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Land Sea Interactions in the framework of ICZM and MSP

SUPREME

Supporting maritime spatial Planning in the Eastern Mediterranean (SUPREME)

SIMWESTMED

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List of Acronyms

BPZ	Biological Protection Zone
CAMP	Coastal Area Management Programme
CBA	Cost-Benefit Analysis
CBD	Convention on Biological Diversity
CISD	Croatian Institute for Spatial Development
CNR-ISMAR	Italian National Research Council - Italian National Institute of Marine Sciences (*Consiglio Nazionale delle Ricerche/Istituto di Scienze Marine)*
CO2	Carbon Dioxide
COP	Conference of the Contracting Parties
CORILA	Consorzio per il coordinamento delle ricerche inerenti al sistema lagunare di Venezia
d.lgs.	Legislative Decree (*Decreto legislativo*)
DPCN	Department of Civil Protection (*Dipartimento della Protezione Civile*)
DPSIR	Drivers, Pressures, State, Impact and Response
EcAp	Ecosystem Approach
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
ESRI	Environmental Systems Research Institute
EU	European Union
GES	Good Environmental Status
GIS	Geographic Information Systems
GRID	GeoReference Interactions Database
HNS	Hazardous and Noxious Substances
ICM	Integrated Coastal Management
ICZM	Integrated Coastal Zone Management
ICM	Integrated Coastal Management
IEO-CEDEX	Spanish Institute of Oceanography – Comercial Autonomous organism Ascribed to Ministry of Public Works (*Instituto Español de Oceanografía – Centro de Estudios y Experimentación de Obras Publicas*) Independent Evaluation Office-Civil Engineering Research Agency (Spain)
IMSP	Integrated Maritime/Marine Spatial Planning
ISPRA	Italian National Institute for Environmental Protection and Research (*Istituto Superiore per la Protezione e la Ricerca Ambientale)*
IUAV	University in Venice, Italy
Km	Kilometre
LSI	Land-Sea Interaction
MAP	Mediterranean Action Plan
MARSPLAN-BS	Cross-Border Maritime Spatial Plan for the Black-Sea – Romania and Bulgaria
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
NAPA	North Adriatic Port Association
NM	Nautical mile
NKUA	National and Kapodistriako University of Athens
NTUA	National Technical University of Athens
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 (*Piano della Gestione del Rischio Alluvione*)
PBTs	Persistent, Bioaccumulative and Toxic Chemicals
PPTR	Puglia regional landscape plan
RBMP	River Basin Management Plans
RRC Koper	Regionalni Razvojni Center Koper
SCI	Site of Community Importance
SCOT	Territorial Coherence Scheme (*Schéma de Cohérence Territorial*)
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
SPA/BD	Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean
SPZ	Special Protection Zone
SPED	Strategic Plan for Environment and Development
SUPREME	Supporting Maritime Spatial Planning in the Eastern Mediterranean
TAP	Trans-Adriatic Pipeline
UCH	Underwater Cultural Heritage
UN Environment	United Nations Environment Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTH	University of Thessaly
WFD	Water Framework Directive

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Foreword

This document was prepared by the Priority Actions Programme Regional Activity Centre (PAP/RAC) in the framework of the projects: “Supporting Implementation of Maritime Spatial Planning in the Western Mediterranean Region“ (SIMWESTMED) and “Supporting Maritime Spatial Planning in the Eastern Mediterranean“ (SUPREME), Co-funded by the European Maritime and Fisheries Fund of the European Union (Grant Agreement EASME/EMFF/2015/1.2.1.3/01/S12.742087 – SUPREME; Grant Agreement: EASME/EMFF/2015/1.2.1.3/02/SI2.742101 - SIMWESTMED).

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 costal 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).

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.

General Framework for LSI developed by EC DG MARE 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).

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)[1] 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.

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

These interactions shall be identified and mapped, assessing their cumulative impacts, benefits 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)

SEA-LAND INTERACTION ***Economic activities / natural phenomena at "sea" interacting with "land"***	**LAND-SEA INTERACTION** ***Economic activities / natural phenomena at "land" interacting with "sea"***
SPECIFIC HUMAN ACTIVITIES	SPECIFIC HUMAN ACTIVITIES
▪ Aquaculture in seawater ▪ Fishing ▪ Mining activities from seabed (including sand and marine aggregates mining) ▪ Industry (systems, including off-shore desalination, CO_2 capture and storage) ▪ Energy industry (offshore /oil and gas] energy, offshore renewable energy [wind, waves, surge/) ▪ Infrastructures (ports, civil works of marine / coastal engineering /artificial reefs, breakwaters, etc./) ▪ Submarine cables and pipelines ▪ Maritime activities in general, including dredging and storage of materials ▪ Maritime transport (maritime traffic, commercial, including ferries) ▪ Tourism and cruise boat ▪ Recreation and sports ▪ Biotechnology ▪ Marine Protected Areas (MPA), Biological Protection Zones (BPZ) (and in general "area based management tools, including marine protected areas") ▪ Defence and security	▪ Coastal and lagoon aquaculture ▪ River and lagoon fishing ▪ Natural resource use (water abstraction, removal of aggregates /quarries/) ▪ Farming and livestock farming ▪ Industry (food, manufacturing, on-shore plant, including desalination plant, CO2 capture and storage) ▪ Energy industry (onshore energy /oil and gas/, onshore renewable energy /wind, sun, geothermal/) ▪ Infrastructures (river ports, including dredging activities, engineering work, including dam, bridges, remediation activities, railways and roads), Port activity ▪ Transports (river transport, road and rail transportation) ▪ Tourism, sports and recreation activities (i.e. bathing stations, touristic facilities) ▪ Biotechnology ▪ Natural Protected Areas (Nature reserves, National Parks, Regional Parks, etc., on-shore or with offshore boundaries) ▪ Defence and security
GENERAL HUMAN ACTIVITIES	GENERAL HUMAN ACTIVITIES
▪ Waste (marine litter)	▪ Urban plants (including pollution of water bodies that collect waste water) ▪ Waste ▪ Services network (i.e. sewage systems)
NATURAL	NATURAL
▪ Extreme events (storms, heavy tides, tsunami) ▪ Sea Level Rise (global and local) ▪ Risks to coastal areas (coastal erosion, marine flooding and saline intrusion) ▪ Algae bloom ▪ Volcanic and tectonic activities	▪ Soil erosion (leaching, wind action) ▪ Natural subsidence ▪ Hydrogeological instability (including landslides) ▪ Transport of river sediments ▪ Flooding ▪ Volcanic and tectonic activities

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.

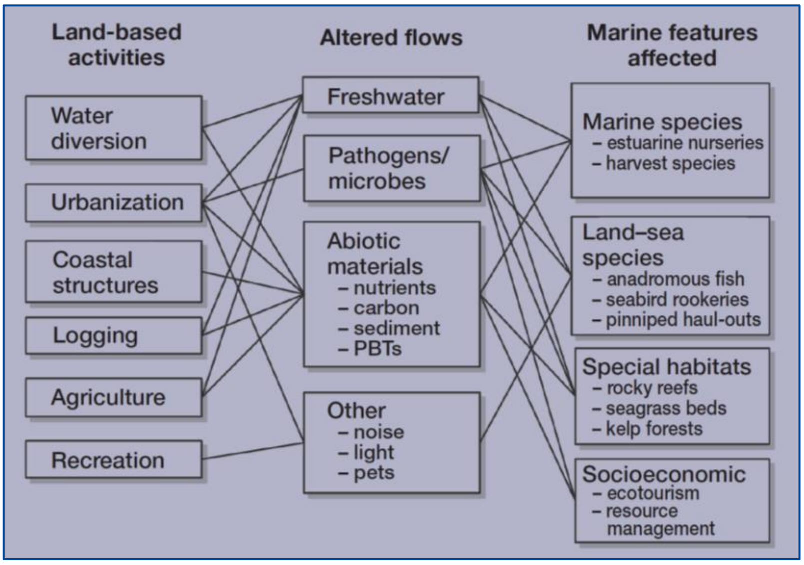


Figure 1: Examples of land-based influences on marine features. Source: Stoms et al. (2005)

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 word's population live in the coastal zone. Socioeconomic interactions can influence land-sea processes and drive cross-system threats.

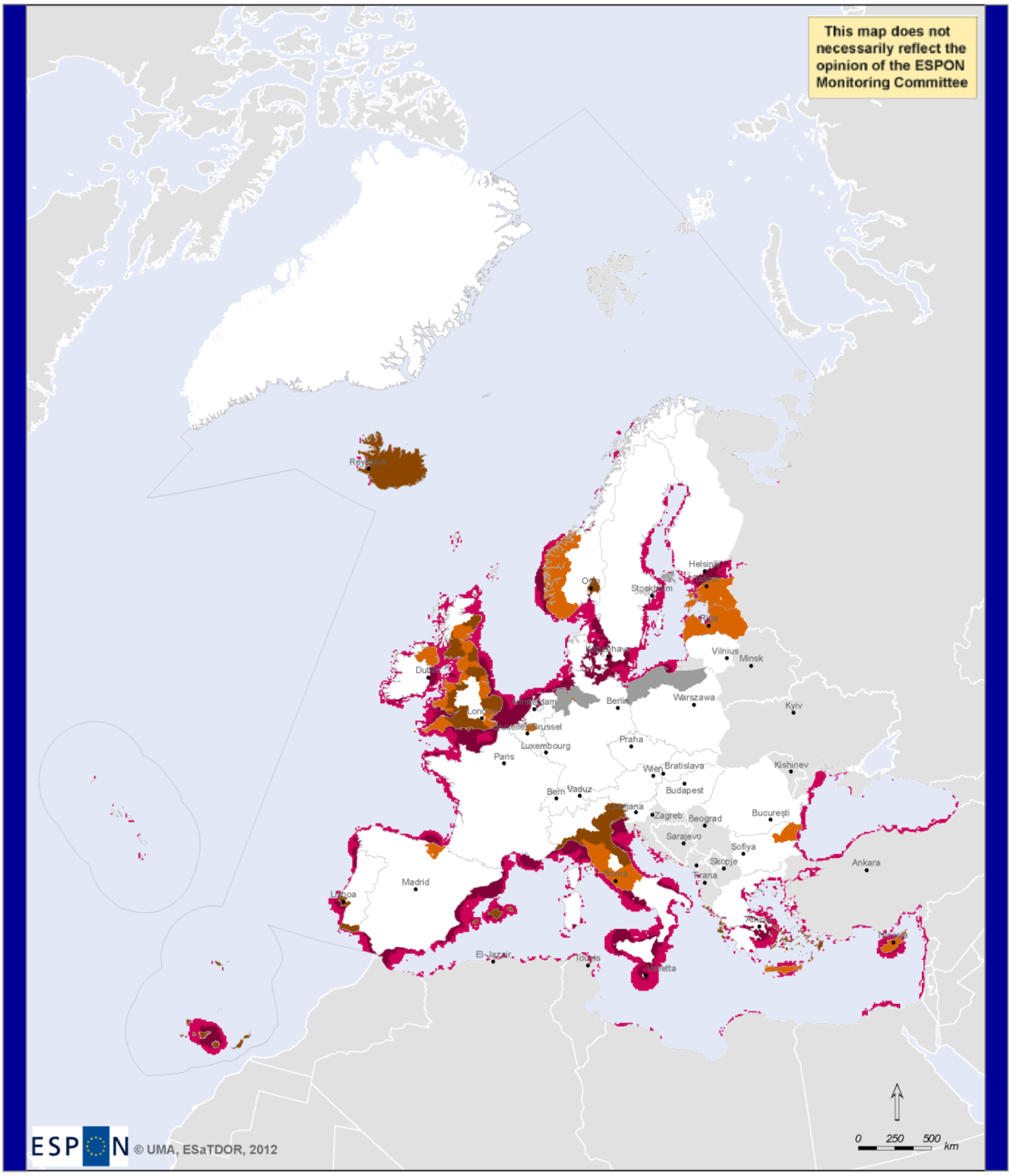
In fact, LSI analysis should not limit to environmental implications of interactions but also consider (and ensure) the well-being of inhabitants of the coastal zones, achieving the combination of environmental, spatial and socio-economic development. Referring to the last point, the importance of interactions 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.



