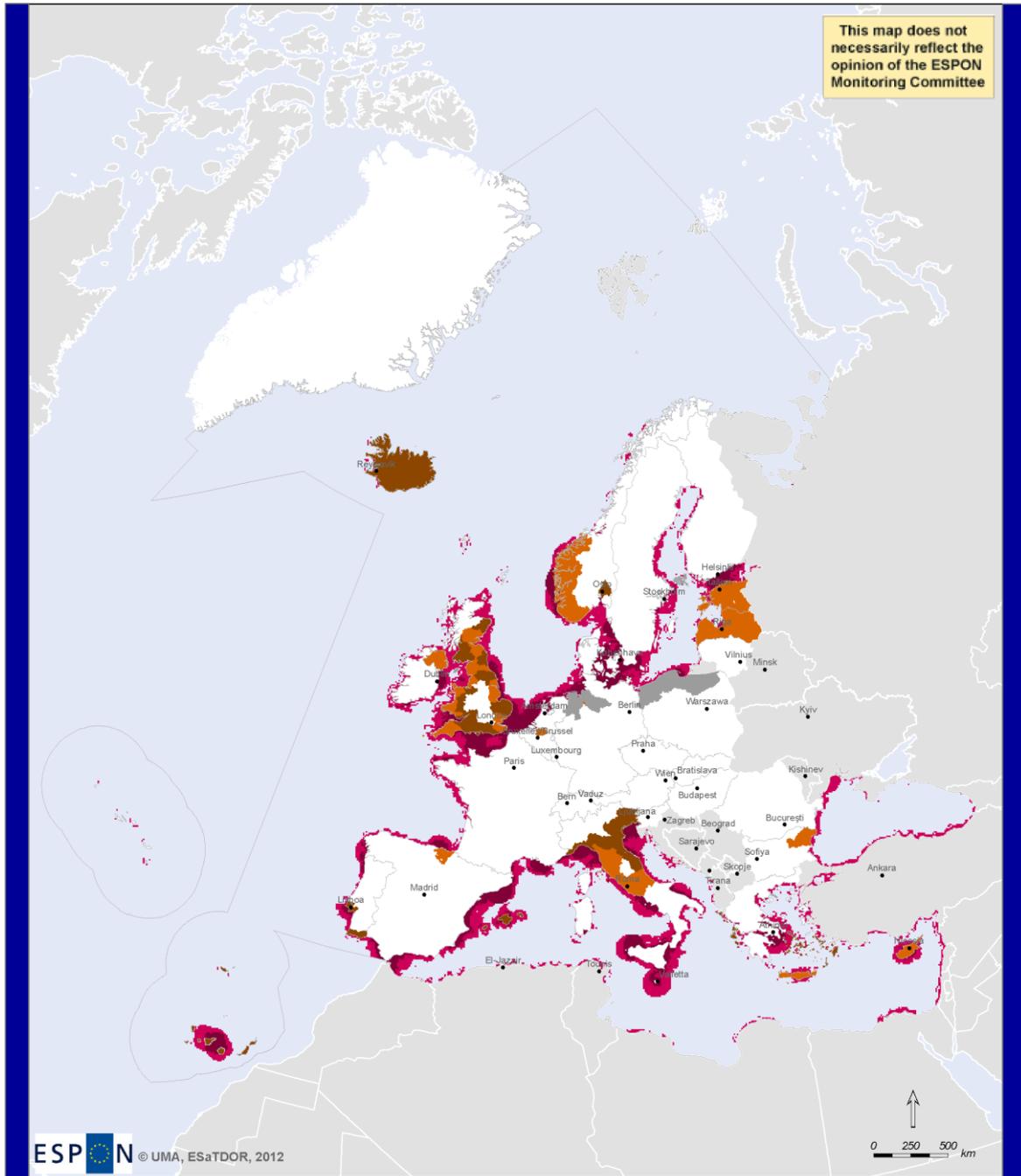
In fact, LSI analysis should not limit to environmental implications of interactions but also consider (and ensure) the well-being of inhabitants of the coastal zones, achieving the combination of environmental, spatial and socio-economic development. Referring to the last point, the importance of interactions among and through people operating on land and sea should be highlighted, in terms of exchange of experiences, knowledge and culture.

Interactions among different ecosystems (not specifically land-sea interactions) are considered in the conceptual model of Leibowitz et al. (2000) (see also Stoms et al., 2005), formulated to assess the cumulative effects of human activities across the ecosystem units of a landscape. The model classifies the interactions among different ecosystem units in promoting or demoting interactions. An ecosystem is assessed as a “**promoter**” if it is a source of beneficial material to an ecological feature or if it is a sink of detrimental material, while it is a “**demoter**” if it is a source of a detrimental substance or a sink for a beneficial one. Considering human activities, a farm contributing to non-point source of pollution is an example of a demoter process, while a marine protected area is an example of a promoter process. Considering a natural process, nutrient removal through wetland ecosystem functioning is an example of a promoter process while flooding of a coastal area due to river overflow is an example of a demoter process. These concepts can be transferred to land-sea interactions, providing another approach to classify them **based on their role, positive or negative**, in the affected system. Nevertheless, this could be possible only on a case-based approach, because the same interaction can have different effects in different locations.

An important consideration emerging from the above categorizations and from literature review is that land-sea interactions not only involve those areas and countries directly facing the marine space, but also inner countries which have important connections to the sea through complex socioeconomic interactions and which might affect the marine environment through large river basin systems. This concept was specifically analysed by the “ESaTDOR – European Seas and Territorial Development, Opportunities and Risks” study, developed within the framework of the ESPON 2013 Programme (ESPON & University of Liverpool, 2013). The study focused on LSI within Europe's six regional seas; LSI was assessed considering three main **features**:

- Economic significance, based on employment in maritime sectors, used to describe the intensity of landward influences;
- Flows, representing the movement of goods, services, information and people through sea areas;
- Environmental pressures, representing the human impacts on the marine environment, through both sea and land-based activities such as, respectively, shipping or agriculture.

Three maps for the three above-mentioned features were produced and then integrated to elaborate the composite maps of Hot (Figure 2) and Cold spots of LSI. These were then used to classify European maritime and coastal regions in five categories (Figure 3 and Table 2) according to the **intensity of LSI**: from European core, where land-sea interactions are at their higher intensity to Wilderness Regions where land-sea interactions are at their least intensity, also considering the intermediate levels represented by Regional hubs, Transition areas and Rural areas.



ESPON @ UMA, ESaTDOR, 2012

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Thematic data: Typology Map.  
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.  
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

**Typology Map (hotspots)**

**Sea (Environmental Pressures and Flows)**

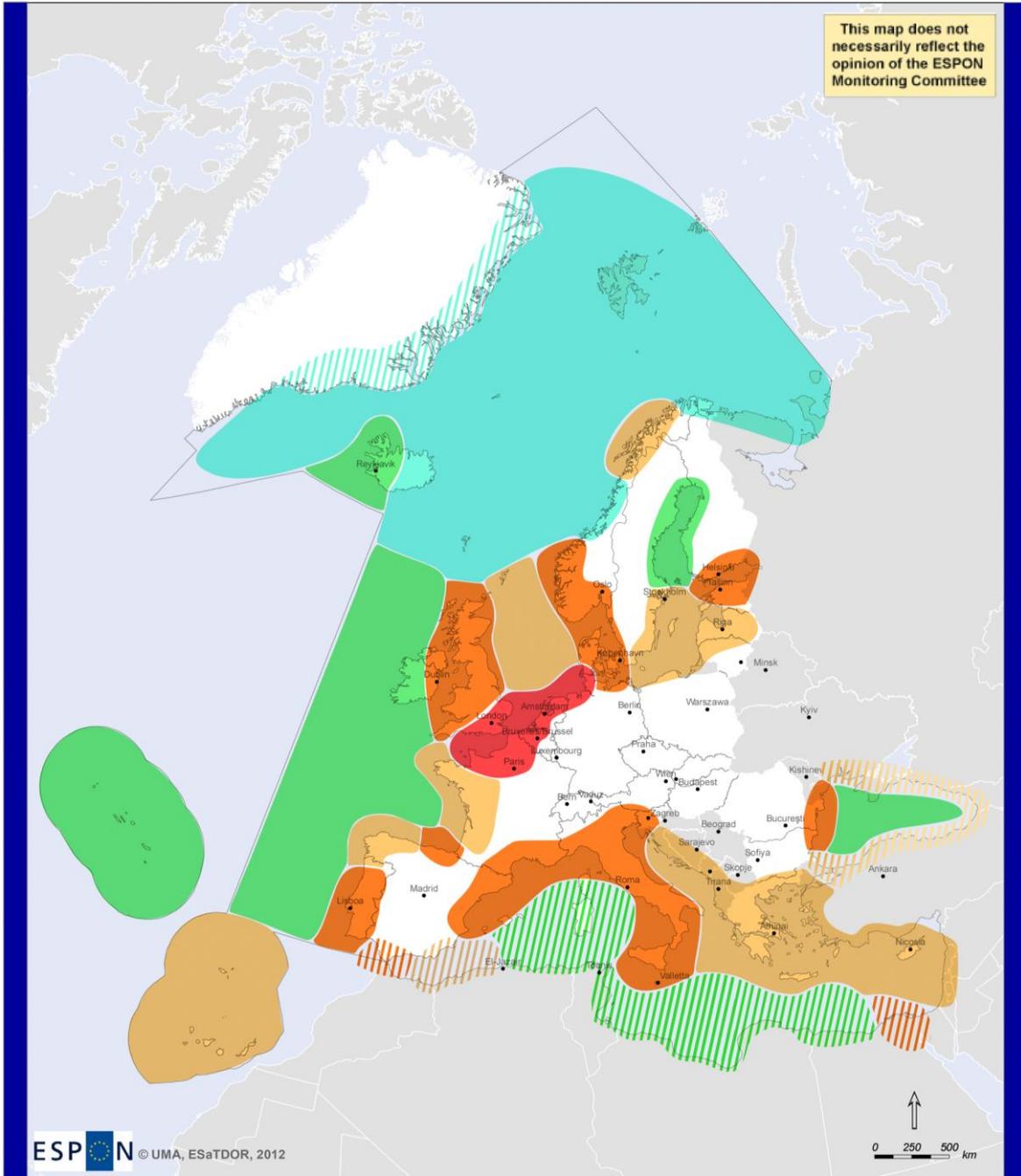
- High intensity
- Very high intensity

**Land (Economic Significance)**

- High intensity
- Very high intensity
- No Data

*This map shows where land-sea interactions are at their most intense in Europe's seas. The effect of the sea on the land is measured in terms of economic significance (employment in maritime sectors) and the effects of anthropogenic activities on the sea are resented by environmental pressures (pollution from pesticides and fertilisers, incidence of invasive species introduced by shipping) and flows (of goods, including container traffic and liquid energetic products, people, from cruise ships and information, from telecommunications cables).*

Figure 2: Hot spots of LSI in Europe.  
Source: ESPON and University of Liverpool (2013)



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Thematic data: Typology Map, Economic Significance and Environmental Pressures Composite Maps  
Land boundaries: © EuroGeographics Association and ESRI. Regional level: NUTS2.  
Sea boundaries: OSPAR Convention, EU Integrated Maritime Policy and EEZ.

