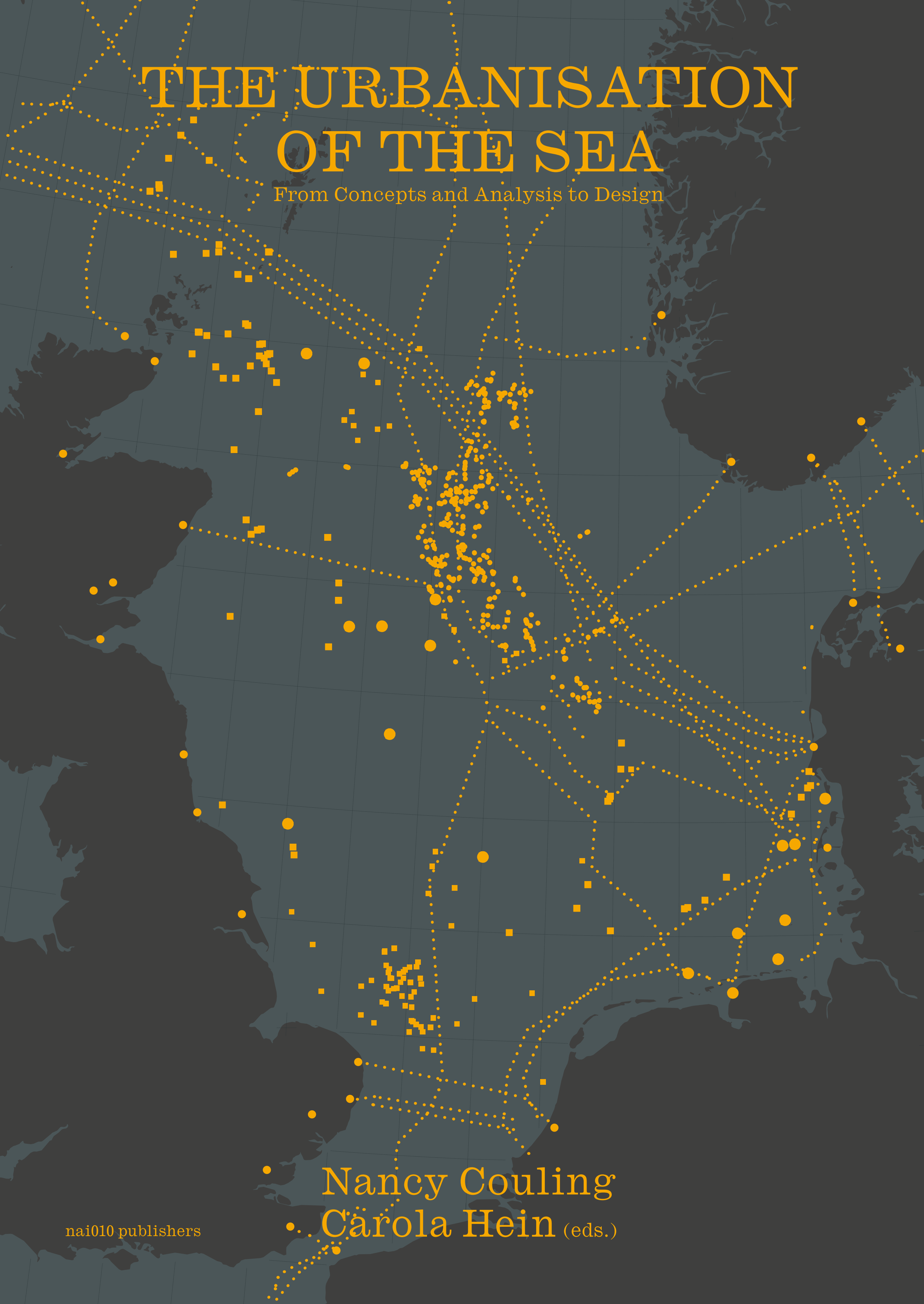
THE URBANISATION OF THE SEA

From Concepts and Analysis to Design



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EDITORS: Nancy Couling & Carola Hein with contributions from Nancy Couling, Carola Hein, Reinout Rutte & Yvonne van Mil, J. M. Ledgard, Claudia Bode & Lizzie Yarina, Christian Schmid, Stephen J. Ramos & Jan Derk Diekema, Serge F. van Gessel, Lennert J. Goemans, & Jan Matthijsen, Anne-Mette Jørgensen, Susan Dunne, Maarten Hajer & Dirk Sijmons, Taneha Kuzniecow Bacchin, Niccolò Bassan, Elisabetta Manea, Alberto Innocenti, & Francesco Musco, Artists' Collective Satellietgroep, Medine Altiok, Milica Topalović, and Rania Ghosn & El Hadi Jazairy.