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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 *(Enviromental 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)

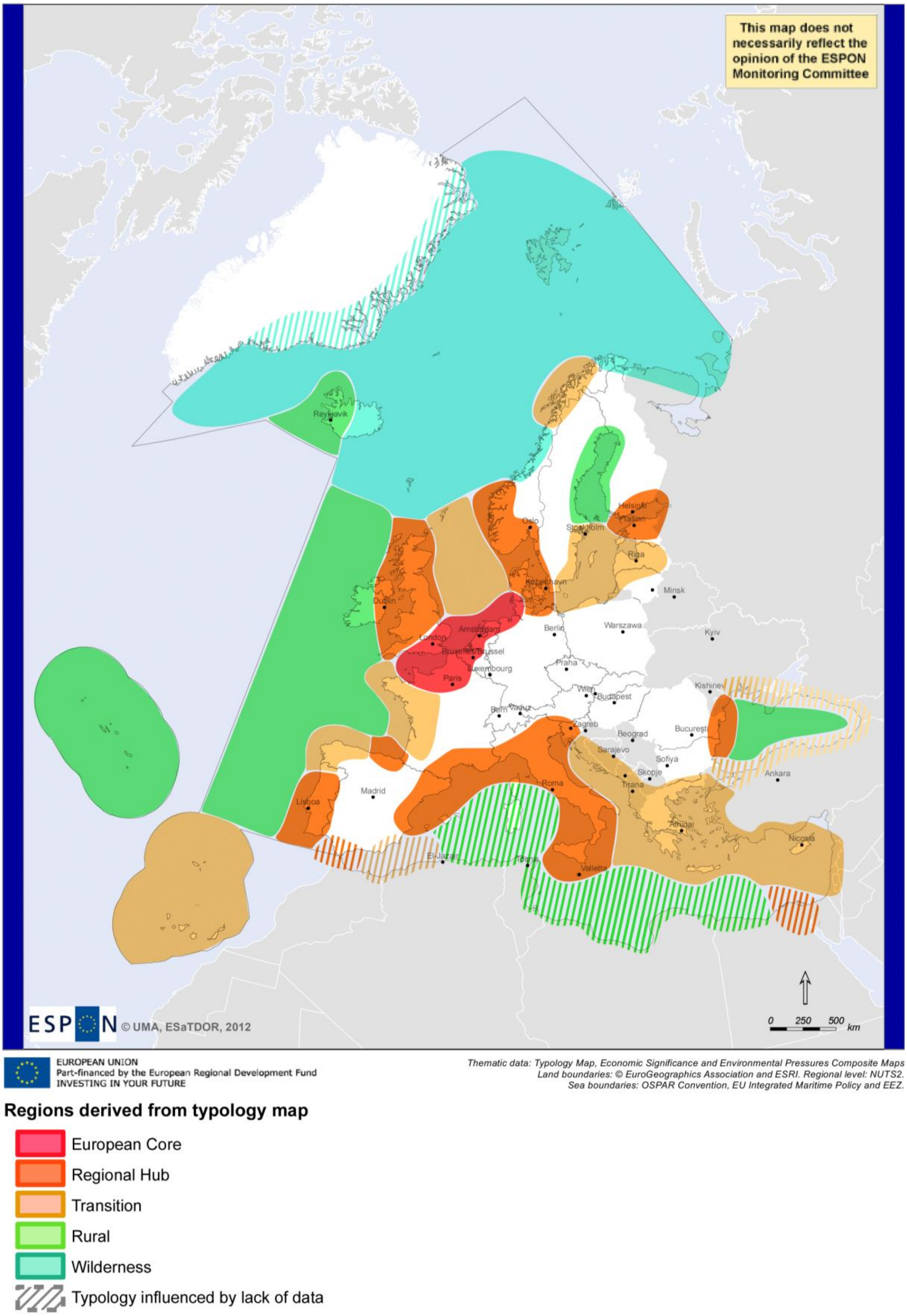


Figure 3: Classification of maritime and coastal regions according to the intensity of LSI.
Source: ESPON and University of Liverpool (2013)

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
Economic Significance	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.
Flows	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.
Environmental Pressures	High environmental pressure associated with human uses.	Significant environmental pressures.	Medium environmental pressures.	Low environmental pressure.	Limited environmental pressure.
Land-Sea Interactions	**Very high**	**High**	**Medium**	**Low**	**Very low**

According to the referred assessment (Figure 3), 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 2 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. Also, Eastern Mediterranean can mainly be considered as area of transitional LSI intensity, with medium environmental pressures and more narrowly or localised concentration of maritime economy. Exception is the Italian coastal area in the Adriatic and Ionian Seas that is part of a regional hub characterised by strong land-sea interactions, high maritime activities and employment (although less than the European Core ones), but also significant environmental pressures. Finally, the southern rim of the Eastern Mediterranean is categorised as a 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^2 (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.

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

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).

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

At the national level, a definition of LSI is provided by different national legislations, mainly related to transposition of the European Directive on MSP. Information provided below is derived from relevant SUPREME and SIMWESTMED Deliverables.

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)[2].

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.

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[3].

[2] Sources EU MSP Platform – www.msp-platform.eu/countries/spain

[3] Source EU MSP Platform – www.msp-platform.eu/countries/malta

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 1st 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);
- UNESCO sites;
- coastal areas with high landscape/seascape value;
- areas with important coastal marine infrastructures (e.g. ports).

The transposition of MSP EU Directive in the **Croatian legislation** is given by the Physical Planning Act (Official Gazette 153/13, 65/17). Section 4.2 of the Act, defines the Protected (Marine) Coastal Area (PCA) (Art. 45-49.f) as a zone of special State interest, encompassing the area of coastal cities and municipalities (including territorial sea). Within that zone, and in order to ensure protection and sustainability of development and planning, restricted area covering 1,000 m wide continental belt (both on terrestrial part and islands) and 300 m wide sea belt, measured from the coastline, is established. In addition, land-sea interactions are explicitly addressed as part of Art. 8, 49.b.1, 49.c of the Act, being one of the key principles of spatial planning.

Slovenian Spatial Planning Act (Official Gazette, 61/17), addresses marine spatial planning, thus transposing MSP Directive in the **Slovenian legislation**. The Act states (Art. 23) that planning of marine uses at sea shall follow the same approach as planning on the land. The Act also requires preparation of marine strategy.

LSI is considered in the **Greek** Special Frameworks for Spatial Planning covering specific sectors, including aquaculture, tourism, industry and renewable energy. These include provisions for the coastal and marine aspects of each sector. The EU MSP Directive has been transposed into the Greek legal system by the Law 4546 (GG 101/A/12-June-2018).

3.2 LSI examples in SIMWESTMED countries

Country fiches (CORILA, 2017; CISD, 2018; NTUA, UTH and NKUA, 2018; RRC, 2018) and comparative LSI overview (NTUA and UTH, 2017) prepared under the SUPREME project for the Eastern Mediterranean EU countries provide a complete picture of relevant LSIs at national level. The following most relevant and common challenges with regard to LSI in the SUPREME area have been identified in the SUPREME country fiches:

- coastal erosion;
- climate change impacts and disaster risk reduction;
- proper planning and management of connections between land and sea-borne transportation;
- coastal urbanisation and littoralization;
- booming of coastal tourism;

- land-based impacts to marine environment as eutrophication and pollutant contamination along hot spot areas;
- degradation/transformation of land-sea transition system as coastal lagoons and deltas;
- difficulties in establishing a proper protection of vulnerable and high values coastal-marine systems;
- limited connection between coastal-marine and rural development.

On the basis of the country fact sheets and the Initial Assessment overview (Musco et al., 2018) of Western Mediterranean EU countries, 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 all the Western Mediterranean EU countries are identified with the maritime **transport**, **tourism**, **energy industries** and **marine litter**.

The Western Mediterranean EU 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.

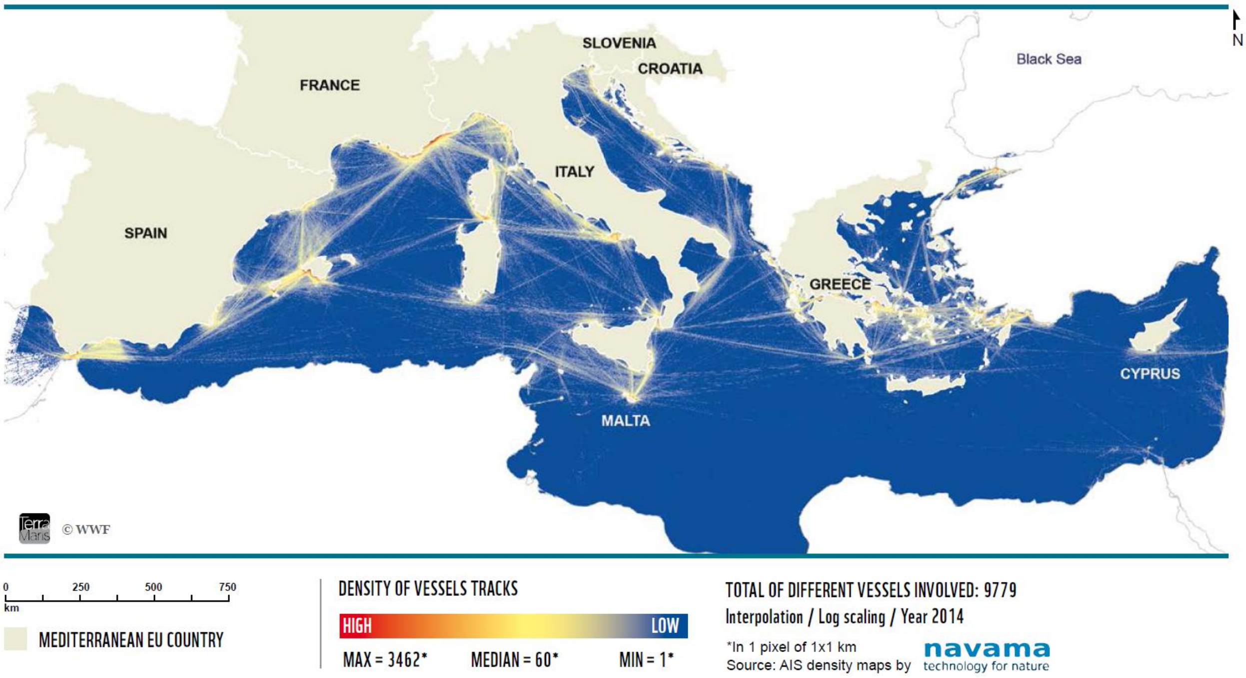


Figure 4: Density of vessels in the Mediterranean Sea Basin (Navama). Source: Piante & Ody, 2015

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.

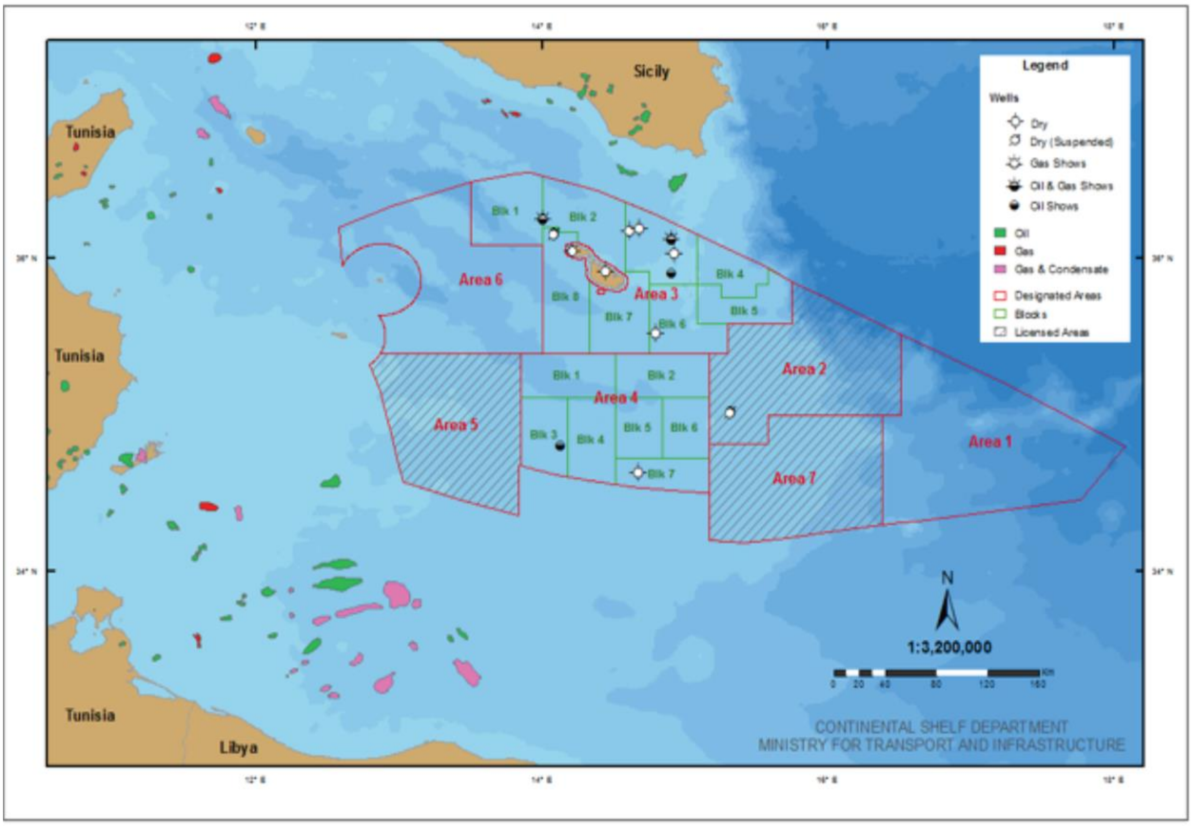


Figure 5: Geographical localization of hydrocarbon prospection areas in Maltese waters.
Source: Musco et al., 2018

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].

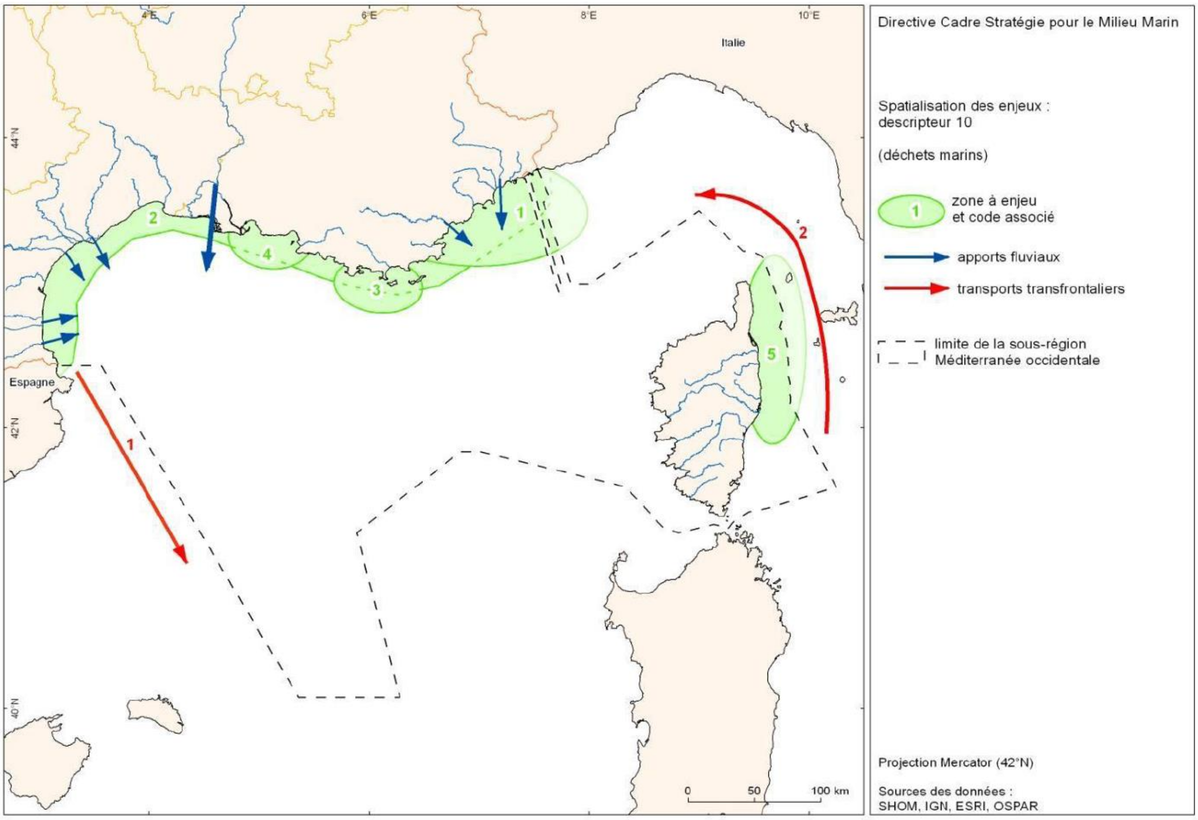


Figure 6: Distribution of marine litter in French waters. Source: Musco et al., 2018.