**Regions derived from typology map**

- European Core
- Regional Hub
- Transition
- Rural
- Wilderness
- Typology influenced by lack of data

Figure 3: Classification of maritime and coastal regions according to the intensity of LSI.  
Source: ESPON and University of Liverpool (2013)

Table 2: Typologies of maritime and coastal regions according to LSI intensity and their main characteristics. Source: ESPON and University of Liverpool (2013)

	EUROPEAN CORE	REGIONAL HUB	TRANSITION	RURAL	WILDERNESS
<b>Economic Significance</b>	Greatest concentration of maritime employment/ high strategic economic importance.	High maritime employment, significant economic importance.	More localised concentrations of maritime employment/ more dependent upon a limited number of strategic industries.	Low levels of maritime related employment, economy dominated by primary production and tourist sectors.	Very low and intermittent levels of maritime employment, limited direct economic importance.
<b>Flows</b>	Great international connectivity, global hinterland.	Nationally significant and some international connections, European scale hinterland.	Nationally and regionally significant connections and hinterland.	Limited connectivity, local/ regional hinterland with some more significant sectors/ seasonal extensions.	Remote areas, limited connectivity. Very small local hinterland, some extensions.
<b>Environmental Pressures</b>	High environmental pressure associated with human uses.	Significant environmental pressures.	Medium environmental pressures.	Low environmental pressure.	Limited environmental pressure.
<b>Land-Sea Interactions</b>	<b>Very high</b>	<b>High</b>	<b>Medium</b>	<b>Low</b>	<b>Very low</b>

According to the referred assessment (Figure 4), Western Mediterranean can mainly be considered as area of intense LSI (regional hub), with significant environmental pressures as well as economic importance. This is also evident from Figure 3 showing concentration of very high and high intensity hot-spots of LSI in the same area. However, the southern rim of the Western Mediterranean is categorised as rural area, with low environmental pressure but also low level of maritime related activities and employment, dominated by primary production and tourism.

### 2.3 Geographical scope of LSI

Considering the variety of land-sea interactions, it is rather evident that these involve a wide number of processes of different nature, which necessarily encompass different geographic areas of various extents. **One of the key questions when dealing with LSI is how far we should expand, both landward and seaward.** The geographic scope of LSI analysis is again very specific, depending very much on the considered context, natural processes involved and human activities occurring at the land-sea interface. These elements define the so-called functional scope of the analysis. However, from the perspective of the planning process, the geographic scope of LSI analysis depends firstly on the spatial domain of the plan LSI analysis is linked to. In fact evaluation of processes relevant for LSI shall be considered in relation with the geographical scope of the planning area. The extension of the maritime plan, the portion of coast involved and its characteristics, relevant processes and activities are used to define the geographical scope of LSI. Natural and anthropogenic processes landwards are considered to the extent their management is relevant for the conditions of the marine areas and maritime activities.

Considering just the specific example of a riverine input of nutrients to the sea can highlight how much the analysis of LSI might be complex. This might involve the whole drainage basin where such nutrients

are originated. This can imply that the LSI analysis and the planning domain can extend far well inland (Alvarez-Romero et al., 2011) if the extension of the drainage basin is very wide. An extreme example comes from the Gulf of Mexico, where river discharge originates from an area of almost 3 million Km<sup>2</sup> (Alvarez-Romero et al., 2011; Mitsch et al., 2001). However, such wide extent is not always recommended, also because it can complicate the analysis, involving different administrative levels and requiring managing a wide amount of data coming from different sources, with the usual problems of harmonizing heterogeneous datasets. A more targeted analysis, addressing only most relevant issues for the marine area to be planned can be undertaken, focused for example on the downstream ends of major rivers or on selected and limited portions of the drainage basin.

This is to argue that there are not pre-defined rules to identify the geographical scope (landward and seaward) of the LSI analysis. However, in order to understand how land-sea interactions could be identified and, accordingly, considered in the implementation process of MSP Directive, it is important to clarify, in legal terms, the geographical area (for planning and management) within major legal instruments related to spatial planning, ICZM and MSP, and identify their possible overlaps and interactions (see the following box).

Box 1: Geographical area of application of the main legal instruments that detect land-sea interactions

- The geographical coverage of the ICZM mentioned in ICZM Protocol of the Barcelona Convention (Art. 3), is defined by the seaward limit of the coastal zone, which is the external limit of the territorial sea and the landward limit of the coastal zone, which is the limit of the competent coastal units (including, therefore, the internal waters and the transitional waters).
- The Marine Strategy Framework Directive adopted on 17 June 2008 (2008/EC/56, MSFD), provides for the development of a strategy for achieving or maintaining Good Environmental Status (GES) in the marine environment by 2020. It applies to waters, including their seabed and subsoil, located on the seaward side of the baseline, from which the extent of territorial waters starts, up to the boundaries of the area of application or exercise of Member State jurisdictional rights, as well as coastal waters as defined by Directive 2000/60/EC, their seabed and subsoil (and thus the internal waters and transitional waters).
- The Directive 2014/89/EU on Maritime Spatial Planning, whose scope of application is extended to marine waters, including their seabed and subsoil, located on the seaward side of the baseline, from which the extent of territorial waters starts, up to the boundaries of the area of application of Member State jurisdictional rights, and the coastal waters and its seabed and subsoil, that are the surface waters on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters.
- The Water Framework Directive 2000/60/EC of 23 October 2000, whose area of application is extended to inland surface waters (static or flowing), transitional waters (surface water in the vicinity of the river mouth, which are partly saline due to their proximity to coastal waters, but which are mostly influenced by freshwater flows), coastal waters (meaning surface waters on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters) and groundwater, within the baseline used as a reference for define the limit of territorial waters.

Source: CAMP Italy project, 2017

Based on literature review and the concept of functional scope mentioned above, a number of criteria can be identified to **delimitate the area of LSI analysis**:

- **Scale of the analysis**, i.e.: continental, regional, sub-regional, national, sub-national, local. It is also worth noting that the scale for LSI analysis should in principle be larger than the planning area, to be able to consider all external elements, influencing the planning area.
- **Coast characteristics**: hydrography, geomorphology, bathymetry, etc. These characteristics influence the way interactions are established, their intensity and their extension (e.g. maritime traffic has a different impact in a narrow channel or in a wide bay; the same applies to dispersion of sediments/nutrients/pollutants discharged by the river mouth in the coastal waters).
- **Typology and extension of the LSI processes**: widely diffused (e.g. flow of goods, large-scale transport or nutrient loads from large drainage basin) or spatially restricted (e.g. coastal erosion or local consumption of marine resources). In fact, the area of LSI analysis encompasses the area where the pressure is generated (e.g. drainage basin in case of sediments, nutrients or pollutants loads) or the human activities are carried out (e.g. navigation routes) and the area where the impact is induced (e.g. coastal waters affected by discharge of sediments/nutrients/pollutants by the river mouth) or the consequences of human activities are determined (e.g. ports construction along the coast).
- **Spatial and temporal distribution** of natural processes and human activities. Space and time are two key variables in LSI. They need to be jointly considered starting with the identification of the area for the analysis. Their co-variation is particularly relevant since natural processes and human activities can vary with time their spatial distribution and extension. Water circulation in coastal areas can vary along the year, determining consequences on various LSIs, like for example distribution of pollutants. Also loads discharged from the watershed are seasonally variable, due to the temporal distribution of precipitations. Navigation is a maritime sector with strong seasonal dynamics, especially when considering cruising, ferries and leisure boating (dependent on touristic season).
- **Distribution of ecological elements**: interfaces, ecological connections, ecological barriers. Accomplishing with ecosystem functional boundaries represents a core element of the Ecosystem Approach (CBD COP 5, 2003) and a main difficulty for maritime spatial planning process. This aspect is of relevance for LSI: for example, when considering interactions due to natural process, such as species living across the land-sea interface, like coastal sea birds having strong relationship with land. Moreover, estuaries are well known to play a major role in the life cycle of many economically important fish species by providing breeding, nursery and feeding grounds. The accelerated degradation of these critical habitats at the land-sea interface (e.g. by indiscriminate trawling, land reclamation, drainage, coastal construction, sediment deposition) threatens marine fisheries and wildlife has resulted in habitats that are no longer adequate to fulfil nursery, feeding, or reproductive functions (Seitz et al., 2014).

These criteria are considered within the proposed methodological guideline presented in chapter 4.

In addition to the above elements, the broader regional or sub-regional scale should be also taken into account when considering some relevant natural and socio-economic processes. For example, hydrodynamic conditions outside of the planning area, at the larger basin scale, can influence LSI at local level. Similarly, socio-economic and political assets and patterns at regional scale may interplay and influence the way LSI interactions are developed locally (e.g. geo-political conditions determine trade and consequently flows of goods and people across land and sea).

At the same time, it should be acknowledged that a number of elements can significantly influence and somehow constrain the identification of the geographical scope of LSI analysis, such as:

- Administrative boundaries on the land component of the coastal area, also including statistical units (relevant for data availability) and planning/managing units;
- Maritime boundaries defined according to national laws and international conventions;
- Availability, quality and scale of data;
- Data sharing among countries and data interoperability, particularly relevant if LSI assumes transboundary dimension as often occurs;
- Lack of cross-border cooperation, also influencing the previous point on data sharing.

## 3. Land-sea interaction at the national level

### 3.1 National approaches to LSI

In **Spain**, the close relationship between land and sea is highlighted already at the level of the Constitution: Article 132.2 establishes that the “maritime-terrestrial public domain” is comprised by the shoreline area, beaches, territorial waters and natural resources of the economic zone and continental shelf. The above-mentioned law regulates the uses of the “maritime-terrestrial public domain” (*dominio público marítimo-terrestre*) and public “easement areas” (*zonas de servidumbre*).

LSI interactions are also addressed by the national Regulation on Coasts (*Reglamento general de costas*), was approved by the Royal Decree 876/2014, of 10 October. Its aim is to protect the coast and ensure sustainable use of the coast:

- Determine the maritime-terrestrial public domain and ensure its integrity and proper conservation, adopting, where appropriate, protection measures and restoration necessary and, where appropriate, adaptation, taking into account the effects of climate change;
- Ensure public use of the sea, its shores and the rest of the public domain sea-land, with no exceptions other than those derived from duly justified reasons of public interest;
- Regulate the rational use of these goods in accordance with their nature, purpose and with respect for the landscape, the environment and historical heritage;
- Achieving and maintaining an adequate level of quality of water and the shore Sea (Article 2 of the Law 22/1988, of July 28)<sup>2</sup>.

In **France**, the new maritime policy includes an integrated land-sea approach (Law No. 2010-788 of 12 July 2010 on National Commitment for the Environment). The National Strategy for the Sea and Coasts (NSSC) adopted in February 2017 encompasses both MSP and MSFD. Its objectives also include the integrated management of the land-sea interface, the development of sustainable blue economy and the ecological management of coast and sea. LSI issues are faced also through the Coastal Protection Agency (*Conservatoire du Littoral*), a public institution with no equivalent in other European countries, whose mission is to acquire plots of land that are threatened by urbanization or degraded so that they can be restored and developed in respect of natural balances.

The transposition of MSP EU Directive in the **Italian legislation** is given by the Decree 201/2016. Herein, in the Article 3, LSI is intended as the “*interactions in which terrestrial natural phenomena or human activities have an impact on the marine environment, resources and activities and interactions in which marine natural phenomena or human activities have an impact on the terrestrial environment, resources and activities*”. Building on this concept, the Guidelines for maritime spatial planning (Decree of the Presidency of the Council of Ministries of the 1<sup>st</sup> December 2017) include several references to the need for the identification of the areas relevant in terms of land-sea interactions and provide a list of elements and factors to be considered in order to identify such areas:

- relevant river basins according to their identification under the provisions of the Water Framework Directive (Decree 152/2006);
- terrestrial and marine protected areas (including SCI, SPZ and Natura 2000 network);

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<sup>2</sup> Sources EU MSP Platform – [www.msp-platform.eu/countries/spain](http://www.msp-platform.eu/countries/spain)

- UNESCO sites;
- coastal areas with high landscape/seascape value;
- areas with important coastal marine infrastructures (e.g. ports).

In **Malta**, the legislative framework for land and sea-use planning is provided by the Development Planning Act of 2016. The Strategic Plan for Environment and Development (2015) provides a planning framework to integrate socio-economic growth and environmental management within the coastal zone and marine area as covered by the Plan, thus facilitating for the integrated approach of land-sea interactions<sup>3</sup>.

### 3.2 LSI examples in SIMWESTMED countries

On the basis of the country fact sheets and the Initial Assessment overview (Musco et al., 2018) developed within SIMWESTMED project, the following main LSIs have been identified at the country level, considering both interactions induced by natural processes and those induced by human activities.

The most relevant crosscutting land-sea interactions for the all SIMWESTMED countries are identified with the maritime **transport, tourism, energy industries** and **marine litter**.