COPY EDITING & PROOFREADING: Molly Mullin
DESIGN: Bureau Mondial, bureaumondial.com
PRINTING: Wilco Art Books
PAPER: Fly 05, 115 gr
PUBLISHER: Marcel Witvoet, nai010 publishers

This publication is published in collaboration with the Chair History of Architecture and Urban Planning, TU Delft, PortCityFutures/LDE centre and TU Delft Open/BK Books

This publication was made possible by financial support from the Creative Industries Fund NL, the Swiss National Science Foundation, PortCityFutures/LDE Centre collaboration, the EU Horizon 2020 programme (Marie Skłodowska-Curie Grant No. 753882) and the Chair History of Architecture and Urban Planning, TU Delft

Photography: p. 229 François Bruneau, Photography in visual breaks, Nancy Couling

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Printed & bound in the Netherlands

ISBN 978–94–6208–593–0
NUR 648 + 900
BISAC ARC010000 + ARC000000

The Urbanisation of the Sea is also available as e-book: ISBN 978-94-6208-594-7 (pdf) and open access through: https://books.bk.tudelft.nl/index.php/press/catalog

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Chapter 16 LAND-SEA INTERACTIONS IN MARINE SPATIAL PLANNING: A CASE STUDY IN TUSCANY

Niccolò Bassan, Elisabetta Manea,
Alberto Innocenti, & Francesco Musco

Through their work on the Tuscan Archipelago, Niccolò Bassan, Elisabetta Manea, Alberto Innocenti and Francesco Musco take us through the challenges of considering land-sea interactions within the Marine Spatial Planning process and demonstrate the potential of research by design in overcoming them.

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The sustainable management of coastal and maritime spaces is gaining increased attention among research institutions, universities and governments around the world.(1) Maritime activities and the exploitation of marine and coastal resources to boost the so-called "blue economy" have rapidly increased, reaching unsustainable levels worldwide.(2) The constantly increasing exploitation and unplanned use of marine resources have compromised the health of marine and coastal ecosystems, undermining their ability to provide services on which socioeconomic well-being relies.(3) Many activities compete for the same spaces and resources, leading to increasing conflicts. Moreover, in many cases difficulties in identifying jurisdictional boundaries of maritime areas have led to transnational disputes.(4) Some of the equity and sustainability imbalances will become more acute in the medium- and long-term as a result of climate change, potentially leading to overlapping negative effects, especially in coastal areas due to sea level rise.(5)

Maritime Spatial Planning (MSP) is a tool used to anticipate conflicts in maritime space while reducing anthropogenic pressures on coastal and marine ecosystems in a way that favours a sustainable blue economy.(6) The planning of maritime space needs to be coordinated with land planning, since land- and sea-based activities are interlinked. In addition, dynamic, viscous marine and coastal environments contrast with land-sea planning binaries, considerably complicating planning and management. MSP may support the integration of land-sea planning regimes by properly assessing interactions among human activities and natural flows crossing the terrestrial-marine interface.

Land-sea interaction (LSI) can be defined as a "complex phenomenon that involves both natural processes across the land-sea interface, as well as the impact of socioeconomic activities taking place in the coastal zone."(7) However, the absence of a recognised approach for LSI analysis and limited and uncertain data complicate the overall task. In response to these shortcomings, we chose a research-by-design approach that offered maximum flexibility. This helped us overcome land and sea conceptual barriers, shifting from a land-based spatial logic, with fixed spatial and legal delineation, to a more fluid, integrated, land-sea approach. LSI was also a way to engage local stakeholders, involve them in the planning process, and collect meaningful information. We then "translated" input from local stakeholders into a graphical language, stimulating the production of shared cartographies and new perspectives. The aim was to better comprehend the porous space of analysis, reasserting connectivity between land and sea realms. We tested this approach in a case study of the Tuscan Archipelago under the framework of the EU-funded SIMWESTMED (Supporting Implementation of Maritime Spatial Planning in the Western Mediterranean Region).(8)

MARITIME SPATIAL PLANNING: DEFINITION AND PURPOSE

Maritime Spatial Planning (MSP) is used to manage maritime areas by allocating different uses in space and time. It can be defined as a public process developed to find solutions to problems concerning the use of marine space and to allocate space for human activities while supporting their sustainability. At an international level, MSP was first promoted by IOC/UNESCO, which in 2006 organised the first international workshop on the use of MSP as a tool to implement ecosystem-based management (EBM), leading to the publication of the first international MSP guide.(9) At the European level, international attention then led to the establishment of the MSP Directive (2014/89/EU), in which EU coastal member states agreed to develop national maritime spatial plans by 31 March, 2021, with a minimum review period of ten years.(10)

Concerns have been raised about MSP implementation processes.(11) In fact, there has been little assessment of the potential negative and distributive effects of MSP, which is unfortunate considering the risks of lobbying and the appropriation of common maritime space. Consequently, the current MSP implementation panorama requires a radical turn, focusing on more equity-based, democratic decision-making and a fairer distribution of ocean wealth. Some of the negative impacts of MSP can be overcome by ensuring broader stakeholder and rights holder consultation and adopting more flexible planning processes.