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^2 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.

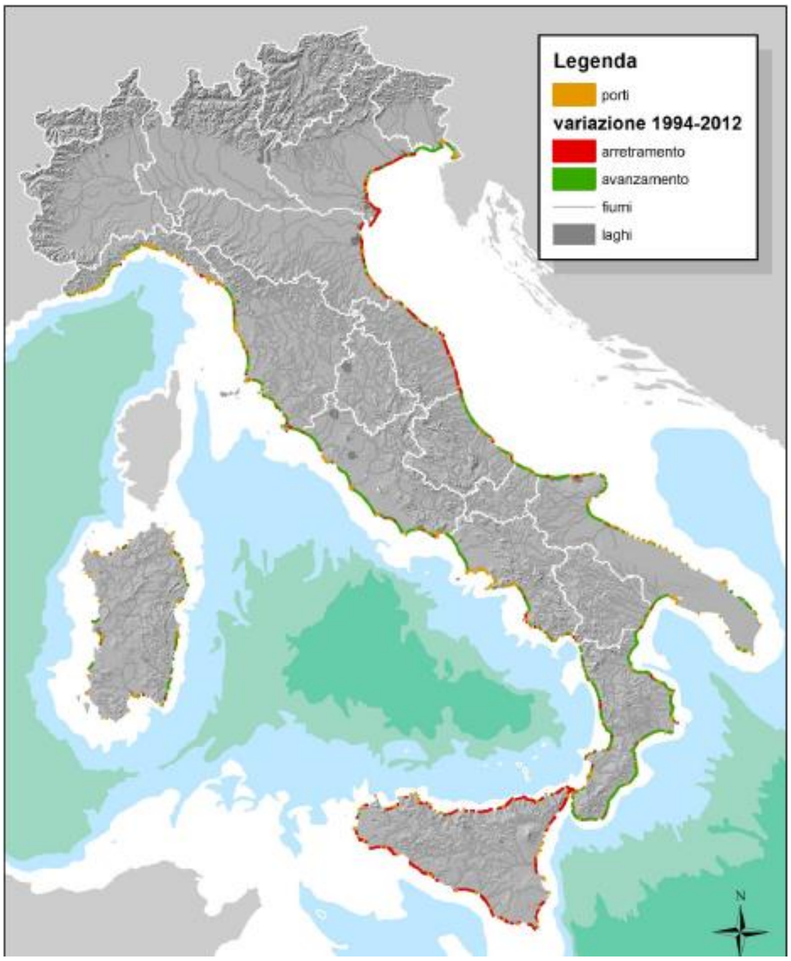


Figure 7: Coastal erosion along the Italian coast. Source: ISPRA, 2017

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 leaded 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.

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).

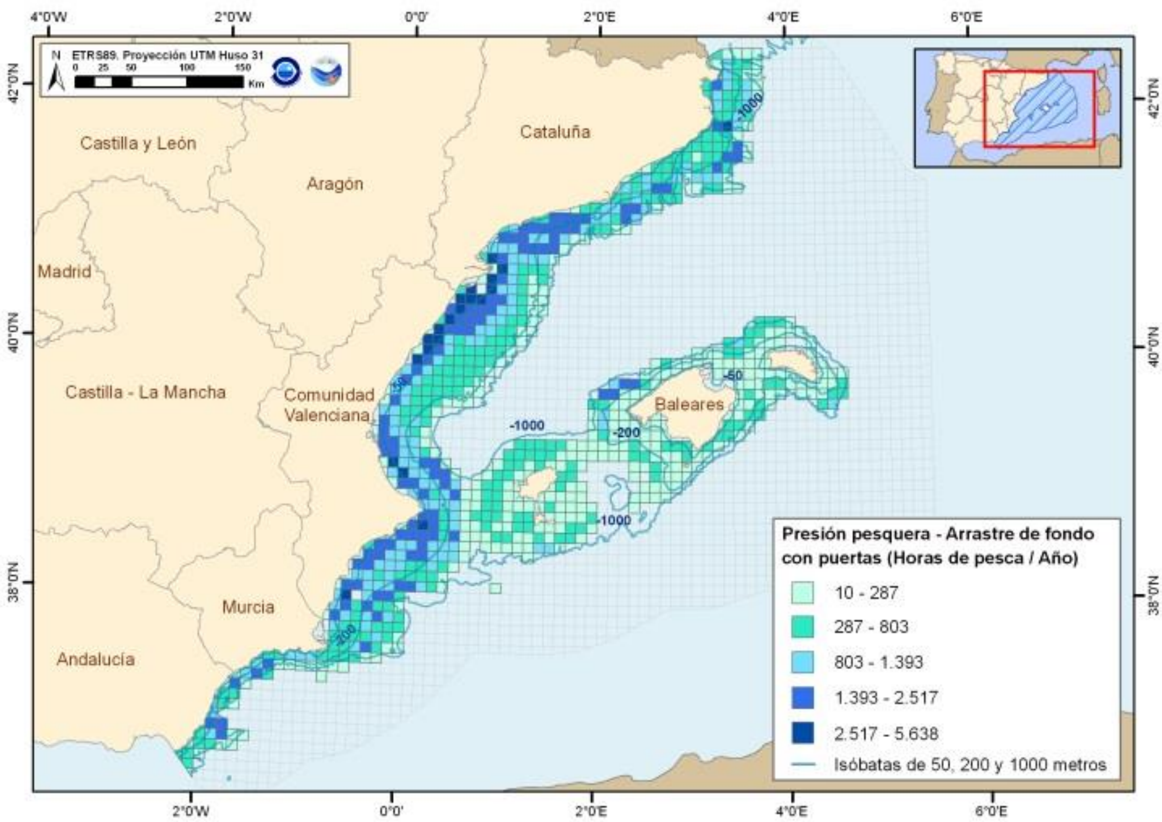


Figure 8: Geographical distributions of a bottom trawl gear effort in Spain. Source: Musco et al., 2018

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.

Risks to coastal areas (coastal erosion, marine flooding, and saline intrusion) represent important, natural LSI for Slovenia. In the Slovenian coastal area, three areas (Izola, Koper and Piran) were defined as Areas of Significant Impacts of Floods according to the Floods Directive (Directive 2007/60/EC). On two of these areas (Izola and Piran) marine flooding is the main risk source, while in the area of Koper flood risk is a result of both marine and river flooding. Natural coastal erosion processes on the Slovenian coast have been significantly altered, since only 23% of the coastline remains in natural state. An important part of the natural coastline represents the flysch cliffs at Piran, Strunjan and Debeli rtič (RRC, 2018).

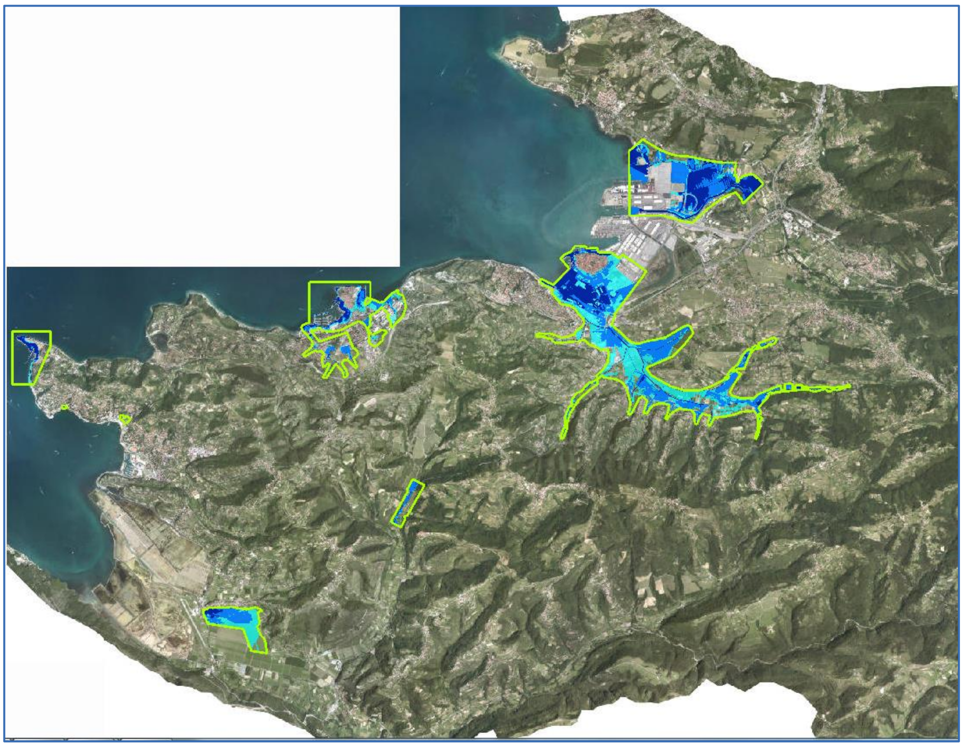


Figure 9: Map of areas with 10-, 100-, and 500-year floods on Slovenian coast – integral map of flood risk. Source: (Altas voda, 2015)

Abstraction of seawater for human uses is a relevant LSI for Slovenia. Some of the water is used for spas, some for the production of heat, technological, and other reasons (such as fire water). Abstraction of seawater can be detrimental to both ecosystem services provision and natural ecosystem functioning, however due to heavily regulated usage of the water abstractions in Slovenia, it is ensured that the impacts on the ecosystem level remain negligible. Since the water is used for a variety of economically profitable sectors (tourism, energy production, technology) its abstraction is beneficial to human society, as it supports jobs, as well as recreational activities. Water abstraction is regulated by granting of permits and rights for the use of sea water, which is under jurisdiction of the Slovenian Water Agency and monitored by the Environment Agency of Slovenia. Geographically, this activity is distributed along the Slovenian coast, see the following Figure 10 (RRC, 2018).

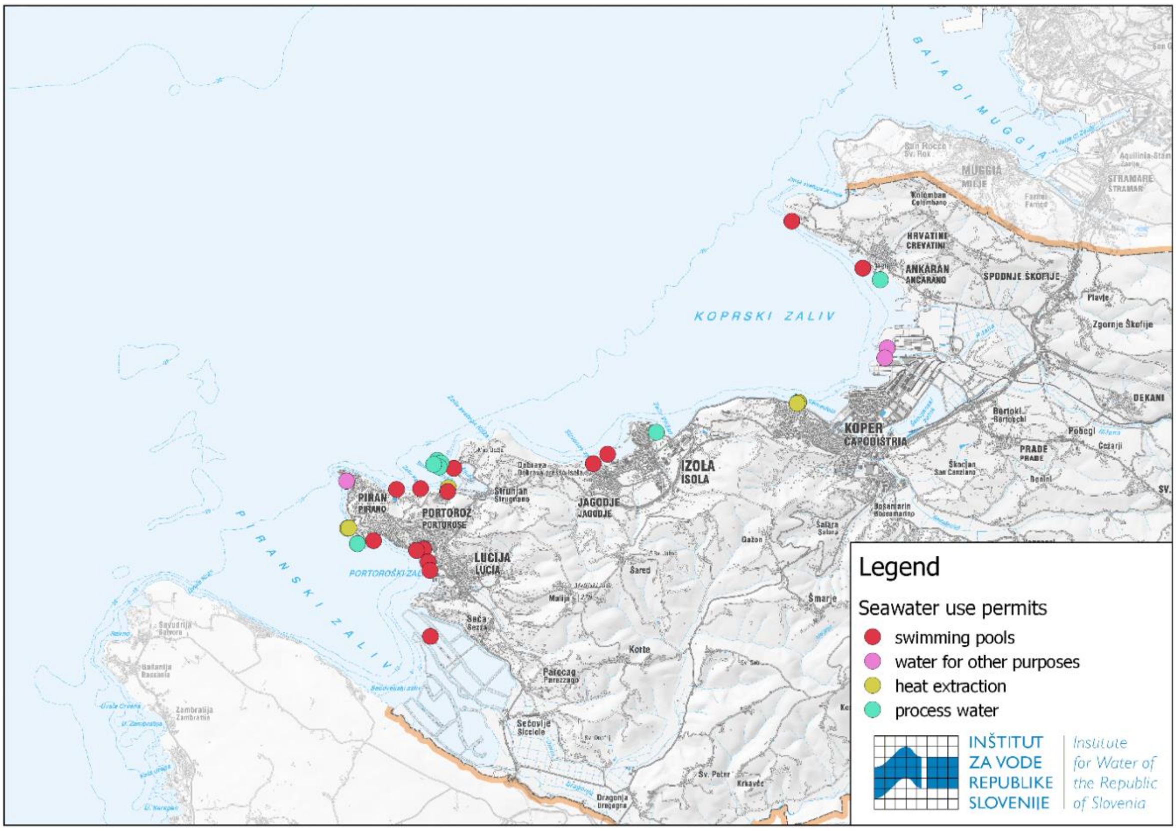


Figure 10: Seawater use permits in Slovenia.
Source: prepared by IzVRS; data source: Atlas okolja, 2017.