The SIMWESTMED area is characterized by intensive **traffic** routes, which mainly consist of transferring people and goods from land through the sea and the relative facilities useful for this process, such as ports, warehouses, passenger terminals, connective roads and railways. Possible pressures generated by this interaction are: oil spills, due to potential accidents, acoustic and chemical pollution, risk of collision between ships and marine mammals, introduction of alien species, due to discharge of ballast waters.

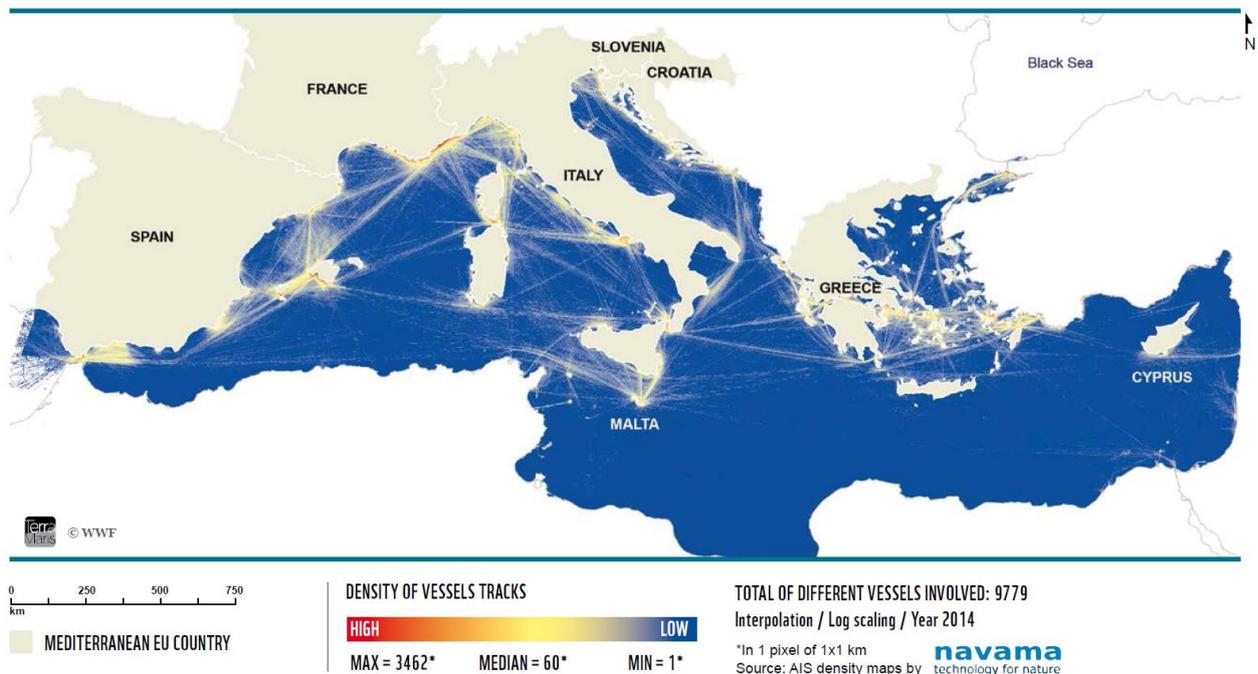


Figure 4: Density of vessels in the Mediterranean Sea Basin (Navama). Source: Piante & Ody, 2015

<sup>3</sup> Source EU MSP Platform – [www.msp-platform.eu/countries/malta](http://www.msp-platform.eu/countries/malta)

Among maritime transport, **maritime tourism activities**, such as cruise tourism and leisure boating, represent, in particular, a significant source of pressure on the natural ecosystem, causing deterioration of water quality (sewage), marine litter, physical alteration of coastlines and landscapes (changes in siltation, abrasion), loss of biodiversity (species and habitats), changes in salinity regime. Cruise tourism can also cause air and water pollution, noise pollution as well as increasing solid wastes and litter.

**Energy** industries are also significant interactions both terrestrial and marine, which characterize all the SIMWESTMED countries. They involve several activities, such as prospection, extraction, refinement of raw material and transportation of fuel and electric energy, which is then distributed on the market. The impact mainly occurs on the benthic compartment due to habitat fragmentation and/or destruction with consequent biodiversity and habitat loss. The following specific pressures can be generated: spills, noise, potential introduction of non-synthetic substances and compounds and though physical disturbance of the seabed. On the other hand, underwater structures provide an artificial substrate for marine organisms, which can find food and repair. Consequently, touristic activities and fishery can both benefit of these structures: tourism with scuba diving activities, while fishery can benefit of the fact that these structures can become attractive sites for species of commercial interest.

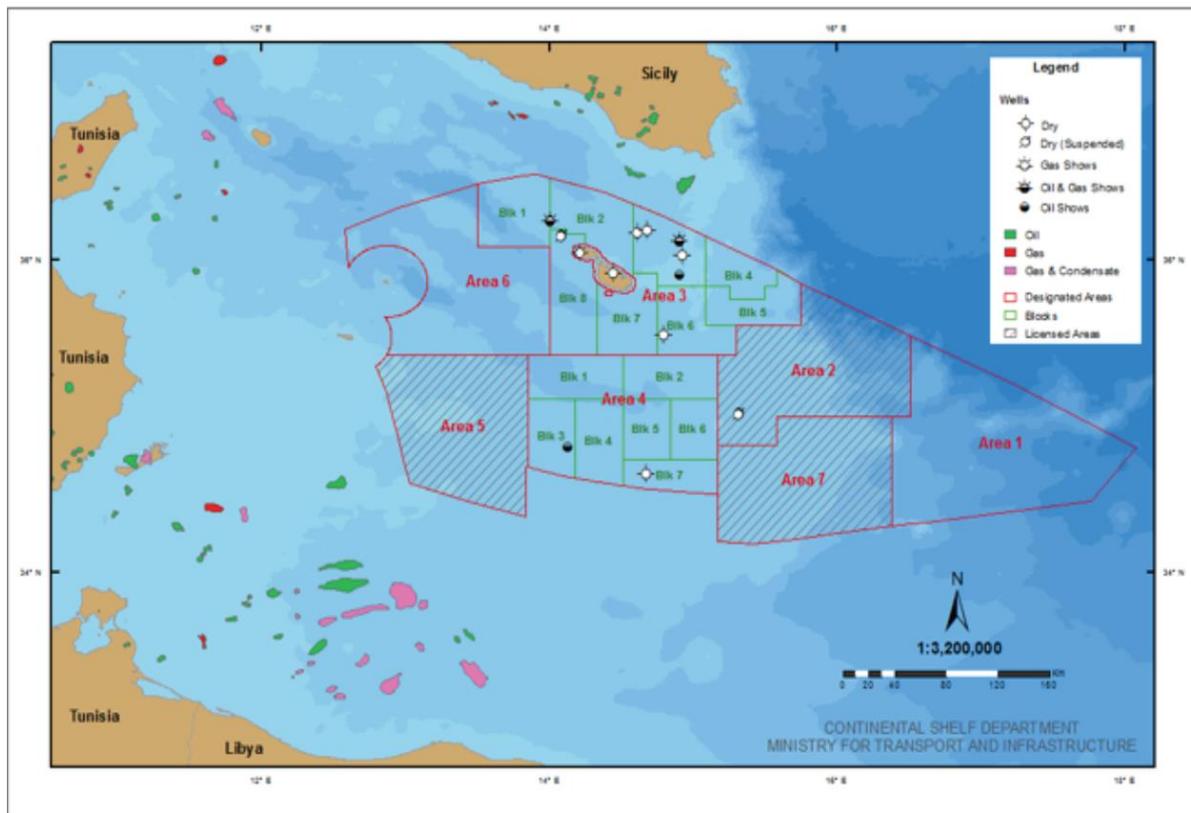


Figure 5: Geographical localization of hydrocarbon prospection areas in Maltese waters.  
Source: Musco et al., 2018

**Marine litter** is one of the main issues generated by several human activities (e.g. maritime transport, tourism, fishery and aquaculture, etc.) with severe impacts on terrestrial and marine environment. Land sources of marine litter are coastal towns, ports, bathing areas, landfills of urban solid waste and rivers, while marine sources are fishing (abandoned gears called “ghost fishing”) and navigation activities. The impacts are negative both for humans and marine organisms. On marine organisms it can cause contamination and death. On humans it can affect water and habitat quality with consequent aesthetic

degradation and impact on tourism activities. Also, fishery in particular small fishery can be negatively affected by debris that can be a limit to this activity. Plans to this issue are: waste disposal system at ports d.lgs. 182/2003; Directive 2000/59/CE modified by Directive 2015/2087/UE; Directive 2008/98/CE; Directive 2009/123/CE Regulation (UE) No. 508/2014; Regional Plan for the marine litter management in the Mediterranean (UNEP (DEPI)/MED WG. 379/5, 28 May 2013); Communication of the European Parliament “Towards a circular economy: a zero waste for Europe” [COM/2014/0398 final/2].

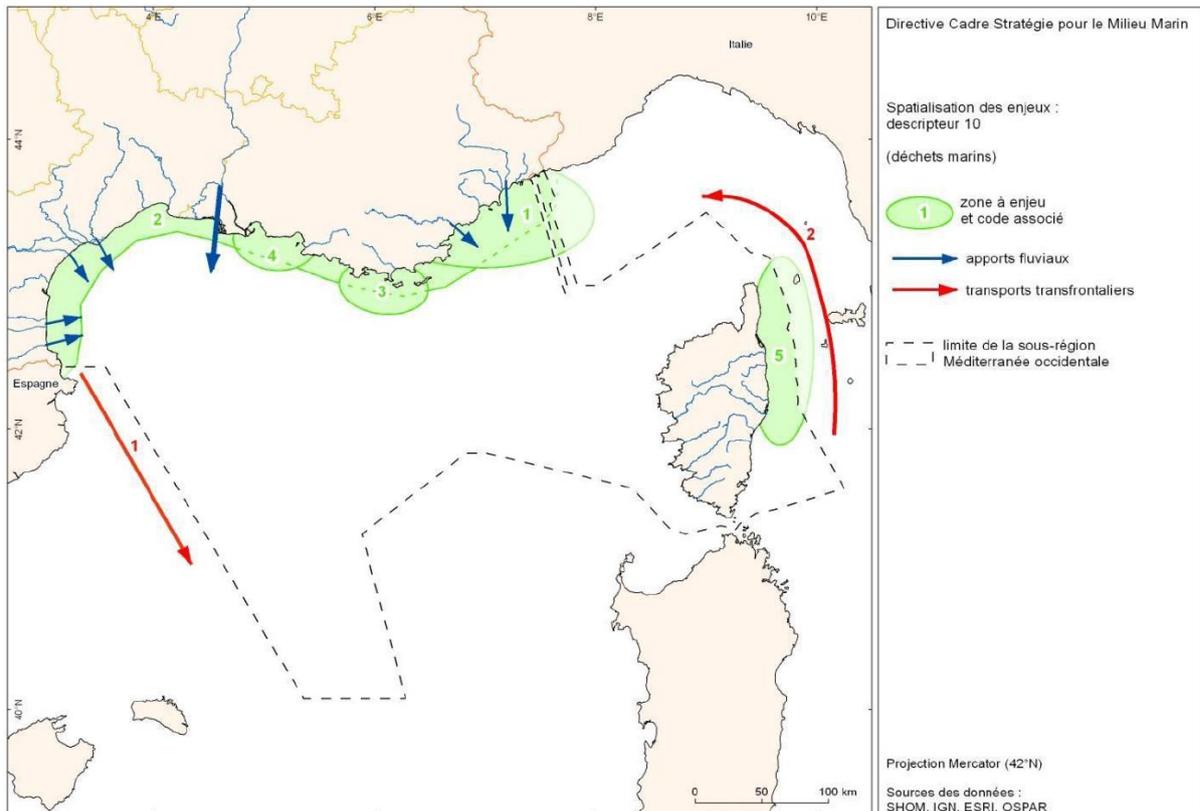


Figure 6: Distribution of marine litter in French waters. Source: Musco et al., 2018.