MSP should also involve an adaptive approach in which the management cycle is conceived as a continuous learning process and measures adopted are reassessed.(12) The role of design is essential to impart flexibility to the process and ensure representation of the different commons, ecologies, and cultural ties. Design becomes a means of engagement, giving visibility to local needs and boosting transparency.

MSP has been implemented in many locations worldwide. However few pilot projects existed in the Mediterranean region, until the EU recently co-financed several projects on MSP in the European basins, including the Adriatic.(13)

LAND-SEA INTERACTIONS WITHIN AN MSP FRAMEWORK

Although a standard definition of LSI does not exist, three main typologies can be identified.(14) First, there are natural land-sea processes, particularly related to the flow of water and nutrients and organisms between terrestrial, freshwater, and marine ecosystems. They ensure functioning of coastal and marine ecosystems and can be altered by human effects. A second typology concerns cross-system threats, including economic activities originating on land and affecting the marine environment or vice versa. These can be categorised according to their 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), and the sector to target for intervention (e.g., urban areas, industry). Finally, there are socioeconomic interactions, because people are part of the ecosystem, interrelated with both land and sea.

Planning at sea should not disregard the terrestrial domain, although planners need to be mindful of the differences in management authorities and responsibilities. Terrestrial and marine environments are connected by ecological, biogeochemical, and oceanographic processes. Although a significant amount of non-systematic research exists around LSI discourse, there is no standard methodology for integrating LSI in a MSP process. Exploring LSI by using design and mapping can provide new insights, shifting from a rigid "planning" logic, with fixed spatial and legal delineation, to a more fluid approach.

RESEARCH BY DESIGN

Research by design promotes discussion and spatial analysis, especially in multi-scale contexts where there is a need to acquire knowledge from the field. Design is used as "a way of inquiring, a way of producing knowledge."(15) Research by design is a way to plan for the future in projects that concern complex environmental challenges.(16) Planners face continuously changing conditions and shifting political and economic programmes, therefore the process of planning should involve feedback sessions, in which critical assessment, comparability, and evaluation take place through sketching.(17) Design is especially useful for adapting the overall MSP planning process since external factors of climate change, migration, economics, and social processes need to be managed even in the absence of a "master plan." Design methods can explore several scenarios at once, imagining multiple futures. This process promotes innovation, exceeding the limits of pure scientific knowledge both in a methodological and theoretical way.(18) Design methods are particularly adapted to the analysis of LSI due to the numerous variables and uncertainties involved. We tested this approach in the Tuscan Archipelago case study of the SIMWESTMED project (2016-2018)(19), specifically during feedback sessions with local stakeholders. In this project, research by design primarily involved mapping and sketching, which facilitated direct visual communication of the acquired knowledge.

CASE STUDY AND RESULTS

The Mediterranean Sea has a wide variety of marine habitats and a high degree of biodiversity, but recent rapid economic and demographic development has increased anthropogenic pressures on the marine environment. Overexploitation of natural resources has led to the urgent need to find the right balance between economic needs and the conservation of the marine environment; overfishing, for example, has widely affecting the whole basin.(20) Past management initiatives concerning sustainable use of marine resources in the Mediterranean have been criticised for failing to reflect real conservation priorities.(21) Because the socioeconomic development of Mediterranean countries depends on marine resources and space, it is especially important to manage such resources sustainably and preserve their integrity.