Hydrogeological instability is a characteristic of Croatia due to the karstic nature of the coast and the underwater. There are significant areas under flysch where landslides are common risk. Flysch in Adriatic part of Croatia is widespread in Istria, Kvarner region, on some bigger islands as Rab, Hvar, etc., Ravni Kotari, Makarska littoral and southern from Dubrovnik in Konavle littoral. These phenomena determine negative LSI due to the risk of earthquakes, tsunamis, remodelling of watercourses, floods connected with barriers caused by remodelling (upstream and downstream), dislocation of river and stream beds, new risks of potential landslides, changes in relief and consequently in habitats (CISD, 2018).

The strong growth of tourism and particularly the increased number **of cruise ships represent a relevant LSI for Croatia** determined by human activities. Tourism development and growth is visible along the entire coast, while the arrival of cruise ships primarily refers to the largest seaside towns such as Dubrovnik, Split and Rijeka.

Negative impacts on the environment are related to the pollution of the sea and sea bottom in nautical anchors, sea pollution along coastline, chemical pollution, waste and wastewater discharge, oil outbreaks, underwater noise and so on. The expansion of nautical infrastructure affects the local loss of marine flora and fauna. Cruise tourism destinations have problems with resolving the issue of large amounts of generated waste (approximately 4,400 kg of waste per day per ship), while the particular problem is the discharge of ballast water through which invasive species are transported. Negative impact is also seen through the spread of invasive species by nautical vessels and pollution of the sea by discharges from nautical vessels. Excessive use of marine space for tourism can lead to a reduction in biodiversity and attractiveness of the area, as well as reduction of overall space capacity. Positive impacts are related with socioeconomic development by increasing the number and diversity of jobs, as well as diversification of tourism and complementary activities. Sea makes it possible to develop bathing tourism and is a main reason for tourist arrivals in Croatia (CISD, 2018).

Related also with the previous one, **expansion of port infrastructure, construction of breakwaters, construction of road transport infrastructure, for connecting islands (bridges), infrastructure construction in general represent together another relevant LSI for Croatia**. Negative impact on the environment is evident in the degradation of the natural landscape, in damaging the submarine habitat (and thus the marine flora and fauna), the collapse of the coast and the coastal sea floor, etc. The expansion of the port infrastructure often results in the expansion of artificial cover (concrete, asphalt) degrading natural coastline and all related elements of the marine and land ecosystem. Construction of roads and road embankments along the coast often destroys valuable marine habitats nearby. Positive impacts of increased number of port infrastructures are related to the development of maritime traffic and maritime activities (fisheries). Positive impact of the construction of breakwaters is visible in increasing the safety of coastal dwellers. The construction of road infrastructure, primarily bridges, is positive for socioeconomic revitalization of islands (CISD, 2018).

Due to its extensive coastal zone, **marine flooding represents an important LSI for Greece related to national processes** in most parts of its coastal territory. The impacts of marine (coastal) flooding on natural resources and ecosystem services are identified in salinization of coastal aquifers, accelerated coastal erosion, intrusion of salt water in estuaries and river systems, degradation of coastal wetlands, deterioration of flora and mobilization of soil pollutants and other phenomena. The impacts on human activities are represented by increased danger of floods and thus, human loss, destruction of coastal settlements, protection structures and other structures, malfunctions in tourism and transports, risk for the coastal historic and cultural monuments, etc.

Aquaculture is a relevant LSI for Greece, having increased substantially during the past 30 years. Finfish farming is usually an intensive industry that involves an addition of solids and nutrients to the marine environment, and is recognised as potentially causing environmental degradation through these inputs. The escaping of exotic species, transmission and control of disease, and control of predatory species are also areas of concern in this type of aquaculture. In contrast, shellfish farming usually results in a net removal of nutrients from the water column, and is generally considered to cause less environmental damage. Nevertheless, shellfish production can cause a build-up of organic material on the seabed below as a result of particulate fallout from the shellfish or from the altered hydrodynamics around the farm. Aquaculture increases pressure on wild fish species; as practiced today, in intensive aquaculture the high concentration of animals means parasites and diseases spread easily. Massive use of antibiotics and vaccines and introduction of exotic species, are still relevant issues. The sector faces various challenges regarding social, environmental and economic sustainability, which can affect the positive prospects of the activity (NTUA, UTH and NKUA, 2018).

Also, **oil spills play an important role as LSI for Greece**: while major oil spills can have extreme impacts on the marine environment, also frequent smaller spills and discharges can exert significant pressures and must be considered appropriately. These can derive from ship traffic, pipelines or platforms for oil and gas exploration or be related to other marine activities, such as e.g. construction of wind energy platforms. Chemical substances potentially being spilled at sea are referred to as “Hazardous and Noxious Substances (HNS)”. They are substances other than oil which, if introduced into the marine environment can create hazards to human health, harm living resources and marine life, damage amenities, or interfere with other uses of the sea (NTUA, UTH and NKUA, 2018).

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 11):

- 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 11).

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.

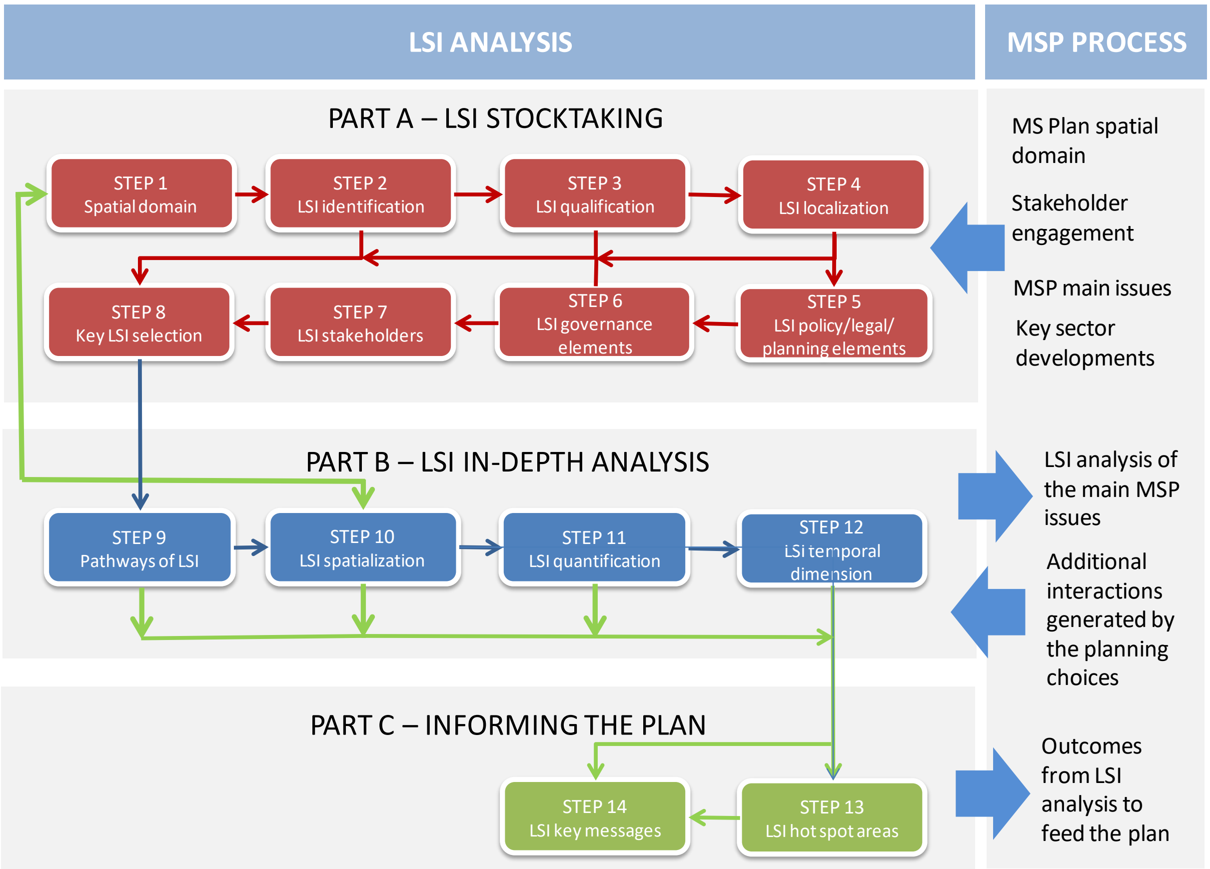


Figure 11: Step-by-step methodological guideline to account for LSI in MSP

The methodological guideline steps are described below. For the various steps, examples are provided of some experiences and tools available across Europe.

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.

PART A:
LSI INTERACTION STOCKTAKING

Step 1: Define the spatial domain

The geographic scope of LSI analysis is case-specific and related to the specific MSP context in which LSI analysis is included. As such, the geographic scope of LSI analysis depends firstly from the spatial domain of the maritime plan the LSI analysis is linked to.

LSI analysis is generally applied to the entire MSP area and also aims to identify LSI hot-spots which can be examined in a second iteration of a more detailed MSP-LSI analysis. However, the methodology is flexible enough to be implemented only in already known LSI hot-spots.

In relation to the planning domain, LSI geographical scope has to consider the territorial context, the natural processes involved and the human activities occurring at land-sea interface. These elements define the so-called “functional scope“ of the analysis. As a consequence of considering such elements, **the spatial domain of LSI analysis can be larger than the maritime planning domain**.

However, being the scale related to the planning domain, the spatial domain of LSI can be limited to local areas, or focussed on sub-national planning territories, or encompass the entire coastal national territory. For example, if the MSP plan considers the entire country, the LSI analysis is also at this scale. On the contrary, in cases where the MSP process focuses on a specific zone (e.g. with high conflicts and synergies) the LSI analysis is also focussed there. This indeed might even result from identification of a LSI hot-spot from a preliminary large scale analysis.

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.

This step is needed at the beginning of the process to set the boundaries of analysis but – since the spatial domain has to consider the relevant matrix of interactions – this step should be retaken after having developed an in-depth spatial analysis of each key LSI interaction (step 10).

A number of criteria can be identified to delimitate the area of LSI analysis:

- Scale of the plan: continental, regional, sub-regional, national, sub-national, local;
- Coast characteristics: hydrography, geomorphology, bathymetry, etc.;
- Administrative boundaries on the land component of the coastal area;
- Maritime boundaries defined according to national laws and international conventions.

How much the scope of LSI analysis should be extended landwards is to be determined on a case base. In fact, the “functional scope“ of LSI depends on physical characteristics, human activities and natural and anthropogenic processes, as well as on the governance aspects. As a guiding principle it can be considered that the landwards limit of the analysis has to be always related to the scope and needs of the maritime plan. Conditions and process taking place on land should be considered only to the extent they are relevant for maritime activities to be planned. For example, the designation of large sea areas to marine renewable energy development would need checking of availability of grid and infrastructures on the coast, and further landwards, for energy distribution. In the case of a river flowing into the sea, environmental conditions, human activities and processes taking place in the drainage basin should be considered only if directly influencing the activities to be planned at sea (e.g. determining conditions that allow/do not allow to carry out marine aquaculture).

Finally, relevant implications of political, socio-economic and environmental conditions at broader (regional, sub-regional) scale should also be taken into account when defining the spatial domain for the LSI analysis. These larger scale conditions could be relevant. For example, for the Mediterranean this analysis might not be limited to the European aspects but also consider interactions at a regional scale. In fact, some important management solutions cannot be implemented by individual countries but at regional scale. Therefore, additional, broader criteria could be taken into considerations:

- Relevant socio-economic processes, outside the plan area, that are (can be) drivers of change: e.g. socio-economic and geopolitical conditions in the area can influence the typology / intensity of maritime transport, determining the flows of people and goods across the land-sea interface;
- Natural process outside the plan area that can be relevant for the LSI and the plan itself: e.g. the presence of big rivers and the characteristic of marine currents can contribute to bring pollution (including deposits or marine litter) to the plan area.

Step 2: Identify interactions

A catalogue of interactions, starting from the initial list indicated in table 1 (section 2.2), is compiled in this step, considering the double direction of LSI: 1) land towards sea and 2) sea towards land.

Both present and potential interactions are identified, the latter being derived from actions foreseen by the available planning instruments (see Step 5 – Identify key policy- legislation – planning aspects).

Interactions can refer to transfer of matter (e.g. water), goods (e.g. sand, oil, fish, etc.), people (e.g. through cruising), information (e.g. through environmental monitoring) across the land-sea interface. These flows can have environmental and/or economic and/or societal implications (ESPON and University of Liverpool, 2013; CAMP Italy, 2017):

- **Environmental Pressures and Impacts**: land and sea can determine positive or negative effects one to the other (e.g. the flow of freshwater from river basin can bring nutrients into coastal waters and ensure they remain productive; coastal water circulation can determine beach erosion; maritime traffic can determine impacts in ports areas due to pollution, traffic congestion, crowding of coastal cities, etc.).
- **Economic effects**: interactions coming from the natural processes or land/sea uses can generate (directly and/or indirectly) added values (as revenues) and/or costs to specific economic activities or economy in general (e.g. sea-level rise can cause flooding and loss of tourism/housing facilities leading to significant economic loss).
- **Societal effects**: societal added values (e.g. job creation, development of local communities, social cohesion) or negative impacts (e.g. loss of local activities, professions, traditions; tension with economic sectors) can be generated.