Concerning examples of interaction specific per country, **coastal erosion** represents one of the most significant processes in **Italy**. This interaction is mainly generated by increased loss of sediments on the coastline. A threat to coastal erosion at a global scale is the sea level rise. Land-based interventions, e.g. alteration of river input, are also potential drivers of coastal erosion. Impacts of coastal erosion are: loss of habitats/ biodiversity/landscaping and environmental heritage, effects on tourism development, fishery, transport infrastructure and physical restructuring of coastline. Erosion trends in Italy are more abundant than the advancing ones. Data from 1950 to 2007 shows that 600,000 m<sup>2</sup> of beaches have been lost. Italian coasts are in continuous evolution and data indicate that there are relevant coastal zones that are subjected to a strong backwardness due to erosion events. Coastal defence from erosion in Italy is regulated by several directives and laws that origin from different levels of governance. At the international level, the ICZM Barcelona Convention Art. 23 on Coastal erosion, the Protocol on Integrated Coastal Zone Management in the Mediterranean to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (2010/631/EU), the Directive 2007/60/EC on the assessment and management of flood risks. At the national level, the Italian law identifies the Region as a competent authority in terms of protection of the coastal zone with the Law No. 179 of 2002. The Art. 109 d.lgs. 152/2006 declares Regions as competent authorities in terms of control and evaluation of coastal activities that are established to contrast the coastal erosion as well as all the activities for coastal protection.



Figure 7: Coastal erosion along the Italian coast. Source: ISPRA, 2017

**Flooding events** also characterize LSI in Italy. They are generated by strong storms and river floods, which leads to the flow of water rich of urban material fragments and waste, sludge and alluvial debris, toxic substances and materials that are discharged in the sea thus impacting the coastal areas and the marine environment, impacting consequently coastal tourism and beach-based activities, fishery, transport infrastructure and physical restructuring of the coastline. Few examples are recorded in the Tyrrhenian coast generated by a seaquake in 2002 and other catastrophic floodings between 2013 and 2015. Flooding events in Italy are managed in line with the Water Framework Directive 2000/60/CE and the Directive 2007/60/CE on the Assessment and Management of Flood Risks that led to the establishment of the Italian d.lgs. 49/2010. Thanks to this law, a Management Plan of Flood Risk (PGRA) for each hydrographic district was established with the aim of managing the protection activities in more significant risky areas and define the security objectives and the priorities of intervention at district scale. At the national level, the PGRA is coordinated by the Department of Civil Protection (DPCN) and by the Ministry of the Environment (MATTM) through the collaboration of the Higher Institute for Environmental Protection and Research (ISPRA).

Another relevant interaction for Italy is represented by **sand extraction** activity. It can directly influence the environmental condition by physically modifying the seabed, increasing water turbidity and sediment resuspension and altering the transport of sediments. Sand extraction may have several impacts on natural resources and ecosystem services as the modifications of benthic populations, the

introduction of potential contaminants in solution and morphological modifications of the substrate. On the other hand, the sand extracted at sea is commonly used for beach nourishment (e.g. Emilia Romagna region coastal area) and to constitute construction materials for coastal infrastructures representing the main activity to contrast coastal erosion.

**France** is characterized by all the above-mentioned common interactions. An additional significant issue for the country is represented by **seismic events**. In France, there are many canyons (Gulf of Lion), which can undergo morphological changes due to their slope instability context, contribution of sedimentary material and seismic risks. This interaction can spread both from land to sea and from sea to land depending whether the epicentre is found on land or on the sea bottom. Seismic events have strong impacts on the environment on the coast, mainly generating habitat loss, with consequent environmental fragmentation, and loss of biodiversity, as well as landscaping and environmental heritage loss. The impact on human activities is mainly on tourism development but it can also affect transport infrastructure and physical restructuring of the coastline.

In **Spain**, like on the Italian coast, **coastal erosion** is a significant issue (in addition to the interactions common to all the SIMWESTMED countries). It is mainly generated by a risk of retreat and flooding, which is induced by a sedimentary deficit due to river regulation or retention by structures like ports, intense storm surges and sea level rise. These risks have a socio-economic impact, as they can destruct coastal infrastructures of this highly populated area.

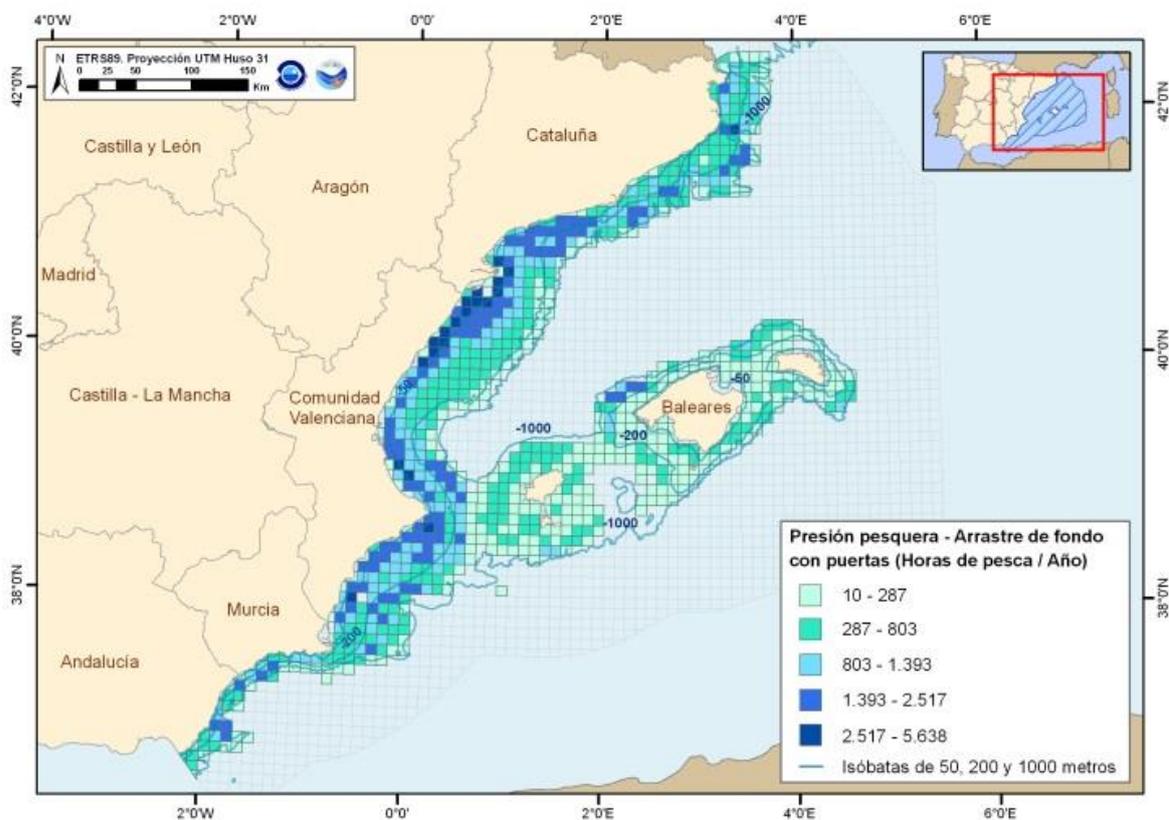


Figure 8: Geographical distributions of a bottom trawl gear effort in Spain. Source: Musco et al., 2018

**Fishery activity** is also intensively present in Spain. It has a strong impact on the coastal area, since fishing vessels operate at sea both inshore and offshore needing adequate land-based moorings and facilities for their operability (e.g. petrol pumps) and maintenance (e.g. cranes) as well as for the processing and commercialization of the marine products (e.g. warehouses, terrestrial means of transport and connections).

In **Malta**, in addition to the interactions common to all the SIMWESTMED countries, run-off events generated by heavy storms, significantly characterize the coastal area. Since the topography of the territory is characterized by a tilt where the coastal areas along the NE are low lying and the South west coast dominated by cliffs, the main drainage pattern often results in seasonal inundation occurring along the low-lying coastal parts. Storm water runoff within urban catchments is able to transport debris, litter, and traces of oil and sewage as well as particulate matter, such as soot from vehicular and industrial activities to the coastal waters. Input loads from diffuse land-based sources may ultimately end up leaching into Maltese fresh waters and coastal waters, potentially affecting water quality. Storm water run-off particularly downstream leads to socio-economic impacts where as a result of the volumes of waters damage to property including cars and inundation of basements in buildings were common outcomes of such events. In the field of water policy Directive 2000/60/EC is transposed into Maltese Legislation through the Water Policy Framework Regulations under the Environment Protection Act.

**Coastal erosion** events represent also a relevant issue for the country. They are visible where human intervention occurred in the form of development or incompatible activities, from aerial imagery and *ad hoc* cases. They are mainly generated by increased loss of sediments on the coastline and can cause loss of habitats/biodiversity/landscaping and environmental heritage, thus affecting tourism development, fishery, transport infrastructure and physical restructuring of coastline.

## 4. Proposals for performing LSI within MSP

The analysis carried out for the initial assessment and the country fiches preparation in the framework of the SUPREME/SIMWESTMED projects provides some overall relevant elements on how LSI can be approached within MSP, what are the challenges and what are the most common interactions across the Eastern-Mediterranean countries.

Firstly, a one-size-fits all approach to address LSI issues within MSP was highlighted not to be appropriate when considering different contexts. The approach to be used not only depends on the specific characteristics of the area, but also on the scale of analysis.

Interactions between land and sea might involve complex relations among environmental, socio-economic and governance elements. Categorization of LSI elements can help in structuring problems understanding; however, an integrated perspective is required to address all aspects of LSI.

Institutional fragmentation between (and within) land and sea is another big challenge. This challenge is further exacerbated by the often-existing mismatch between administrative boundaries and the scale of natural and socio-economic LSI processes.

All these points require increased capacity building, education and knowledge transfer on LSI to stakeholders, including land and sea planners. In addition, the following operative elements have emerged as relevant in the discussion on how to deal with LSI at case study level:

- Two typologies of LSI interactions should be considered: interactions due to natural processes and interactions among land and sea-based activities.
- Influence of LSI on planning processes and plans for land and sea areas, as well as relations between land and sea communities, should be taken into account.
- Temporal dynamics of interactions should be considered. This is particularly relevant when dealing with natural processes across the land-sea interface.
- Criteria to define the scale and geographic scope of the analysis (see section 2.3) should be considered, weighting them according to their relative importance in the specific study area.
- Independently to the specific approached scale, link to a sea-basin scale approach should be taken, as a number of LSI issues have a clear wide-transboundary dimension.
- Linking to the more detailed analysis, identifying the specific hot-spot areas for LSI (e.g. major port infrastructures, river input, coastal nursery habitat, etc.) is also needed.
- LSI analysis should be based on the best available information, transparently highlight current gaps.

### 4.1 Methodological guideline to perform LSI within an MSP process

Building on the elements identified above and emerged throughout the discussion among the partners of the SUPREME and SIMWESTMED projects, the scope of this section is to suggest a methodological guideline to account for LSI in the MSP process. The methodological guideline is intended to support integrated planning and management of inshore and offshore activities in a harmonized manner, considering the functional integrity of the land-sea continuum. The proposed methodological guideline

capitalizes the experience of the report on Initial Assessment prepared under the SUPREME and SIMWESTMED projects.

The methodological guideline foresees the compilation of a catalogue of interactions, populated with semi-quantitative and quantitative information (also externally associated). The use of a GIS as a mapping tool can support the analysis, particularly its advanced phases.

The methodological guideline consists of a **step-wise, tiered process** considering (Figure 9):

- an initial and more general stocktaking phase (PART A); is followed by
- an in-depth analysis about most relevant interactions (PART B); and by
- a final phase (PART C) aiming at informing the planning process about key outcomes from LSI analysis.

PART A and PART B of the **step-wise process** are proposed as two different levels of analysis according to a tiered approach. PART A is intended to be a preliminary analysis phase, aiming at identifying most relevant elements for LSI, and considering, in principle, all known land-sea interactions in the area. PART B represents a focused analysis phase, to be carried out only for the most important interactions, selected through PHASE A. These interactions are those relevant for MSP key issues, identified by the planning process. Given this approach, some steps in PART B represent a deepening of the analysis carried out thorough corresponding steps in PART A.