The Tuscan Archipelago represents the specificities of the Mediterranean basin: it is a recognised hot spot of biodiversity, presenting diverse marine habitats of great ecological value, and numerous maritime activities take place there. We used a research-by-design approach in the Tuscan case study to better address and analyse LSI within an MSP context [Fig. 1]. We explored the socioeconomic potential of the coastline in this region and identified major hot spots of anthropogenic pressures affecting the environment. The LSI analysis was structured in three main phases: design, feedback, and redesign. In the first phase, we collected meaningful information regarding the case study and established criteria for compiling maps. We decided to develop single thematic maps and to summarise them in diagram maps that highlighted essential features. This supported feedback sessions with local stakeholders and rights holders, previously identified with the help of local authorities and engaged through specific events meant to explain the benefits (and risks) of actively participating in the MSP process. Preliminary outputs were shared to gather stakeholders' feedback. After we collected and mapped all the stakeholders' information, it was possible to redesign and update the previous mapping. This generated more complete knowledge and we were able to condense the information in a final diagram map, which shows the main areas and interaction hot spots. The results were incorporated in the case study's overall MSP planning proposal.

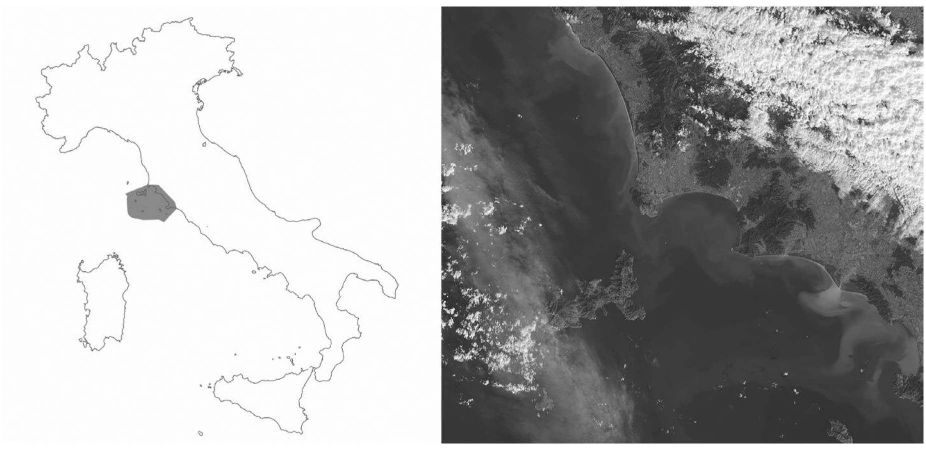
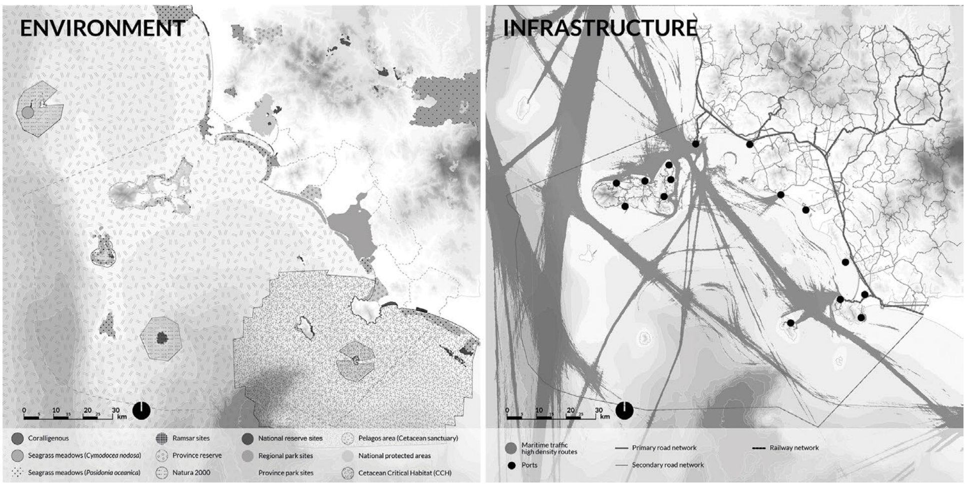


Fig. 1
The case study boundaries and satellite image (ESA 2014)

Following the main internally recognised methodological "steps," an initial assessment was carried out through desk-based research, including current environmental, socioeconomic, and governance information.(22) The existing multi-level strategic documents (international, national, and regional) were analysed to identify preferred future development trajectories, as well as high-level environmental and economic objectives established for the planning area. The initial assessment showed that the case study's coastal area presents high ecological and socioeconomic value due to the important environmental components found in shallow waters (less than 30 metres deep) that deliver many ecosystem services [Fig. 2] Seagrass meadows cover part of the coastline, supporting the area's high degree of biodiversity, increasing its resilience to erosion and providing food sources, shelter, and breeding grounds for numerous marine species, including some of commercial value, such as hake (*Merluccius merluccius*) and rose shrimp (*Parapenaeus longirostris*).