The space where interactions take place should also be considered: sea surface, water column, coastal / seabed soil, coastal / seabed sub-soil, aerial space (Mourmouris, 2017).

In addition, the temporal component of the interactions should be considered: they might change/appear/disappear during the year or on a longer scale.

As indicated in section 2.2, both interactions related with natural processes and with land and sea uses are relevant and are to be considered (UNEP-MAP PAP/RAC, 2017). The first refer, for example, to coastal erosion, transport of river sediments, flooding. The latter refer instead to pollution from landward activities, littering at sea, increased resuspension caused by dredging. Thus, the following structure is to be considered for the catalogue:

a) Interactions due to natural processes
   i) Land → Sea interactions
   ii) Sea → Land interactions
b) Interactions due to uses and activities
   iii) Land → Sea interactions
   iv) Sea → Land interactions

An indicative list of interactions, to be considered as a starting point for the compilation of the catalogue is reported in Table 1. A starting list of LSIs for the most typical maritime sectors is also identified by Shipman et al. (2018).

Step 3: Localize interactions

In this step information about the geographical location of interactions is included in the catalogue. The collection of the geographical location of interactions allows the preparation of a general map for the study area, by using existing map and a GIS software, identifying, at a first level of approximation, the geographical distribution of interactions.

The temporal component of the interactions should be considered also in this step: there location might vary during the year or on a longer scale.

Main areas of interaction can be evaluated already in this step and overlapping between areas of interaction will help identifying conflicts and synergies related with LSI. Mapping requires the use of GIS-Software (e.g. ESRI, Post-GIS, Mapviewer, R) and the collation and storage of some spatial data in a standardised geodatabase. This is intended to be a preliminary spatial analysis, with results easy to understand, at first glance. Results from this step will be capitalized in Step 10 where an in-depth spatial analysis of key interactions will be carried out.

Step 4: Describe and qualify interactions

In this step each interaction is shortly described in order to explain, from a technical point of view, its nature, what it is about and the reasons why the interaction exists. Each interaction is then evaluated and qualified as positive (+), negative (–) or neutral (0). For each interaction, description and qualification are done in relation to the three dimensions of sustainability (wherever pertinent):

a) Environmental: considering positive or negative effects on the coast or on the sea, respectively.
b) Economic: considering positive or negative economic effects related with the use of land and sea respectively, and human activities in general.
c) Societal: considering positive or negative societal implications of natural or use-related interaction.

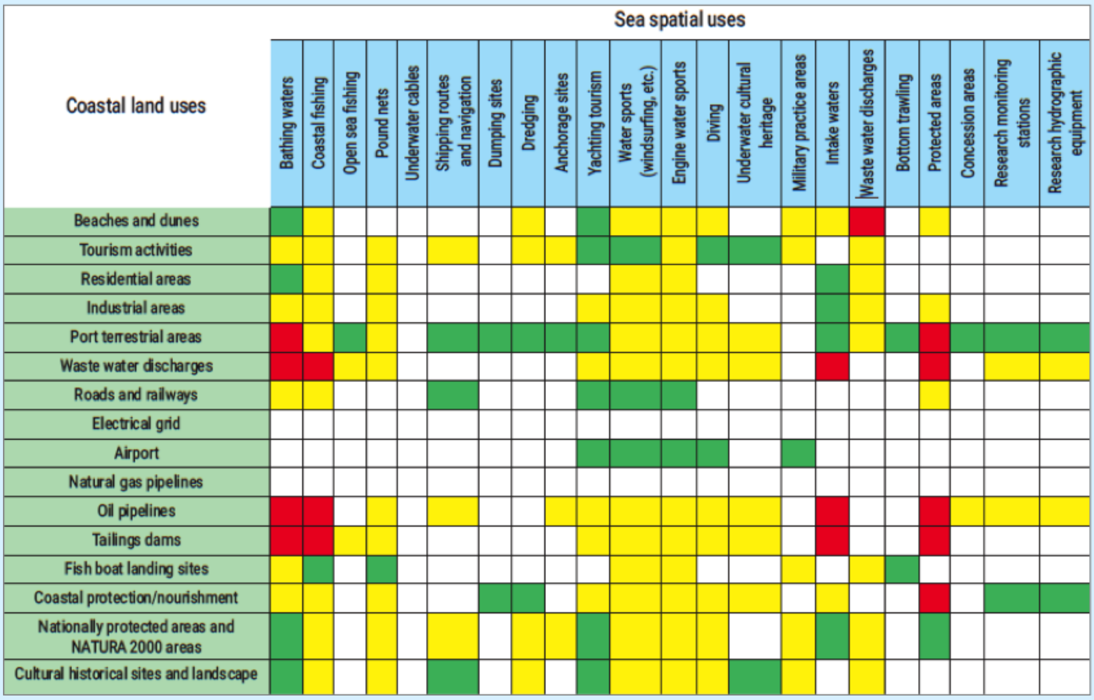
It is worth noting that considering these three dimensions of sustainability allows accounting for complexity of interaction matrix: in fact, the same interaction can have, for example, positive implications for economy and society but negative ones on environment. The complete picture of interactions is needed to inform the planning process. Again, temporal component should be considered also in this step, whenever relevant.

Short description and qualification for LSIs of the most typical maritime sectors, also according to the three categories indicated above, can be found in Shipman et al. (2018).

Box 2: Case study Burgas: Land-sea Interactions

Qualification of LSI interaction was done in the framework of the MARSPLAN-BS project, for the pilot Maritime Spatial Plan developed for the area of Burgas. Burgas is the fourth largest city in Bulgaria, located along the South Bulgarian Black Sea coast and one of the most important ports at the Black Sea with significant infrastructure for supporting the economic activities.

Following the analysis of the natural environment and environmental conditions, the urban development, existing economic activities, potential interests and land/sea uses along the coast and in the marine area of Burgas, a matrix showing the conflicts and synergies between different land/sea uses was produced. The latter is shown in the figure below: green colour are interactions without conflict and compatibilities between land and sea activities, and with environment; yellow colour indicates weak conflicts between land and sea uses and with coastal and marine environment; red colour indicates interactions with conflicts in the land-sea uses and environment; empty boxes denote to no interactions identified.



Sources and links:

- http://msp-platform.eu/sites/default/files/marsplan-bs-burgas_lsi.pdf
- http://marsplan.ro/en/
- http://msp-platform.eu/practices/case-study-burgas-land-sea-interactions

Step 5: Identify key policy – legislative – planning aspects

Aim of this step is providing a general overview of policy, legal and planning aspects. In this step the catalogue of interactions is integrated with main information on policy, legislative and planning instruments. This step is crucial, since there seems to be general concern across the EU for a lack of integration regarding the application of European legislation such as the MSP Directive, the Marine Strategy Framework Directive, as well as other international legal instruments in force in the MS, including European legislation and strategies (EC DG MARE, 2017). A fundamental outcome of this step is the identification of potential interactions, deriving from actions foreseen from the existing (sector or cross-cutting) plans. This step can either be undertaken here (PART A) or included in step 9 (PART B); in the latter case the policy, legislative and planning aspects will be considered only in relation with the key interactions selected in step 8.

Step 6: Identify key governance aspects

Aim of this step is providing an overview of main regulatory stakeholders. In this step – closely linked to the results from step 5 – the institutions engaged with interactions' topics / processes / sectors in the area are identified. This step can either be undertaken here (PART A) or included in step 9 – Pathways of interactions (PART B); in the latter case the governance aspects will be considered only in relation with the key interactions selected in step 8.

Step 7: Identify and engage stakeholders

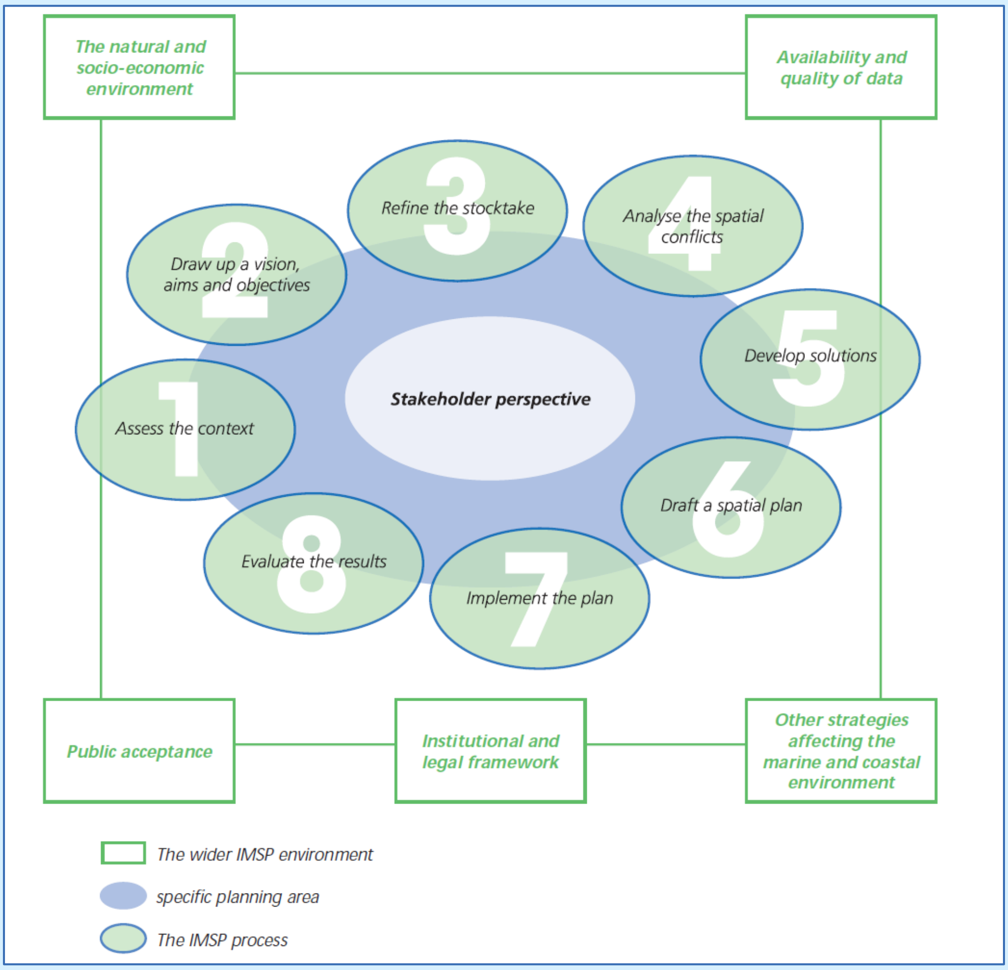
Stakeholder engagement for LSI analysis is to be integrated into the MSP overall process of engagement. This is not a separated process but a specific part of the MSP engagement process (see section 6.1 – Table 3 for a complete overview of the links between the steps of the LSI methodological guideline and the steps of the plan preparation).

The stakeholder engagement plan under the MSP process should foresee specific actions in order to address LSI issues. Some stakeholders involved in LSI can be the same ones involved in planning process (e.g. those with specific interests in the sea space) but others are to be engaged specifically for LSI (e.g. those with specific interests in the coastal area and inland territory in relation with the sea). Anyway, being always recommendable to stakeholders' effort, interactions on LSI relevant topics can be organized in parallel as part of those relevant for the overall MSP process. Nevertheless, a Stakeholder active role in discussing and selecting key LSI interaction is foreseen. Relevant stakeholders are identified, with reference to the interactions catalogue. Representatives of institutions engaged in the topics/sectors involved in the identified interactions, representative of academia with competence on of topics relevant for the interactions, actors of the governance systems and representatives from the civil society are identified. Brainstorming process can be applied to collect an exhaustive list of people/groups/institutions. They will then be structured according to the common procedures of stakeholder mapping.

Box 3: Stakeholder involvement in MSP

The experience on stakeholder involvement in MSP of the BaltSeaPlan project, as well as of other projects (e.g. BALANCE, PlanCoast) is summarized in the "Stakeholder involvement in MSP report" which can be useful also for LSI analysis specifically. This report aims to address the issue of stakeholder management in MSP by presenting and discussing the methods / tools and experience gained by BaltSeaPlan partners. It provides recommendations, guidance and inspiration for stakeholder management of MSP processes, while demonstrating that there is no "one-size-fits-all" approach or solution.

For example, it provides insight on finding the right timing and techniques to interact with stakeholders as well as an overview of possible techniques (e.g. Public hearings, Focus groups, Surveys, Interview, Workshops) and examples of their application.



The integrated MSP Process (PlanCoast, 2008)

Sources and links:

- BaltSeaPlan Report No 24 "Stakeholders Involvement in MSP"
- http://www.msp-platform.eu/practices/stakeholder-involvement-msp
- http://www.baltseaplan.eu/index.php?cmd=download&subcmd=downloads/2_BaltSeaPlan_24_final.pdf
- http://msp-platform.eu/practices/case-study-burgas-land-sea-interactions

The following categories of stakeholders can be considered (adapted from BaltSeaPlan, 2018):

- Stakeholders formally involved in the MSP process. These stakeholders are representatives from public institutions like ministries, regional or local authorities – depending on the scale of analysis. They are identified based on the analysis of relevant legislation and existing institutional framework and the assessment of political and administrative responsibilities for the area of analysis.
- Stakeholders linked to commercial and non-commercial activities in and around the project area. These stakeholders are identified on the basis of information collected in the catalogues of interactions, where relevant activities are identified.
- Stakeholders who contribute to the public and / or the scientific debate on all governance level, regarding the uses of the maritime and the coastal space: these stakeholders are also identified on the base of the stocktaking phase and additional focussed research within the area of analysis.

In this process stakeholders are expected to play an active role in discussing and selecting key interactions (step 8). Their role is therefore expected to be active and to take the form of "stakeholders as partners approach" (BaltSeaPlan, 2018) where the responsible entities for (MSP and) LSI analysis contribute to the analysis on equal terms.