The **tiered approach** was introduced to ease the application of the methodological guideline both to contexts where the planning process is just in a preliminary phase and knowledge and information are still to be collected, and to contexts where the planning process is more advanced. In this second case, the guideline could be applied starting directly from PART B or using PART A to re-organized available knowledge, data and materials according to the needs of the in-depth analysis. The tiered approach provides flexibility to the methodological guideline, which is considered useful to both organize available knowledge on LSI and gather new information in a structured framework, avoiding duplication of effort.

Since LSI analysis is embedded within the process of preparation of an MSP plan, the proposed LSI steps are clearly linked to some of the typical MSP phases, as highlighted in the following paragraphs and illustrated in chapter 5. Some of the proposed LSI steps consistently overlap with corresponding MSP ones, and shall therefore be implemented together also to avoid duplication of effort and optimize timing. The opportunity to streamline LSI analysis within the process of plan making is highlighted also by Shipman et al., (2018) where links are identified with all the phases of MSP: scoping, assessment, analysis and plan making.

Within the process of plan preparation LSI analysis should be undertaken in two distinct phases: 1) in the stocktaking and analysis phase, where the existing and potential interactions are identified based on the present conditions of the territory and the already planned developments); 2) after scenarios identification, where new interactions could emerge (or disappear) due to the planning choices (see the left arrow pointing to PART B in Figure 9).

**Active engagement of stakeholders** is a key component of the proposed methodological guideline, and it is specifically foreseen in selecting the key LSI interactions (at the interface between PART 1 and PART 2, is Step 8) on the basis of a preliminarily compiled long-catalogue. As for the overall methodological guideline, it is essential that stakeholder engagement in LSI analysis is integrated as much as possible with the process of stakeholder involvement foreseen by MSP.

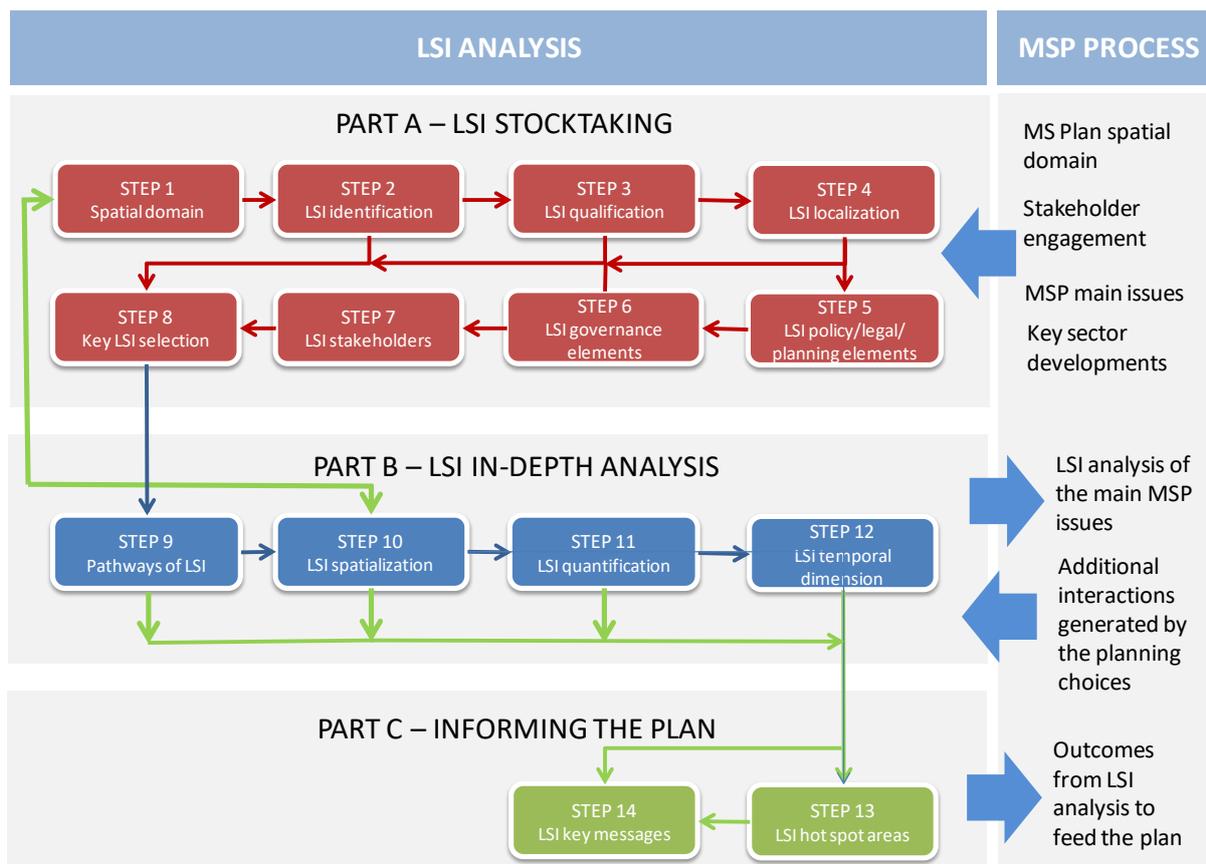


Figure 9: Step-by-step methodological guideline to account for LSI in MSP

In order to provide operational support to LSI analysis in the pilot cases of SUPREME and SIMWESTMED projects, a structured table was prepared according to the steps of the methodological guidance and made available to the project partners as editable file (see Annex 1), to be compiled during the analysis.

*A more elaborated analysis of the on how to perform LSI analysis is given in the complementary document, prepared under the SUPREME project.*

## 5. LSI in the case studies area

Interactions between land and sea have been investigated in the context of SIMWESTMED case studies, some of which (at least in part) applied the methodological guideline for LSI analysis. In general, case study analysis confirmed the added value and usefulness of the proposed approach and its applicability. It also highlighted strengths and weakness and provided recommendations for its further evolution.

The case study on the **Var Department in France** applied most of the steps forming Part A of the proposed methodological guideline. The spatial domain of the analysis (step 1) was defined according to the limits of coastal provinces which are part of the Territorial Coherence Scheme (SCOT – Schéma de Cohérence Territoriale)<sup>4</sup>. Specifically, the landward limit of the spatial domain was set on the terrestrial limit of coastal provinces part of the SCOT, while the seaward limit extended to 3 nm from the coastline. This analysis identified (steps 2 and 3) most relevant land to sea and sea to land interactions related to both natural processes (e.g. coastal erosion and flooding) and human coastal and maritime activities (e.g. those related to mariculture, coastal and lagoon aquaculture, professional and recreational fishing at sea, river and lagoon fishing, agriculture and livestock farming, industry and energy production on land, submarine cables and pipelines, maritime transport and port activities, nature protection). Identified existing LSIs were then qualified according to their environmental, societal and economic effects (step 4). The analysis was completed by the identification of most relevant policies (step 5) and responsible institutions (step 6) related to the considered LSI.

The Var case study highlighted a number of positive elements from undertaking Part A of the methodological guideline, as this:

- enables to collect and structure a detailed information and at the same time provides a glimpse of the bigger picture;
- identifies areas where knowledge is missing;
- enables to deal with a large variety of sectors;
- identifies authorities that can be involved to strengthen integration.

More in general, it was recognised that the use of the LSI analysis can contribute to coherent planning across the coastline and facilitate the integration of MSP and ICZM.

At the same time, some limitations were identified and related recommendations provided by the Var case study:

- Evaluation of interactions includes a certain degree of relativity and subjectivity, which implies that different experts can differently qualify LSI. *Recommendation*: different stakeholders could be involved in LSI evaluation; results could be then combined to produce an overall understanding.
- Evaluation of LSI in terms of environmental, societal and economic effects requires the selection on pre-defined broad attributes (positive, negative and neutral). *Recommendation*: there might be the need to include other attribute values to properly take into consideration a specific condition. For example a “negative” socio-economic impact does not necessarily imply that involved activities cannot be combined: coexistence between coastal and maritime activities can occur in the future, if appropriate measures are planned and implemented.

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<sup>4</sup> SCOT is a French urban planning scheme which provides a common territorial project involving several municipalities with the aim of bringing together sectoral policies (e.g. on housing, mobility, commercial development, environment and landscape).

- Information on some specific aspects (e.g. on military activities) might be unavailable and difficult to obtain. *Recommendation*: when dealing with LSI evaluation, unavailability of information should be properly highlighted (e.g. with the attribute: information not available).
- Definition of some terms of the analysis (e.g. activities taken into account by the sectors) is not immediately clear. *Recommendation*: develop a small manual/glossary.

As part of the **Strait of Sicily case study**, a methodological guideline for LSI analysis was applied in **Malta**, as well. The Maltese exercise also compared the proposed LSI guideline with the steps taken to prepare the Strategic Plan for Environment and Development (SPED), which essentially constitutes Malta's first MSP plan, covering both the terrestrial and parts of the marine waters falling under Malta's jurisdiction (up to the limit of 25 nm).

### Define the spatial domain (step 1)

Within the scope of the SIMWESTMED Maltese case study area, and in accordance with the provisions of the MSP Directive, the spatial domain considered for the LSI analysis was the same defined for the SPED and to be considered again in future revisions of the MSP plan.

### LSI identification, localization and description (steps 2, 3, 4, 9 and 10)

In Malta, the highest concentration of LSIs related to human activities occur within the proximity of the major urban conurbation around the Grand Harbour, Marsaxlokk Harbour and the embayments along the low lying north facing coast, which have been developed for tourism over the last 50 years and have gradually changed to support urban settlements. To a lesser extent, LSI hotspots incorporate also the main inter-island ferry terminals. In general, it can be deduced that the extent of LSIs decreases with distance from the coast. Lower intensity of LSIs is also observed along the southern shores of mainland Malta and most part of the island of Gozo, where access to the sea is very limited. Importance of urban development and associated infrastructure – including road networks – shall be considered as highly relevant for any MSP plan in Malta, since concentration of human settlements provides high demand of various maritime activities. Similarly, the presence of agriculture and rural areas along the coast needs to be taken into consideration, in particular when they extend on or impact natural areas providing important habitats for the life cycle of species dependent on the marine environment (e.g. nesting grounds for seabirds and sea turtles).

Main sea to land interactions due to natural processes identified in the Maltese case study occur along the coastal land and internal waters; they include: interactions due to storms, sea flooding and saltwater intrusion. Principal land to sea interactions are soil erosion and sedimentation. Climate change is expected to consistently affect some of those processes with significant implications on coastal infrastructure serving maritime activities, particularly within ports and harbours.

### LSI policy, legal and governance elements; LSI stakeholders (steps 5, 6 and 7)

The SPED provides a comprehensive policy framework to address the relationships between coastal and maritime activities. Furthermore, it is built on other sectoral plans, such as the Energy Plan and the Aquaculture Strategy, whose preparation was subjected to stakeholder consultations and where relevant, to Strategic Environment Assessments. Therefore, there is a considerable degree of confidence that the MSP plan in Malta is based on an integrated policy framework. Furthermore, the SPED policies call for planned maritime activities to support the national objectives related with the implementation of the Water Framework Directive and the Marine Strategy Framework Directive. For both, the required Programme of Measures respectively seeks to regulate pressures on the marine environment.

According to the Maltese case study analysis, it can be asserted that various LSIs are being addressed within the existing policy framework. However, further in-depth analysis is required to ascertain the degree of integration and attention given to ensure that all measures are actually in place. Monitoring of policy implementation would provide information on the effectiveness of the governance mechanisms in place. For this exercise to be as accurate as possible, it is recommended that the work is carried out with relevant updated information and is supported by stakeholder input that truly reflects the degree of interaction.

### LSI quantification and analysis of temporal dimension (Steps 11 and 12)

The data available for the case study did not allow for a proper evaluation of the degree of the interactions identified, as required by the detailed steps included in Part B of the proposed methodological guideline. However, a preliminary description of the temporal dimension of the LSIs could be determined to a certain extent. Some LSIs – whether arising from natural processes such as storms, or activities, such as tourism – have a seasonal pattern. Fisheries and aquaculture, particularly tuna penning, also incorporate a degree of seasonality. Other LSIs, such as cargo handling and port activities and the resulting direct effects on transport management occur throughout the year. An understanding of the temporal aspect of LSIs would enable planners to determine the appropriate policy framework to adopt, such as whether or not the same maritime space can accommodate different uses through different periods in the year. For example, fisheries and yachting could be accommodated in the same marine space if they occur in different periods, while areas where saltwater is extracted to provide drinking water through desalination would require restriction of other uses throughout the year, possibly defining water protection zones at sea.