Step 8: Select key interactions

Selection of key interactions represents the conclusive step of the first phase of LSI analysis. It is suggested to undertake this step through stakeholder engagement. The aim of this step is to prioritize interactions and select the most relevant ones to be considered for further steps. A stakeholder driven process is suggested in order to engage in LSI analysis people operating on land and sea, allowing exchange of experiences, views, knowledge and culture.

Discussing, prioritizing and selecting interactions require sharing of technical information and entering in the details of the selection process. It is therefore an activity to be carried out within relatively restricted groups. In view of these specific objectives, the following engagement techniques are suggested: interviews with key stakeholders, focus groups, local workshops. Number of interviews, number of focus groups to be arranged and their size (number of participants) and size of workshop is to be defined based on site-specific base.

For interactions prioritization the following methodology can be applied (two-steps process):

1. A catalogue of interactions a long-list is prepared based on desk research.
2. A first selection is done by interviewing key stakeholders and consulting within 1-2 focus groups. A short-list is thus prepared.
3. The shortlist is discussed, presented, amended and finally validated in a technical workshop.

Alternative approaches can be used for prioritization:

- Quantitative approach (scoring): each stakeholder assigns a quantitative score to each interaction, within a pre-defined scoring range.
- Semi-quantitative approach: each stakeholder selects her/his top relevant interactions within a maximum number of allowed preferences (e.g. three, five, seven).

Interactions can be prioritized as a whole, or separately, according to different criteria. In any case, links should be guaranteed between LSI analysis and the MSP process. The MSP relevant issues identified for the area by the planning process can be used to prioritize interactions: their relevance for each of the issue can be scored. If the maritime plan is addressing a strong emphasis on Blue Growth, interactions relevant for maritime sectors development should be selected in this step, by using appropriated prioritization criteria. Alternatively, according to a more general approach, the three dimensions of sustainability (environmental, economic, and societal) can be used as criteria for scoring.

Prioritization using a quantitative approach can be done according to the following steps:

1. Identification of prioritization criteria (e.g. each of the three dimensions of sustainability).

Interaction	Environmental priority	Economic priority	Societal priority

2. Scoring according to criteria: scoring metric is defined (e.g. High = 3, Medium = 2, Low = 1, Not Known). This step is undertaken by each stakeholder interviewed.

e.g. Stakeholder n. 1

Interaction	Environmental priority	Economic priority	Societal priority
INT-1	1	3	3
INT-2	2	1	3

3. Integration of scores from stakeholders: average score per interaction, per criteria is computed by averaging the scores from stakeholders (other metrics can be also used).

Average scores across stakeholders (results for stakeholder n.1, from previous box)

Interaction	Environmental priority	Economic priority	Societal priority
INT-1	2.1	2.8	2.6
INT-2	1.8	1.2	2.8

4. Integration of criteria: criteria can be integrated in order to make ranking of interactions more operational. Average score by criteria can be computed (other metrics can be also used). Alternatively, criteria can be also kept separated and separated rankings can be provided according to each of them. Key interactions to be evaluated in the following steps of analysis can selected by expert judgement (e.g. with a final Focus group).

Spatial specificity should also be taken into account in prioritization. When developing the analysis at country or regional (sub-country) scale, key interactions can be different in different sub-areas of the LSI analysis domain. Area-specific interactions are therefore identified. Next steps of this methodological guideline might in principle be focussed only on the interactions existing in the identified areas. If this is the case, step 13 in Phase 3 is not to be undertaken and the areas identified here represent already “hot spot of interactions“.

Box 4: Analysis of conflict scores

The analyses of conflict scores is a tool prepared under the COEXIST project. It applies a mixture of expert judgment and numerical scoring to make the classification of potential interactions repeatable and more transparent than an expert judgment approach alone.

The calculation of conflict scores is organised in three steps:

- Definition of activities of interest;
- Setting spatial and temporal attributes of each activity;
- Applying rules to calculate the conflict score of activity.

The strength of this approach is that it is a transparent and reproducible approach to analyse expert knowledge. However, the only use of expert knowledge may be also seen as weakness. This is why it has been associated to data and information on spatial and temporal attributes. Another characteristic of this approach or tool is that extra costs for users and the level of software skills needed are quite low.

Sources and links:

- www.coexistproject.eu
- www.coexistproject.eu/images/COEXIST/Tools/ConflictScores_FINAL.pdf
- http://msp-platform.eu/practices/analysis-conflict-scores

PART B:
LSI INTERACTION IN-DEPTH ANALYSIS

This part of the LSI analysis is to be undertaken for the interactions identified as relevant via Part A. In case or more advanced planning contexts, where the aspects included in Part A are already available, practitioners should make sure the knowledge and data are already organized in a catalogue containing the elements indicated above (including e.g. localization, description and qualification of interactions).

Phase B should be undertaken also for the new catalogue of interactions emerging as result of the choices made in the planning process. New interactions might emerge from the planning decisions; other could disappear or change in nature. If this occurs, a second round of LSI analysis is needed.

Step 9: Pathways of interactions

In this step mechanisms behind each selected interaction are identified and described: they can relate to flows of matter (e.g. water discharged by a river system, pollutants transported by sea currents, but also landed fish, extracted oil – gas, sediments), flow of monetary values (e.g. revenues from economic sectors), flow of information (e.g. results from monitoring site at sea or on land).

Additionally, in this step, policy – legislative - planning aspect could be in-depth analysed: comments are included about synergies / reinforcement, conflicts / contradictions and / or gaps related to these aspects.

Moreover, governance-related aspects are also in-depth analysed: comments are also included about eventual uncertainty on responsibility or known weaknesses of the governance system. Also elements to be strengthened and improved are collected in the catalogue. The interaction catalogue is complemented with a list of relevant actors from the governance system.

The latter is a relevant element to be considered. In fact, the complex pattern of responsibilities between land and sea was identified as a key issue of concern in relation with LSI interactions. A diffuse uncertainty about who is responsible for what and whether the scale of governance related to LSI issues is fit for purpose has been claimed, together with the existence of a mismatch between administrative boundaries and the scale of natural and socio-economic LSI processes (EC DG MARE 2017).

Step 10: Spatialize interactions

The specific spatial domain of each interaction is identified and mapped. Spatial domain includes: the area where the interaction is generated (e.g. a point of waste water discharge located along the coast, the location of a wind mill at sea), the area exposed to impacts/benefits (e.g. the coastal area benefitting from revenues by small-scale fisheries, the marine ecosystems exposed to impacts of sand extraction from the seabed), the area in between (if pertinent).

Mapping of interactions can be finalized at evaluating cumulative impacts of interactions (on land and at sea), thus representing a valuable support to integrated planning of marine-coastal areas, aimed at reducing conflicts between different uses, efficient use of resources, protection of biodiversity and promotion of the principles of sustainable development (CAMP Italy, 2017).

For identifying and mapping the interactions, the following elements can be considered:

- 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).
- Spatial and temporal distribution of human activities.
- Distribution of ecological elements: interfaces, ecological connections, ecological barriers.

Spatial information about key interactions is going to be used in step 14 for the identification of LSI hot-spot areas.

Box 5: Georeference Interactions Database

Georeference Interactions Database is a web-based flexible database, developed within the COEXIST project connected with a number of tools (stress level and conflict score analyses) to analyse marine activities and interactions (conflicts and synergies). GRID has a dedicated GIS application to analyse spatial distribution of present and future activities and interactions.

The Version GRID 1.2 allows performing the following types of analyses considering different possible scenarios:

- calculation of conflict scores;
- generation of matrices of interactions;
- plot of maps;
- evaluation of spatial interactions existing in a specific marine coastal area;
- calculation of asymmetric spatial overlaps;
- calculation of stress levels.

Sources and links:

- www.coexistproject.eu
- www.coexistproject.eu/images/COEXIST/Guidance_Document/Best%20practices%20guidelines_FINAL.pdf
- www.coexistproject.eu/images/COEXIST/Tools/GRID.pdf
- www.msp-platform.eu/practices/georeference-interactions-database

Step 11: Quantify interactions

In this step interactions are possibly quantified, based on available data and knowledge. This step corresponds to pressures / impacts analysis of negative interactions and to evaluation of positive impacts (i.e. benefits, added values) for positive interactions.

In this step results available from a variety of other policy and sector analysis can be capitalized: Water Framework Directive, Marine Strategy Framework Directive, and ICZM Protocol.

Quantitative information concerning pressure / impact / benefit indicators are included in the catalogue in a synthetic format. Based on the quantitative knowledge, each interaction is ultimately classified as:

- of Low intensity;
- of Medium intensity;
- of High intensity;
- of Very high intensity.

As for the entire methodological guideline, whenever pertinent, the interaction is qualified considering separately the three dimensions of sustainability (environmental, economic, societal). This classification is going to be used in step 14 for the identification of LSI hot-spot areas. The indicator(s) used to classify the interaction is also specified in the catalogue.

Box 6: Examples of indicators and tools to quantify interactions

Lots of different approaches and experiences are available from across Europe that can be capitalized in this step. For example, the PERSEUS project characterised the pressures on the coastal areas of the Mediterranean and Black Seas by preparing a comprehensive matrix based on an inventory of activities, pressures, impacts and ecosystem components. Expert opinions were used to weight and score pressures/impacts and identify priorities in the different areas. Simultaneously, a methodology was developed in order to build indicators related to some pressures in the coastal areas (fishing, aquaculture, sewage and river plumes, coastal artificialisation) of the SES using Very High Resolution (metric and sub-metric) satellite images.

In terms of tools available for pressures / impacts analysis the “DPSIR framework” (Drivers, Pressures, State, Impact and Response) was highlighted to be one with of the most suitable ones because it displays quite well the complexity of interlinks and interrelations in marine ecosystems. The “Qualitative Risk Analysis” (consequence X likelihood) method is also to be considered for risk and vulnerability assessment thanks to its simplicity and applicability by any end-users, devoicing specific scientific knowledge and technical expertise for its use.

Concerning tools for economic evaluation, the CBA Tool Kit – a user-friendly tool for Cost-Benefit-Analysis was indicated as one of the most convenient to be used. The COAST model supports stakeholders in planning and evaluating flooding and estimating their economic impact can also be considered.

Step 12: Analyse temporal dimension

In this step temporal dimension of interactions is analysed. Interactions are qualified as:

- Irrelevant temporal dimension.
- Temporal dimension relevant on the short term (e.g. on a cyclic base: daily, seasonal; on a non-cyclic base: inter-annual variability).
- Temporal dimension relevant on the long term (e.g. changes in environmental conditions along years; trends in sector development; changed climatic conditions).

In addition, interactions are evaluated under the future scenarios identified by the planning process.

PART C:
INFORM THE PLAN ABOUT LSI ANALYSIS OUTCOMES

Step 13: Identify LSI hot-spot areas

In this step hot-spot areas are identified within the larger area considered for LSI analysis. Hot spot areas are those areas with high intensity of key LSI. Outcomes from step 10 (spatialize interactions) and step 11 (quantify interactions) are considered to identify these areas.

Firstly, three distinct maps are prepared considering separately the three components of sustainability:

1) Hot spots for environmental interactions;
2) Hot spots for economic interactions; and
3) Hot spots for societal interactions Finally, an integrated map is produced combining the previous ones.

This step is not undertaken in the cases where area-specific interactions have been identified in step 8 and the following steps of the methodological guideline have been focussed only on the interactions existing in the identified areas. These already represent "hot spot of interactions".

Step 14: Identify key messages from LSI analysis

This final step is aimed at identifying **key message from LSI analysis to inform the planning process**. The possibility to involve stakeholders in selecting key messages is evaluated on a case base. Essential elements for identification of key message can include:

- Comments about synergies / conflicts / gaps derived from the analysis of policy, legislation and planning context, and of governance system.
- List of the most relevant LSIs in the planning area (max 10 interactions) with a short description of their nature (e.g. mechanisms, positive or negative, which dimension of sustainability most relevant).
- List of key stakeholders to be engaged in order to deal with most relevant LSI interactions.
- Localization of hot-spot area of LSI and their characteristics.
- Potential mitigation measures that might be applied to minimize negative impacts and maximise positive impacts can be suggested, together with options for addressing the LSI through plan making (Shipman et al., 2018).

5. LSI in the case studies area

Interactions between land and sea have been investigated in the context of SUPREME and 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 Territorial)[4]. 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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[4] 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 12, 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.