### LSI hotspot areas (Step 13)

On the basis of the available information, LSI hotspots in Malta were identified in the areas that are strongly influenced by ports, harbours and urban development, with high concentration of tourism activity. Greatest LSI intensity characterises Marsaxlokk Harbour and Grand Harbour, represented in dark red in Figure 10, which includes also the highest concentration of urban development. The dark orange areas correspond to the inter-island ferry terminals and the main seasonal touristic sites.

### LSI key messages (Step 14)

The main messages that can be extracted from the LSI analysis implemented in Malta case study include the following:

- The list of human activities to be considered in an MSP plan should not only refer to marine uses. The focused approach to determine the typology and location of LSIs broadens the perspective of the MSP plan to the land component as well, to ensure an integrated approach on planning and management of social, economic and environmental aspects.
- The step requiring the analysis of governance and legal aspects highlight the relevance of an integrated policy approach. Furthermore, they can help determining which aspects need to be covered by an MSP plan and which aspects are already covered by other plans and simply need to be supported by the MSP plan.
- The identification of LSI hotspots should help MSP planners to determine where attention is actually needed, and where issues may require specific policy measures or not.

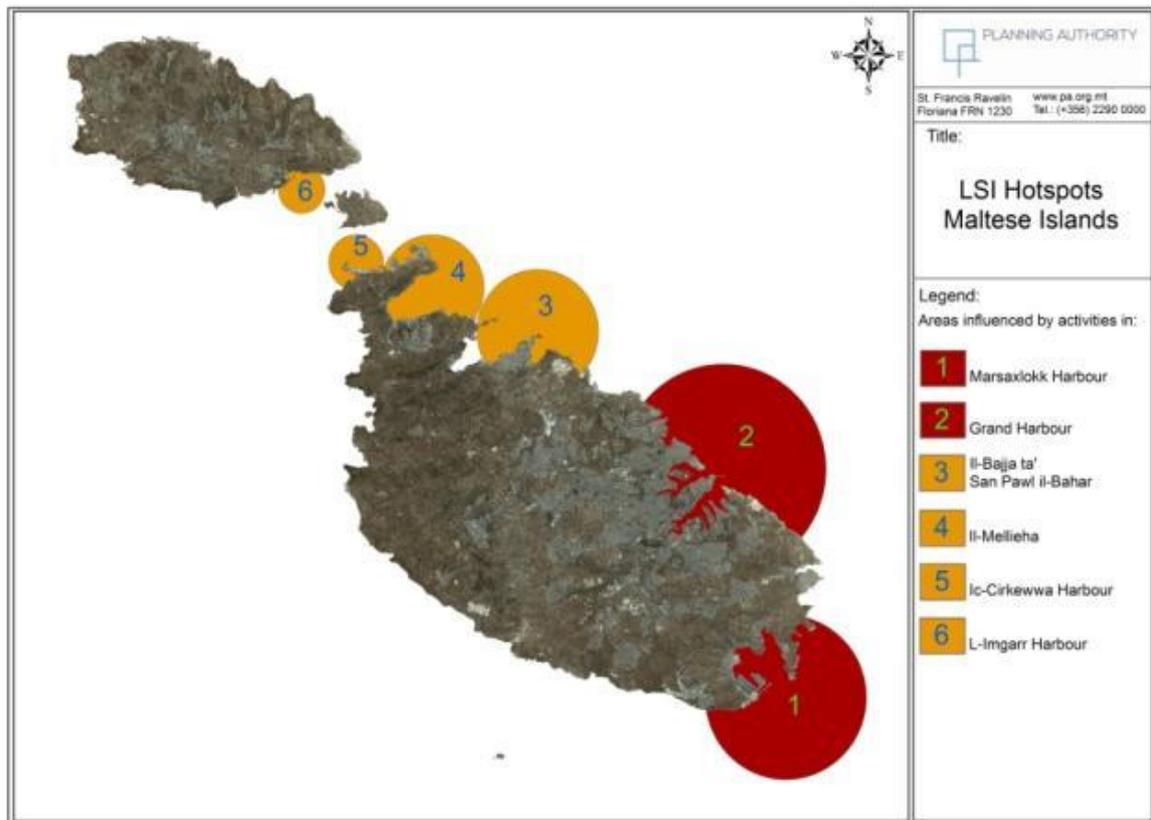


Figure 10: LSI hotspots in Maltese islands. Source: Farella et al., 2018

Finally, the Maltese case study provided following conclusive remarks:

- The LSI analysis implemented within the case study helped to test and somehow validate the conceptual approach of the proposed methodological guideline, as it follows the main procedural steps for the formulation of strategic policy making.
- The guideline shall be adopted in a flexible manner to reflect the state of MSP development in a country. In the case of Malta, it could be applied in the context of SPED review, also as a tool supporting adaptive management for MSP.
- The concrete application of the methodological guideline requires dedicated efforts in terms of resources and time and data availability.
- Additional work to improve wider understanding of LSIs within the MSP process may be required. However, there is a significant parallelism between the concept of LSIs and the ICZM approach. The experience on ICZM may provide opportunities for further refinement on the methodology.

The LSI analysis was also applied in the **Sicilian** portion of the geographical scope of the Strait of Sicily case study, which specifically focused on Parts B and C (steps 9 to 14). As a general comment, it was stressed that the information required for the implementation of the methodological guideline was too detailed, at least for some of the steps, for the case study context. A preliminary application was therefore developed, which indeed enabled to localize the main area and activities involved in LSI. This also allowed to identify methodological gaps and proposals for future ameliorations.

The LSI analysis focused on the four sectors most relevant for the area: offshore oil and gas, fisheries, maritime transport, coastal and maritime tourism. Detailed results of the analysis are described in Farella et al. (2018); the fisheries sector is considered here as an example to illustrate the performed analysis.

Fisheries play an important economic and social role in the considered area. The Strait of Sicily is one of the most important fishing areas in the entire Mediterranean Sea. The fleet consists mainly of bottom trawlers, pelagic trawlers, purse-seiners, long-liners and small-scale boats, which are distributed along a widespread system of fishing ports along the Sicilian coast. In the case study area they are specifically included between the fishing ports of Pozzallo and Portopalo.

Typologies and pathways of interactions were firstly investigated (step 9). Generally, LSIs affecting fishery activities are related with the changes of environmental quality of coastal waters due to nutrients inputs. Such inputs can affect the fishery-based economy in the areas where major fishing ports exist and where fishery products are mainly consumed and used for restaurant purposes. Fishery can for this reason interact with the tourism sector. Moreover, fishery can affect coastal tourism due to its impact on marine habitats and species, when applied techniques are destructive and there is overexploitation of the natural resources. Moreover, fishing activities in the area are source of litter that is discharged in the marine environment. On the other hand, good practices are present in the study area, with several examples of fisheries heritage tourism in Sicily and fishing tourism.

Fisheries-related LSIs can be spatially located between the coastline and the 3 nm limit, along the coast portion including the major fishing ports of the area (Pozzallo and Portopalo) (step 10). As in the case of the other sectors considered in the LSI analysis, quantification of identified land-sea interaction (step 11) was not possible due to a limited availability of needed knowledge and data. It was highlighted that fisheries-related LSIs can show a significant spatial and temporal variability. The latter is mainly due to a high seasonality of stocks life cycles and, as a consequence, of fishery activities (step 12).

Based on the results of the LSI analysis applied to all the four considered sectors, the Sicilian case study identified LSI hot-spot areas (step 13), as reported in Figure 11 (note that boundaries of the highlighted areas are approximated and absolutely not exhaustive of all LSIs). Area 1 refers to the port of Marina di Ragusa and its surroundings, where the main touristic marina is located; therefore, it is specially characterized by LSI of the coastal and maritime tourism sector. Area 2 is mainly related to the oil and gas activities, particularly in terms of connections between offshore platforms and the port of Pozzallo. Area 3 refers to the LSI mainly related to commercial and passengers transport in the port of Pozzallo, but is also influenced by LSI of other activities. Finally, area 4 refers to the interaction of land-based activities and coastal tourism with the Posidonia meadows localized along the coastline.

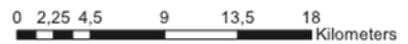
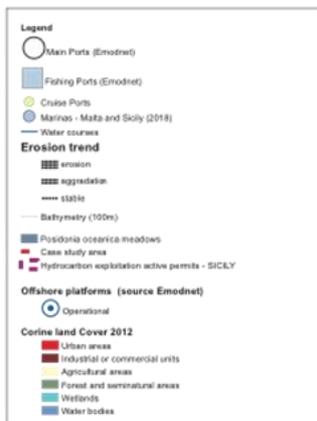
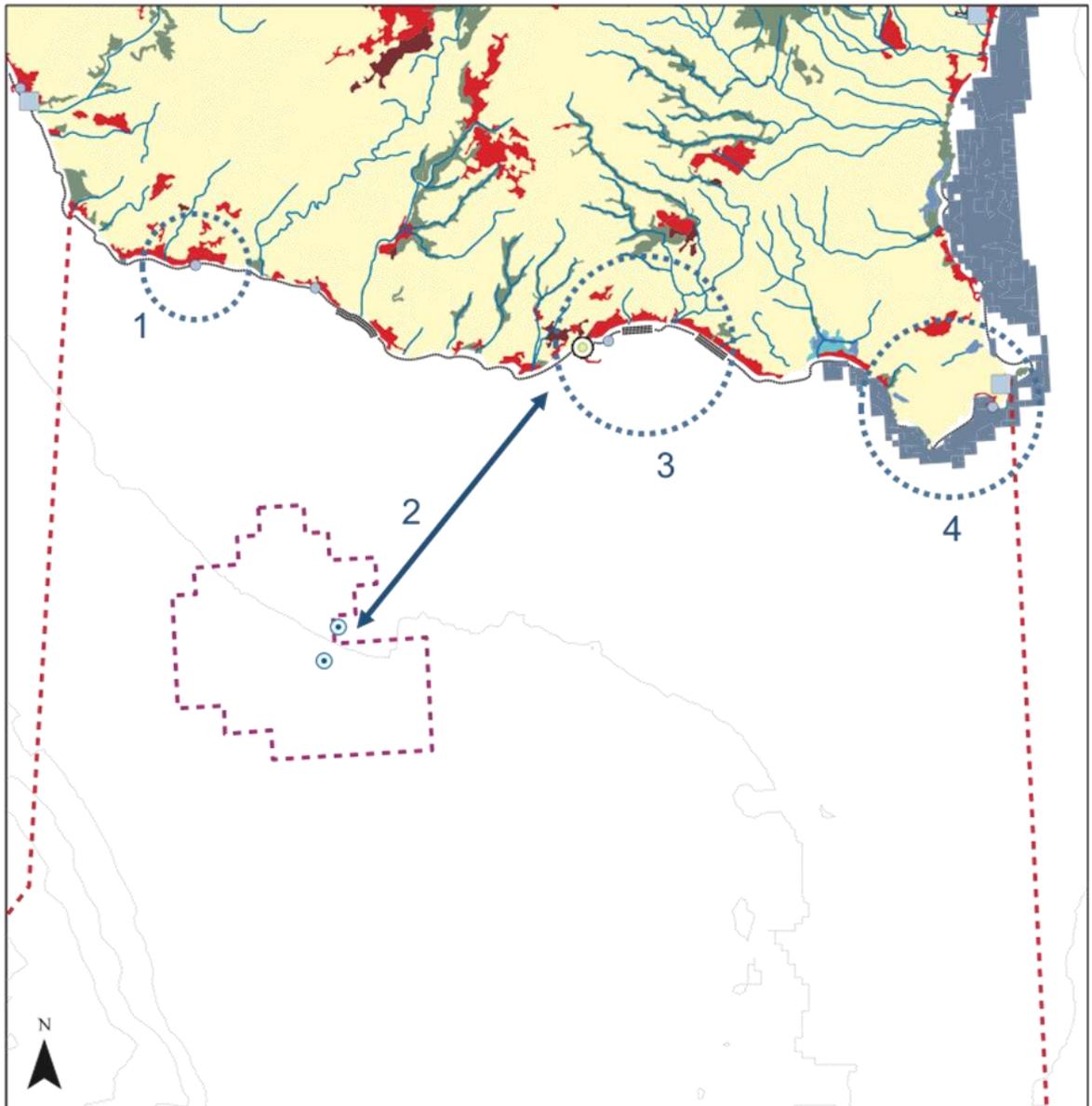