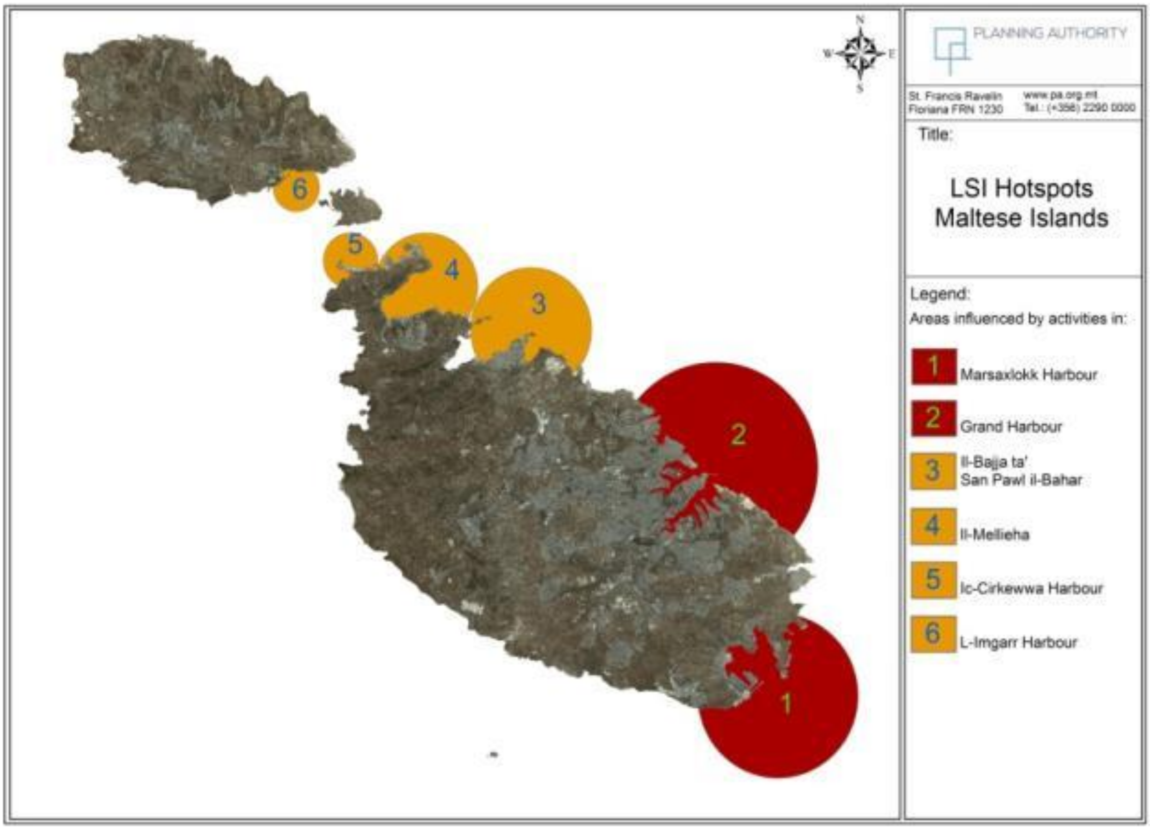


Figure 12: LSI hotspots in Maltese islands. Source: Farella et al., 2018

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 13 (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.

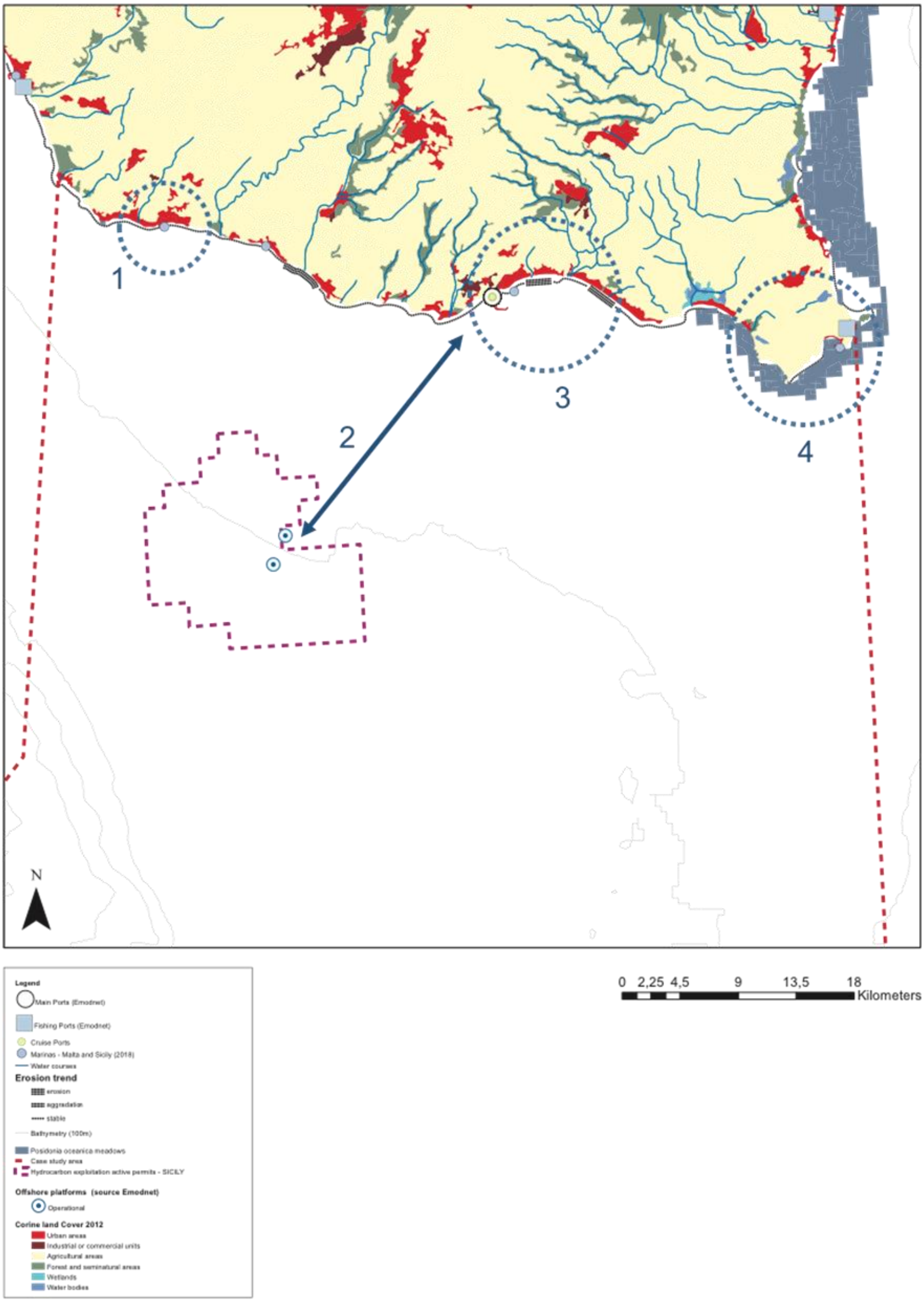


Figure 13: LSI hotspots in the Sicilian portion of the Strait of Sicily case study. Source: Farella et al., 2018

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.

The **Northern Adriatic** case study applied Parts B and C (steps 9 to 14) of the methodological guideline for LSI analysis. As a general comment, it was stressed that the information required for the implementation of this 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 identifying methodological gaps and proposals for future ameliorations.

The LSI analysis focused on the sectors most relevant for the area: aquaculture, fisheries, tourism, offshore oil and gas, military use of coastal and marine areas. Detailed results of the analysis are described the case study report; tourism sector is considered here as an example to illustrate the performed analysis.

Typologies and pathways of interactions were firstly investigated (step 9). Coastal tourism is strongly related to LSI as it depends on the quality of the coastal and marine environment; at the same time it is a relevant pressure on the same environment it relies on. Rivers input of nutrients and contaminants in the bathing waters negatively interact with tourism activity, while tourism is source of pollution affecting coastal waters.

Fishing tourism (pescatourism) is one of the activities with the higher development potential in an LSI perspective, which can help improving synergies between the two involved sectors. In a wider LSI perspective, development of a combined offer involving sustainable and compatible activities at sea (e.g. pescatourism, diving, etc.) and on land (e.g. visit to museums, environmental research and marine species recovery centres, etc.) can be fostered in the area, sustainably exploiting its wide range of cultural and naturalistic sites. Touristic itineraries crossing the land-sea border could be supported, including some of the most important Italian wetlands (e.g. Venice and Caorle lagoons, Po Delta) and touching world famous art cities like Venice and smaller villages with historical maritime tradition (e.g. Caorle, Chioggia, Cesenatico, Cervia).

Tourism is widely distributed along the coastline of the case study area. High concentration of tourism-related LSIs can be found in the Po Delta, in Venice and Caorle lagoons and related settlements, as well as in the towns of Chioggia, Cesenatico and Cervia (step 10). For most of the considered sectors, the analysis highlighted the difficulty of quantify interactions (step 11), due limited availability of needed knowledge and data. This was also confirmed in the case of the tourism sector, in particular in relation to site-specific evaluation of socio-economic aspects and the LSI interactions related to environmental quality. The case study stressed that tourism-related LSI interactions show a strong temporal dynamic, linked to seasonality of the tourism activities.

Based on the results of the LSI analysis applied to all the four considered sectors, the Northern Adriatic case study identified LSI hot-spot areas (step 13), as reported in Figure 14 (note that boundaries of the highlighted areas are approximated and absolutely not exhaustive of all LSI). Area 1 refers to the whole land-sea interface of the case study area and is related with the LSIs derived by the presence of rivers and ports, which are located along the entire coastline. Area 2 refers to LSI between aquaculture and tourism activities. Area 3 refers to LSI related to subsidence processes along the coast due to the presence of offshore extraction platforms. Finally, area 4 refers the military area and the LSI interactions that origin from its presence, both from the environmental and socio-economic points of view.

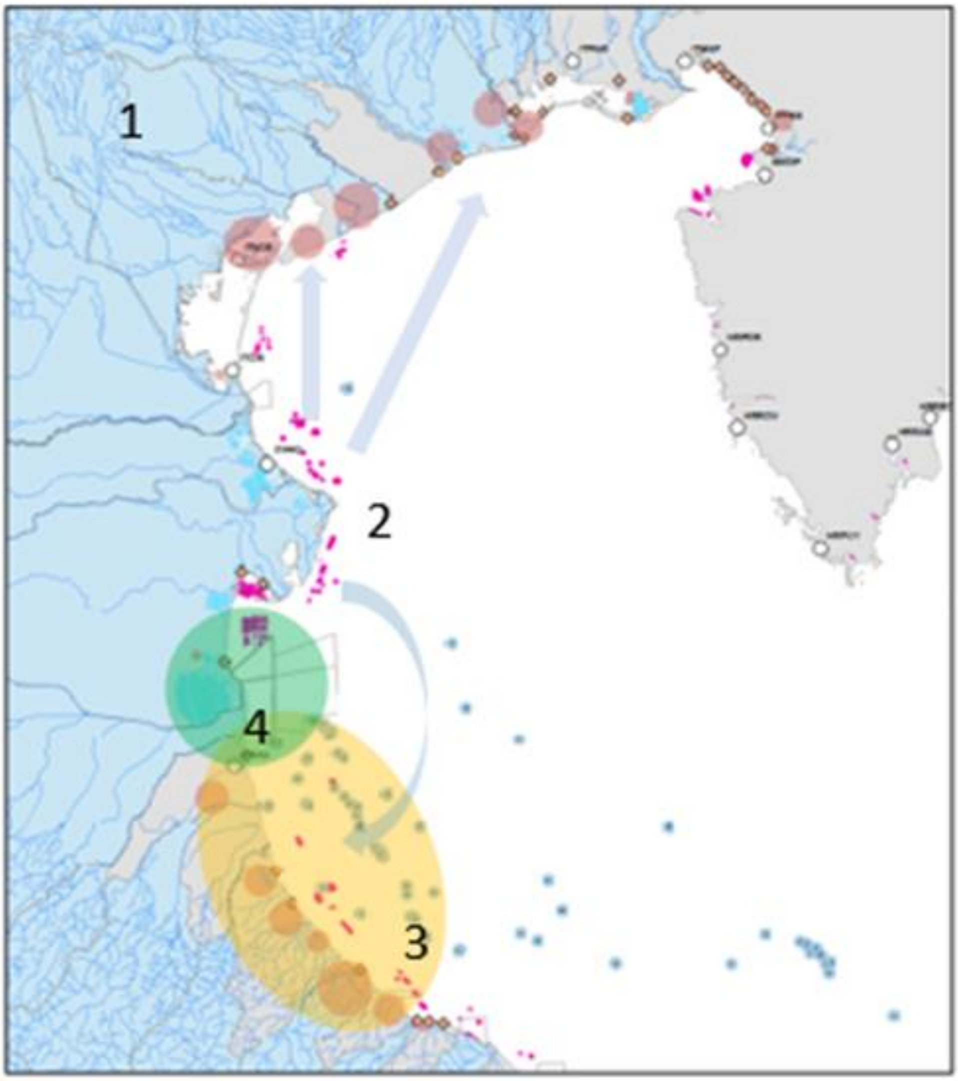


Figure 14: LSI hotspots identified in the Northern Adriatic case study. Source: (CORILA, 2018)

Based on the test of the LSI analysis performed in the Northern Adriatic case study, following conclusive remarks were provided:

- The geographic 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 advance 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 details 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 compensations 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.

Within the SUPREME project, some of the steps of Part A of the methodological guideline were also tested in the **Dubrovnik-Neretva County** case study in Croatia. Steps 1 to 4 were implemented considering interactions due to both natural processes and human activities, which were categorised in terms of sea to land and land to sea interactions.

A wide number of LSIs related to natural processes were identified. Interactions related to three marine processes (storm, saline intrusion and seiches) were recognised as highly relevant in terms of their impacts on the land component of the coast. Storm not only causes soil erosion, interruption of commercial operation or disruption of energy and water supply, but they also contribute to the accumulation of floating garbage in the coastal area. Strong southern winds wash off illegal dumping grounds located on the south-eastern coast of Adriatic and, due to natural sea circulation cover beaches, ports and bays with huge amounts of floating garbage. Impacted areas are the old port of Dubrovnik, Prapratno bay and other beaches oriented to the southeast. Saline intrusion is one of the increasingly growing concerns in the County area. It is the result of the combination of various processes, including exploitation of natural sand deposits in the river mouths, decrease of river water flow due to an increased number of hydropower plants, and climate changes caused sea level rise. This interaction has a great impact on the society and economy (coastal tourism and agriculture) by damaging agricultural land and affecting drinking water sources. Seiches are standing wave generated in an enclosed or partially enclosed body of water. Also known as meteo-tsunami, seiche in the Adriatic occurs every few decades causing damage to the coastal infrastructure as well as to professional and recreational fishing and aquaculture equipment. They can impact the shallow bays of Dubrovnik-Neretva County (city of Vela Luka and Mali Ston bay area).

Referring to land to sea natural interactions the case study highlighted the role of spring and fall rainfall. They wash-off the surface portion of the soil transporting organic nutrients to the coastal waters, thus beneficially influencing the sea trophic levels.

Most of the analysed sea to land interactions related to human activities resulted in having negative impacts. However, for the two sectors of marine protected areas and underwater cultural heritage (UCH) substantial positive effects were identified. Together with cruising, UCH was recognised by the analysis as the most relevant sector in terms of LSI. Cruising is probably the most controversial activity in the Dubrovnik-Neretva County. Although it has positive effects on overall well-being, it produces serious impacts on natural habitats, environmental quality and other non-touristic economic activities (e.g. by affecting air and water quality, increasing noise pollution, increasing greenhouse gases levels, contributing to the introduction of allochthone species, increasing volume of solid and liquid waste to manage, competing for space, and increasing the risk of damaging Posidonia habitats by anchoring). Proper preservation of underwater heritage can be combined with sustainable touristic activities, expanding the traditional land-based offer.

Similarly also land to sea interactions are characterised by significant negative impacts. Most significant ones are those related to coastal tourism and aquaculture. Over decades, tourism has experienced continued growth and deepening diversification to become one of the fastest growing economic sectors in Croatia. However, the importance of coastal environmental components to support sustainable coastal tourism is still ignored. The resulting impact on coastal communities along with their physical, socio-economic and cultural environment is increasing, threatening space by overuse, causing sea pollution and directly affecting coastal habitats. Aquaculture (mariculture) is a traditional economic activity in Mali Ston bay in the Dubrovnik-Neretva County. Typically, aquaculture zones exclude other uses, bringing to spatial conflicts. Although shellfish farming is in general environmentally neutral, some typologies of aquaculture may lead to habitats damage, spreading of diseases and water pollution.

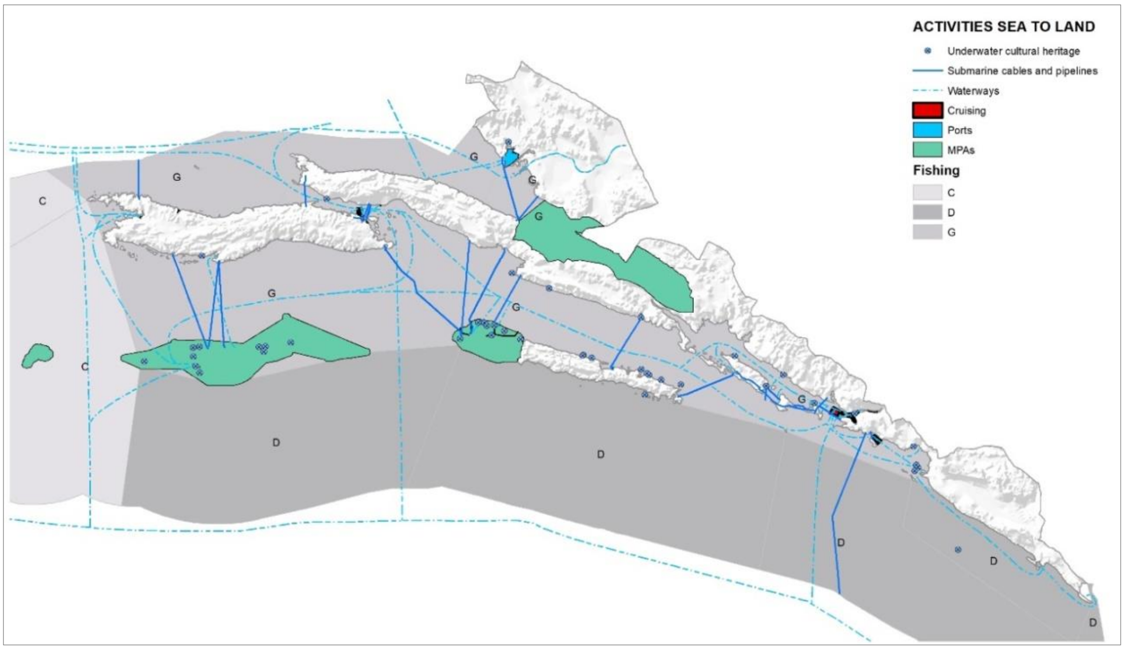


Figure 15: Sea to land interactions related to human activities in Dubrovnik-Neretva County. Source: (Glavor, H. et al., 2018)

Within the Dubrovnik-Neretva case study the geographic scope of LSIs (step 3) was analysed through GIS tools, relying on data provided from the County spatial plan. Localization of some interactions showed difficulties: for some LSIs was not feasible, while for others it emerged that localization is not univocal and therefore requires more detailed analysis when intensity is considered, making the analytical process more complex. For example the areas of Dubrovnik and Korčula are both heavily influenced by cruising tourism, but the intensity of influence on the first is much stronger. The LSI analysis was completed with the identification of key policy, planning and legislative aspects for the considered LSIs (step 5), as well as with the identification of responsible bodies (step 6).

The following conclusive remarks were derived from the implementation of the LSI analysis in the Dubrovnik-Neretva County. The application of the methodological guideline resulted useful for the identification and representation of current land-sea and sea-land interactions. Result of the analysis can serve as a basis for further planning of coastal and marine areas, including the integration of specific LSI-oriented measures in the plan. It is recommended that this kind of analysis is conducted in the initial phases of the plan development. Data availability and acquisition plays a very important role for the elaboration of coastal and marine plans, including therefore the analysis of LSIs. Data gaps shall be clearly highlighted, while effort should focus on data production, integration and public sharing.

The LSI analysis of the Dubrovnik-Neretva County case study also applied the structured table prepared according to the steps of the methodological guidance and reported in Annex 1. The same operational tool was tested in the two Greek case studies (Inner Ionian Sea – Corinthian Gulf and Myrtoon Sea/Peloponnese – Crete Passage) to structure the information required by steps 1 to 6. Information on processes involved in sea to land and land to sea interactions were summed-up in the first file sheet, as for example in the case of extreme storms and marine flooding events for both case studies. These processes can be responsible of infrastructure damage and negative impact on coastal tourism and protected areas.

Sea to land interactions related to human activities (e.g. aquaculture, fisheries, offshore oil and gas related activities, submarine cables and pipelines, dredging, recreational boating, cruising, maritime transport, protection of marine areas, defence and security, preservation of underwater cultural heritage, etc.) were categorised in the second sheet of the table. For example, for both cases interactions related to aquaculture were qualified as positive in relation to societal aspects (in terms of socio-economic benefits for coastal communities) and negative for environmental ones, due to visual impact and possible water pollution. Both cases also pointed out the potential negative impacts of unsustainable marine aquaculture development on coastal tourism. Marine litter is another issue that can be mentioned as example for both Greek case studies; although marine litter is mainly generated by land-based activities, the interaction occurs also in the other direction (sea to land), as this peculiar form of pollution can affect the coastal environment and human activities relying on its quality.

Finally, the analysis enabled to structure information on land to sea interaction related to human activities (e.g. coastal and lagoon aquaculture, river and lagoon fishing, water abstraction, agriculture and livestock farming, coastal industry, land-based energy production and delivering, port activities, transport, coastal tourism, coastal landfill, etc.). For example, for both Greek case studies coastal industry interactions with sea based activities were considered negative in the case of professional and recreational fisheries, aquaculture, maritime tourism and management of MPAs, while were identified as positive in the case of the maritime transport and energy sectors.

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 16):

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 16: 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.

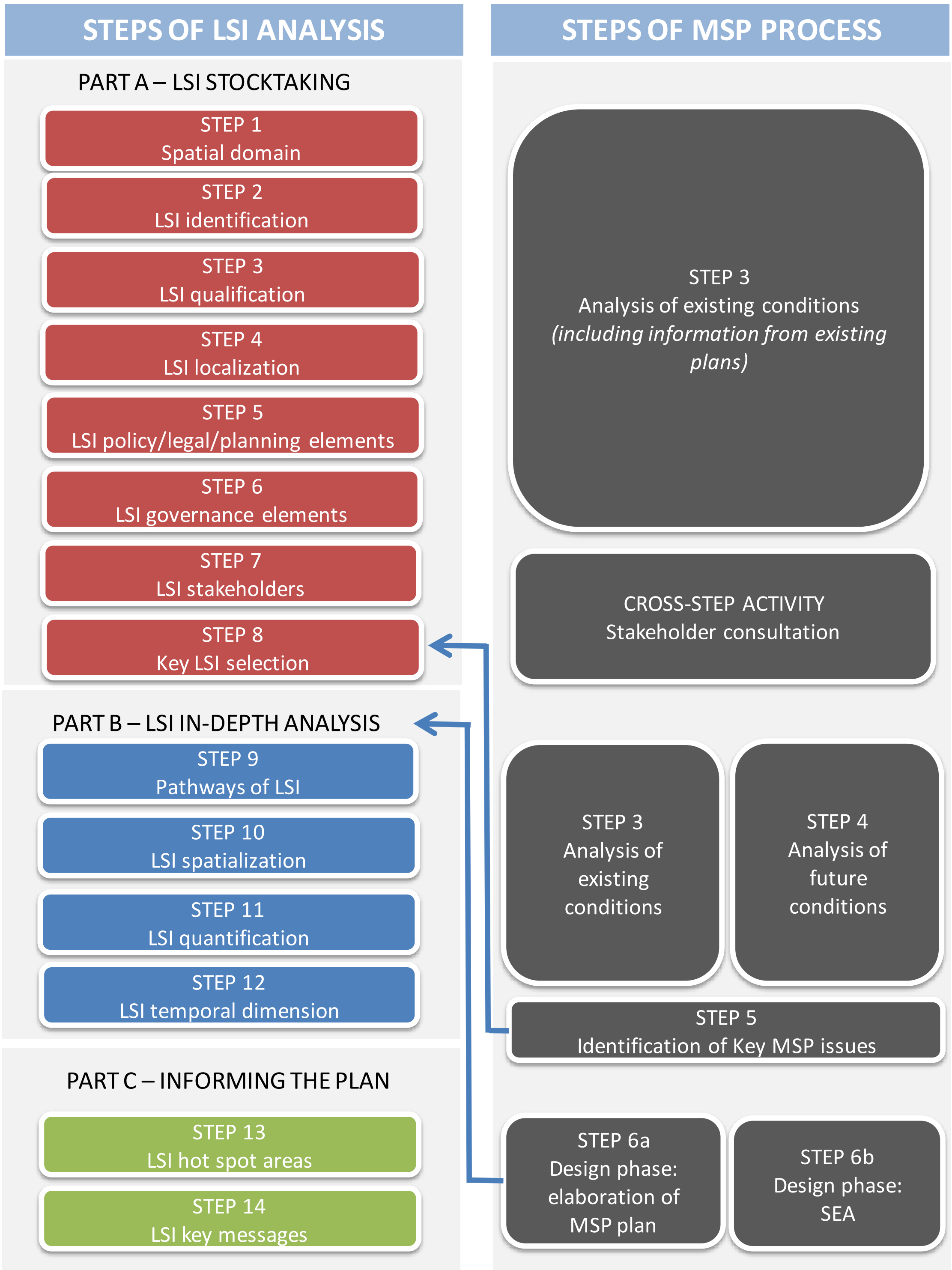
Independently of the typology of interrelation between terrestrial and marine plan, LSI assessment shall be a key component of any process aiming to design a maritime spatial plan, as clearly required by the EU MSP Directive.

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"



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
Art. 7.b	*"Organise appropriate coordination between the various authorities competent for both the marine and land parts of coastal zones …".*	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.
Art. 8.1.a	The Parties "*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…*".	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.
Art. 9.1.e	The Parties "*shall define indicators of the development of economic activities to ensure sustainable use of coastal zones and reduce pressure that exceed their carrying capacity*".	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.
Art. 9.2	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.
Art. 10	"*The Parties shall take measures to protect the characteristics of certain specific coastal ecosystems…*", 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.

<table>
<tr><th>Ref.</th><th>Provision</th><th>Consideration on LSI methodological guidelines</th></tr>
<tr><td>Art. 11.1</td><td>“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”.</td><td>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 ensures 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).</td></tr>
<tr><td>Art. 14.1</td><td>“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…..”.</td><td>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.</td></tr>
<tr><td>Art. 15.2</td><td>“The Parties shall organise….educational programmes, training and public education on integrated management of coastal zones with a view to ensuring their sustainable development”.</td><td>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.</td></tr>
<tr><td>Art. 18.1</td><td>“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….”.</td><td rowspan="3">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.</td></tr>
<tr><td>Art. 18.2</td><td>“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….”.</td></tr>
<tr><td>Art. 18.3</td><td>“Coastal plans and programmes....shall specify the orientations of the national strategy and implement it at an appropriate territorial level…”.</td></tr>
</table>

<table>
<tr><th>Ref.</th><th>Provision</th><th>Consideration on LSI methodological guidelines</th></tr>
<tr><td>Art. 19.1</td><td>"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".</td><td rowspan="2">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.</td></tr>
<tr><td>Art. 19.2</td><td>"In accordance with the same criteria, the Parties shall formulate, as appropriate, a strategic environmental assessment of plans and programmes affecting the coastal zone".</td></tr>
<tr><td>Art. 22</td><td>"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".</td><td rowspan="2">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.</td></tr>
<tr><td>Art. 23.1</td><td>"…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".</td></tr>
<tr><td>Art. 27.2.c</td><td>"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".</td><td>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.</td></tr>
</table>

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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PAP/RAC is established in 1977 in Split, Croatia, as a part of the UN Environment Mediterranean Action Plan (UN Environment/ MAP). PAP/RAC's mandate is to provide assistance to support Mediterranean countries in the implementation of the Barcelona Convention and its Protocols, and in particular of the Protocol on Integrated Coastal Zone Management in the Mediterranean. PAP/RAC is oriented towards carrying out the activities contributing to sustainable development of coastal zones and strengthening capacities for their implementation. Thereby, it co-operates with national, regional and local authorities, as well as with a large number of international organisations and institutions.

Following the emerging need to introduce MSP in the entire Mediterranean Region, the 20th 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.