Figure 11: LSI hotspots in the Sicilian portion of the Strait of Sicily case study. Source: Farella et al., 2018

Based on the test of the LSI analysis performed in the Sicilian portion of the Strait of Sicily case study, following conclusive remarks were provided:

- The geographical scale influences the LSI analysis in terms of selection of relevant formation, availability of needed information, depth of the analysis, type and entity of the (socio-economic, administrative and environmental) interactions identified. When applying the methodological guideline, the scale of analysis shall be clearly defined.
- A more advanced definition of what is meant by land-sea interaction might be useful to better support the analysis and orient gathering of needed information. This would also help in better distinguishing the concept of LSI from those of conflicts and synergies among uses and between human uses and environment.
- Depending on the involved processes and sectors, land-sea interactions can be very different in terms of intensity and spatial domain. There is the need to develop in more detail criteria and approaches to properly identify boundaries of the LSI analysis both landward and seaward. More research is needed on this issue and others (as for example the one considered in the previous point) to advance the understanding and framing of LSI topics.
- The performed LSI analysis highlighted that in the case study area there is not exhaustive information to assess the effect of land-sea natural processes on coastal and maritime activities. This understanding is considered highly important – and shall not be underestimated – to identify compensation measures or even anticipate negative interactions.
- Collaboration, co-production of knowledge and sharing of needs and priorities between maritime-based and terrestrial planning communities are fundamental to pave the way toward the best practice of planning.

## 6. Integrating LSI in spatial planning

This document aims to propose a methodological guideline for LSI analysis within the MSP process. However, results from the LSI analysis can inform and support not only maritime spatial planning, but a wider variety of planning contexts. According to the conceptual approach proposed in this document the entire process of accounting for LSI can be divided in three phases (as shown in the diagram of Figure 12):

1. setting context and defining concept (as described in chapter 2);
2. evaluating LSI (according to the proposed methodological guideline presented in chapter 4); and
3. incorporating LSI analysis outcomes into (coastal and maritime) plans (this chapter).

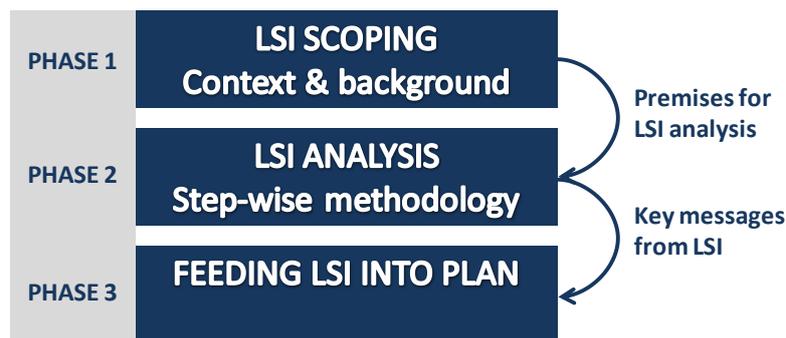


Figure 12: The phased process to account for LSI in planning contexts

Transferring of LSI analysis outcomes (key recommendations according to the last step in the proposed methodological guideline) represents the final and probably the most critical phase in the process of accounting for land-sea interactions. In fact, given the heterogeneity of planning contexts, the timing and the ways to incorporate LSI outcomes may be different. When planning processes formally recognize LSI (like in the case of ICZM or MSP) this can be done within a clear scheme and governance. When LSI is not formalized as a step in the planning process informal mechanisms should be established.

Relevant planning context where LSI analysis outcomes feed into are identified and addressed in the following points, also capitalizing that mentioned at the conference on MSP and LSI held in Malta in June 2017 (EC DG MARE, 2017).

### 6.1 Maritime Spatial Planning

Marine plans developed according to the EU MSP Directive can have different relationships with terrestrial plans:

- Terrestrial and marine planning systems can be maintained separately still ensuring coordination among the two systems to properly take LSI into account. Some Member States have chosen to maintain separately terrestrial and marine planning systems whilst still ensuring that land-sea interactions are taken into consideration. An example of this can be seen in Finland where land-sea interactions are strongly reflected because the Land-Use and Building Act is implemented in territorial waters as well; coastal municipality plans and regional land-use plans (including more municipalities) cover usually both land and sea (up to the territorial water limit). At the same time, the national MSP process has identified four planning areas including the EEZ and territorial waters, thus overlapping to municipal and regional land-use plans (Bocci & Ramieri, 2018).

- Territorial plans can extend to the marine environment with a view to integrate both the land and sea components in a single plan and include land-sea interactions within these areas. For example, the Spatial Planning Act of Mecklenburg-Vorpommern (Germany) covers both land and sea areas (12 nm zone) and the Spatial Development Programme Mecklenburg-Vorpommern contributes to integrated land-sea spatial development. The original idea was to extend ICZM to “more offshore” areas – thus it was called Integrated Maritime Spatial Planning – it was not meant to only cover “planning” but also the implementation/management aspects. In addition to the existing coastal land-use plans that already include marine areas, following the provisions of the Physical Planning Act (fully transposing the MSP Directive), Croatia has started the preparation of the State Plan for Spatial Development including the entire terrestrial and marine area up to the external limit of territorial waters. This plan will be completed by two other MSP plans at the national level: the Spatial Plan of the Ecological and Fishery Protection Zone and the Spatial Plan of the Continental Shelf of the Republic of Croatia (EU MSP Platform, 2018).
- A common strategy (typically at the national scale) encompassing both the terrestrial and the marine components of the coastal area can be created to coherently guide the two planning/management processes.
- It is also technically possible to address LSI by extending the remit of MSP inland, landwards of the high-water mark. However, this would impinge on existing terrestrial planning systems; it is not an approach that appears to have been adopted so far.

The final report of the Malta conference (EC DG MARE, 2017) discusses strengths and challenges of above approaches, also providing examples of their application. It is worth noting that it stresses that there is not one-size fits-all approach: the specific **physical, geographical, legal, administrative, cultural characteristics** of the given context must be taken into consideration to properly select the approach to apply.

Independently of the typology of interrelation between terrestrial and marine plan, LSI assessment shall be a key component of any process aiming to design a maritime spatial plan, as clearly required by the EU MSP Directive.

The “Conceptual Framework for MSP in the Mediterranean” adopted in December 2017 by the Ordinary Meeting of the Contracting Parties to the Barcelona Convention (UNEP-MAP PAP/RAC, 2017) is recognized as a guiding document to facilitate the introduction of MSP into ICZM through the relevant regional framework and within the system of the Barcelona Convention and its Protocols. This framework identifies common principles for MSP implementation in the Mediterranean (including the need to take LSI into account) and provides a step-by-step methodology which has been designed through the capitalization of previously existing guiding documents (Ramieri et al., 2014; Barbanti et al., 2015; Schultz-Zehden et al., 2008; Ehler et al., 2009). Steps considered by the “Conceptual Framework for MSP in the Mediterranean” are:

- Step 1. Starting the process and getting organized.
- Step 2. Assessing the context and defining a vision.
- Step 3. Analyzing existing conditions.
- Step 4. Analyzing future conditions.
- Step 5. Identifying key issues.
- Step 6a. Design phase: elaboration of MSP plans.
- Step 6.b: Strategic Environmental Assessment.
- Step 7. Adopting the plan and organizing the implementation.
- Step 8. Implementing, monitoring and evaluating the plan.
- Cross-step activity: stakeholder consultation.

Table 3 provides a snapshot representation about how the proposed methodological guideline for LSI analysis can be embedded into the MSP process.

Table 3: Links between steps of the proposed methodological guidelines for LSI analysis (chapter 4) and the steps for MSP implementation included in the “Conceptual Framework for MSP in the Mediterranean”

<b>PART A – LSI INTERACTION STOCKTAKING</b>	
<i>Steps of LSI analysis</i>	<i>Steps of MSP process</i>
Step 1. Define spatial domain	<b>Step 3. Analysis of existing conditions</b> <i>(including information from existing plans)</i>
Step 2. Identify interactions	
Step 3. Describe and qualify interactions	
Step 4. Localize interactions	
Step 5. Identify key policy, legislative, planning aspects	
Step 6. Identify key governance aspects	
Step 7. Identify stakeholders	<b>Cross-step activity: stakeholder consultation</b>
Step 8. Select key interactions	
<b>PART B – LSI INTERACTION IN-DEPTH ANALYSIS</b>	
<i>Steps of LSI analysis</i>	<i>Steps of MSP process</i>
Step 9. Pathways of interactions	<b>Step 3. Analysis of existing conditions</b> <b>Step 4. Analysis of future conditions</b> <b>Step 5. Identification of key issues</b> <i>(results from this step feed into LSI analysis – Step 8 to inform selection of the key interactions)</i>
Step 10. Spatialize interactions	
Step 11. Quantify interactions	
Step 12. Analyse temporal dimension	
<b>PART C – INFORM THE PLAN ABOUT LSI ANALYSIS OUTCOMES</b>	
<i>Steps of LSI analysis</i>	<i>Steps of MSP process</i>
Step 13. Identify LSI hot spot areas	<b>Step 6a. Design phase: elaboration of MSP plans</b> <i>(results from this step feed into LSI analysis PART B for a second round of analysis focusing on changes in interactions linked to the planned actions)</i> <b>Step 6.b: Strategic Environmental Assessment</b>
Step 14. Identify key messages on LSI	

## 6.2 Integrated Coastal Zone Management

LSI interactions may be assessed and managed through ICZM initiatives that are well placed to support integrated/holistic planning and management of the coastal areas. This is particularly relevant for the **Protocol on ICZM in the Mediterranean**, given its geographical scope including both the land and marine components of the coastal area (Art. 1). The importance of LSI within the ICZM process is re-affirmed by some of the Protocol's objectives and principles, as:

- *“Ensure preservation of the **integrity of the coastal ecosystems, landscape and geomorphology**” (Art. 5; objective d). Given the definition of the coastal zone provided by the Protocol, this integrity can be preserved only if the land and marine parts of the coastal area are considered together with the consequent needed analysis of LSI.*
- *“Prevent and/or reduce the effects of **natural hazards** and in particular of climate change, which can be induced by natural or human activities” (Art. 5, objective f). The role of LSI is evident also in this case, being most of the coastal hazards (e.g. erosion, coastal flooding, saltwater intrusion in freshwater systems) LSI themselves.*
- *“The biological wealth and the natural dynamics and functioning of the intertidal area and the complementary and **interdependent nature of the marine part and land part** forming a single entity shall be taken particularly into account” (Art. 6, principle a).*
- *“All elements relating to hydrological, geomorphological, climatic, ecological, socio-economic and cultural systems shall be taken into account in an **integrated manner...**” (Art. 6, principle b), which also refers to land-sea interactions due to natural processes and human uses and activities.*
- *“The **ecosystem approach** to coastal planning and management shall be applied so as to ensure the sustainable development of coastal zones” (Art 6, principle c).*

As in the case of MSP, LSI analysis is not a new discipline or requirement, but it is an intrinsic component of the ICZM process (see also section 2.1), which is needed to ensure that the land and sea components of the coastal area are planned and managed in a coherent way. LSI analysis is expected to inform and contribute to ICZM not only supporting the planning processes. Indeed, the proposed methodological guideline can provide input to a wide number of provisions of the ICZM Protocol that the Mediterranean countries are called to implement to put in practice the Protocol's objectives and principles. Some of the principle ones are listed and commented in Table 4, however being aware that LSI assumes relevance for the implementation of the entire Protocol.

The proposed methodological guideline is based on a tiered and flexible approach. As highlighted for MSP, also in the case of ICZM it can be applied both in the case an ICZM process is already in place or in the case this has to be initiated or is in a preliminary phase. In the second case, the entire procedure formed by parts A and B can be applied to gather and analyze the information which is needed to identify and understand LSI implications on coastal planning and management. If an ICZM is already in place, the guideline could be applied starting directly from PART B or using PART A to re-organized available knowledge, data and materials according to the needs of the in-depth analysis to be performed on specific LSI elements and/or areas.

Table 4: Provisions of the ICZM Protocol with relevant links to the proposed LSI methodological guidelines

Ref.	Provision	Consideration on LSI methodological guidelines
<b>Art. 7.b</b>	<i>“Organise appropriate coordination between the various authorities competent for both the marine and land parts of coastal zones ...”.</i>	Step 6 of the proposed procedure aims at identifying the institutions which have competence and responsibility on LSI issues. Some of these shall be also involved in the institutional coordination requested by the ICZM Protocol. Step 5 focusing on policy, legal and planning aspects is also relevant to this regard.
<b>Art. 8.1.a</b>	The Parties <i>“shall establish in coastal zones, as from the highest winter waterline, a zone where construction is not allowed. Taking into account, inter alia, the areas directly and negatively affected by climate change and natural risks, this zone may not be less than 100 meters in width...”.</i>	The delimitation and establishment of the so-called set-back zone clearly requires the identification and analysis of some land-sea interactions, in particular those related to coastal risks as flooding and erosion as well as long-term processes as those connected to sea level rise. Assessment of LSI due to human activities is also highly relevant; for example, defence structures can influence coastal dynamics, while the presence of coastal infrastructures (such as ports) can limit the full application of the set-back concept.
<b>Art. 9.1.e</b>	The Parties <i>“shall define indicators of the development of economic activities to ensure sustainable use of coastal zones and reduce pressure that exceed their carrying capacity”.</i>	The proposed methodological guideline provides information on most relevant LSI in the planning area that shall be considered when developing indicators. Moreover, step 11 focuses on the quantification of key LSI, which can therefore provide direct input to the computation of some indicators.
<b>Art. 9.2</b>	This article of the Protocol requires that the economic activities (agriculture, industry, fishing, aquaculture, tourism, extraction of minerals, extraction of sand, use of aquifers, ports, maritime works, building of infrastructure) are implemented in a sustainable way to ensure preservation of coastal (land and sea) ecosystems and resources.	Most, if not all, of the activities listed by the Protocol depend on or are responsible of LSI. The identification (steps 2 and 8), localization (steps 3 and 10) and assessment (steps 4, 9, 11 and 12) of these interactions are essential to ensure the sustainable management of land and sea-based economic activities.
<b>Art. 10</b>	<i>“The Parties shall take measures to protect the characteristics of certain specific coastal ecosystems...”</i> , including: wetlands and estuaries, marine habitats, coastal forests and woods, dunes.	Some of the coastal ecosystems mentioned in Art. 10 of the Protocol are land-sea transition systems (coastal wetlands and estuaries), which actually rely on LSI and/or are themselves responsible of LSI, in terms of exchange of energy and matter. Interaction of natural processes play a relevant role in shaping coastal habitats (e.g. dunes are modelled by storms and sea dynamics), while human activities (at sea or on land) might be responsible of significant impacts on such systems. The same steps of the proposed methodological guideline highlighted in the previous point, are therefore relevant also for Article 10.

Ref.	Provision	Consideration on LSI methodological guidelines
Art. 11.1	<i>“The Parties recognizing the specific aesthetic, natural and cultural value of coastal landscapes, irrespective of their classification as protected areas, shall adopt measures to ensure the protection of coastal landscapes through legislation, planning and management”.</i>	The value of a coastal landscape is also related to the integrity of the coastal zone, along the land-interface-sea continuum. The aesthetic value of pristine sea facing an unspoiled coastal territory is surely higher than the value of a similar marine area located in front of a highly urbanised coast. The protection of the coastal integrity is not only relevant for aesthetic and cultural reasons, but aims to ensure the preservation of natural processes occurring at the sea-land interface, which are essential for many habitats, species and ecosystem services. The aesthetic, natural and cultural value of coastal landscapes has to be considered in the proposed methodological guideline for LSI analysis, in particular when impacts and benefits are assessed (steps 4 and 11).
Art. 14.1	<i>“With a view to ensuring efficient governance throughout the process of the integrated management of coastal zones, the Parties shall take the necessary measures to ensure appropriate involvement in the phases of formulation and implementation of coastal and marine strategies, plans and programmes or projects, as well as the issuing of the various authorizations, of the various stakeholders.....”.</i>	Step 7 of the methodological guideline recognises the importance of improving the interaction between land- and sea-related stakeholders, in particular to discussing the list of interactions forming the LSI catalogue and selecting key ones. It is important to stress that stakeholder engagement in the LSI analysis is a part of the overall stakeholder involvement across the entire ICZM processes. This implies that a number of stakeholders are common (to the overall ICZM and the specific LSI), while other might be specific for the analysis of land-sea interactions.
Art. 15.2	<i>“The Parties shall organise....educational programmes, training and public education on integrated management of coastal zones with a view to ensuring their sustainable development”.</i>	Given the relevance of LSI analysis for the ICZM process, the methodological guideline illustrated in chapter 4 could be part of educational and training programmes on integrated management of coastal zones.
Art. 18.1	<i>“Each Party shall further strengthen or formulate a national strategy for integrated coastal zone management and coastal implementation plans and programmes consistent with the common regional framework....”.</i>	ICZM strategies and coastal plans and programmes must refer to the entire area to which the Protocol applies as defined by Art. 3. including both the land and sea components of the coastal zone imply a strong focus on LSI as well. The entire proposed methodological guideline for LSI analysis is meant to support a process dealing with coastal planning and management. Specifically step 14 aims to provide the key message from LSI analysis to inform the planning process.
Art. 18.2	<i>“The national strategy, based on the analysis of the existing situation, shall set objectives, determine priorities with an indication of the reasons, identify coastal ecosystems needing management, as well as relevant actors and processes....”.</i>	
Art. 18.3	<i>“Coastal plans and programmes....shall specify the orientations of the national strategy and implement it at an appropriate territorial level...”.</i>	

Ref.	Provision	Consideration on LSI methodological guidelines
<b>Art. 19.1</b>	<i>“Taking into account the fragility of coastal zones, the Parties shall ensure that the process and related studies of environmental impact assessment for public and private projects likely to have significant environmental effects on the coastal zones, and in particular on their ecosystems, take into consideration the specific sensitivity of the environment and the inter-relationships between the marine and terrestrial parts of the coastal zone”.</i>	Art. 19 of the Protocol stresses the importance of taking land-sea interaction into account in the environmental impact assessment (EIA) of projects and strategic environmental assessment (SEA) of coastal plans and programmes. The proposed methodological guideline for LSI analysis can support the environmental evaluation process, specifically considering steps 2, 4, 9, 10, 11 and 12 which enable to assess the nature and intensity of the interactions also in terms of environmental impacts, as well as to spatially localised these LSIs.
<b>Art. 19.2</b>	<i>“In accordance with the same criteria, the Parties shall formulate, as appropriate, a strategic environmental assessment of plans and programmes affecting the coastal zone”.</i>	
<b>Art. 22</b>	<i>“Within the framework of national strategies for integrated coastal zone management, the Parties shall develop policies for the prevention of natural hazards. To this end, they shall undertake vulnerability and hazard assessments of coastal zones and take prevention, mitigation and adaptation measures to address the effects of natural disasters, in particular of climate change”.</i>	The great part, if not all, of natural hazards affecting the coastal systems (e.g. river and sea flooding, sea storm coastal erosion, saltwater intrusions) are related to land-sea interactions due to natural processes, which can be also affected, even strongly, by human activities. Coastal erosion for example is not only due to natural phenomena as the action by hydrodynamic forces, but also to human activities that affect the coastal equilibrium sometimes changing its unstable geo-morphological equilibrium. Future climate changes and sea level rise are expected to increase climate variability and the occurrence of extreme events, thus exacerbating the existing hazards. The proposed methodological guideline can help identifying key LSI interactions to be considered in vulnerability and hazard assessments.
<b>Art. 23.1</b>	<i>“...the Parties, with a view to preventing and mitigating the negative impact of coastal erosion more effectively, undertake to adopt the necessary measures to maintain or restore the natural capacity of the coast to adapt to changes, including those caused by the rise in sea levels”.</i>	
<b>Art. 27.2.c</b>	<i>“With the support of the Organisation, the Parties shall in particular: .....carry out activities of common interest, such as demonstration projects of integrated coastal zone management”.</i>	This guiding document can provide the methodological basis to develop demonstration projects specifically targeted to the analysis of LSI and the integration of its results into a real coastal and marine planning process. The outcome of case studies developed within the SUPREME/SIMWESTMED projects as well as of some of the CAMP projects can be to this regard particularly useful.

## 6.3 Other planning processes

LSI analysis plays a relevant role also in other planning processes which might have a more sector/focused approach.

**River Basin Management Plans (RBMP)** prepared under Water Framework Directive (WFD) provisions represent one of these contexts in which to address LSI. These plans actually focus on the Land → Sea interactions and foresee a detailed analysis of pressures and impacts on water bodies. Measures are ultimately oriented to reach and guarantee a good chemical and ecological status of water bodies. Given the geographical scope of these plans, as defined in the Directive, they represent a powerful instrument to manage chemical and ecological quality of waters according to a system approach, thus considering the interconnections between the terrestrial waters (lakes, rivers and groundwater) through the transitional waters with the coastal marine waters. Implementation of the WFD shall be carried out in coordination with the EU Floods Directive (2007/60/EC), notably RBMP shall coordinate with **Flood Risk Management Plans**. The EU Flood Directive applies to both inland and coastal waters, aiming to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. Even if this Directive and related plans focus on a specific Sea → Land interaction (flooding), the analysis of other LSIs is essential to determine the vulnerability of the coastal areas to flooding and assess the risk to human settlements and economic activities.

The **Programmes of Measures** developed according to the **Maritime Strategy Framework Directive** do need to consider LSI analysis outcomes in order to guarantee the achievement and maintenance of a good environmental status. Pressures/impacts analysis is a key step in the implementation process of this Directive and this is where land-based pressures should be taken into account, to assess how they affect the environmental status of marine waters. Still referring to MSFD, the experience of Croatia, which has developed the Strategy for the Management of the Marine Environment and Coastal Zone, is worth mentioning. This Strategy links the ICZM Protocol obligations with the obligations of the MSFD, following the ecosystem-based approach (EU MSP Platform, 2018).

**Sector plans** also represent contexts for LSI analysis application. As discussed above, all maritime activities have strong connections to land and these demand for planning of the use of space in the terrestrial domain.

For example, marine aquaculture and fishery are dependent on access to ports and their demand for mooring, landing areas and other activities are relevant for ports planning. When aquaculture is planned and developed in coastal waters its siting needs to consider compatibility with other uses of, for example, beach tourism, and with the needs of environmental protection.

Cable and pipelines need a physical connection with land to onshore energy and communication terminals. So do pipelines for transfer of product, shipping for supply, maintenance and off-loading. Ports and coastal plans are core instruments to accomplish with the needs of these maritime activities and harmonizing them with the other uses of the sea and the coast.

Maritime transport in general including the cruising component of maritime tourism also has a very relevant demand in terms of space on land, port facilities and land connectivity. These components are also of utmost relevance for plans dealing with territorial inter-mobility, connections, and transportation.

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Following the emerging need to introduce MSP in the entire Mediterranean Region, the 20<sup>th</sup> Meeting of the Contracting Parties to the Barcelona Convention (COP 20, Tirana, Albania, 2017) adopted the *Conceptual Framework for Marine Spatial Planning*. Therefore, MSP was introduced within the Barcelona Convention System, as the main tool/process for the implementation of ICZM in the marine part of the coastal zone, thus contributing to the balance between environmental, social and economic dimensions of sustainable development.