Conservation activities are encouraged in the area through the presence of several protected sites, including the Tuscan Archipelago National Park [Fig. 2] Often protected sites and regimes spatially overlap, creating complexity in analysing the governance schemes (i.e., determining who is the responsible authority, which protection measures are mandatory, and which areas have prohibitions on particular activities). Although marine and land systems present important differences from an environmental point of view, these two realms are strongly connected through shared ecological processes. (23) Nonetheless, in the Tuscan Archipelago there is a lack of coordination between land and marine conservation tools that do not address the many anthropogenic effects on the natural environment at the land-sea interface.

Fig. 2 Environmental and infrastructural frameworks in the area (Bassan, Manea, Innocenti, Musco)



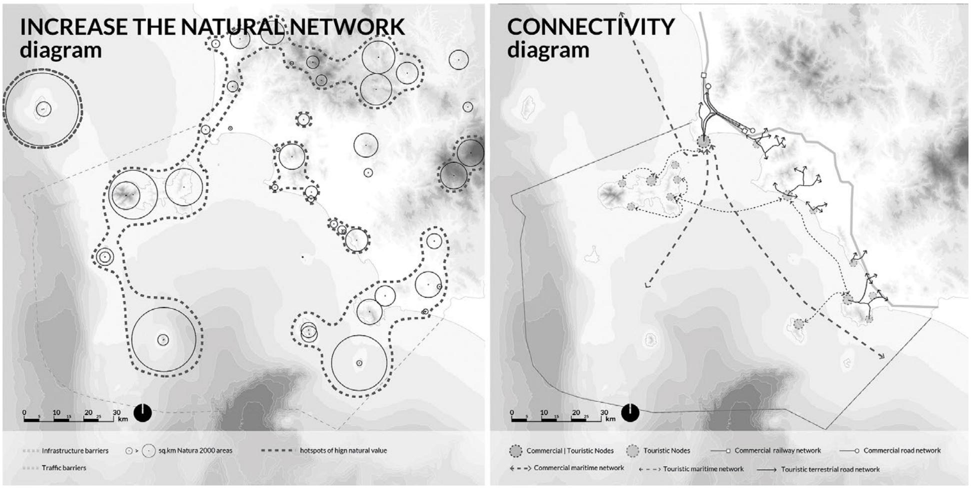


Fig. 3
Diagrams of possible increased natural networks and transport connectivity in the area. (Bassan, Manea, Innocenti, Musco)

LSIs are also influenced by transport infrastructures and fluxes [Fig. 2]. Accounting for these "infrastructural barriers" helped us understand how to mitigate impacts and conflicts. Maritime activities such as shipping, fishing, sailing, and movement of passengers require dedicated port infrastructures, which usually negatively affect coastal habitats. From the perspective of commercial shipping, LSIs not only involve connections with the different ports, but also with the road transport system. For these reasons, the transportation sector determines a high percentage of LSI in the area, supporting the overall connectivity, which assists socioeconomic development, but involves considerable environmental impact (e.g., habitat fragmentation, noise, pollution).

The dual nature of transport systems, as vectors of connectivity and as barriers, was assessed in the study. The flexible approach to design facilitated engagement with local administrators and stakeholders and we were able to define the main issues through collaborative mapping and immediate feedback. Results suggested that traffic decongestion measures should be applied and activities be monitored to reduce environmental pressures. In addition, with a communicative approach and the use of iterative mapping, the identification of transport connectivity gave input that can be used to optimise these networks [Fig. 3].

On the other hand, in order to promote natural connectivity, we developed diagram maps showing possible ecological corridors in a wider natural network. This network covers both land and sea territories in a comprehensive way, with the aim to facilitate preservation of land, coastal, and marine environments [Fig. 3]. We used these results to demonstrate the need to proceed cautiously when planning with uncertainties and with poor data quality/quantity, and to understand where to apply localised measures and monitoring activities.

The case study area includes landscapes of great value, while also hosting important productive activities. There is clearly great potential for developing sustainable tourism throughout, especially in light of farmhouse activities and "slow" agriculture practices (olives and wine). Local tourism depends on environmental quality and yet is recognised as one of the main sources of direct and indirect environmental pressures, often exacerbating the fragile equilibrium between activities on the coastline and the capacity of natural resources to recover.(24) An example is the depletion of water resources due to excessive exploitation of aquifers resulting in saline intrusion. The degree to which such activities affect the coastal and marine environment at the land-sea interface needs to be assessed in the absence of a defined terrestrial boundary that might help determine the real source of touristic pressures. Especially in this context, land and sea planning frameworks must "talk" in order to avoid inconsistencies.

To overcome the lack of definition to the limits of analysis, we assumed a buffer zone around the coastal beach areas, diving sites, and main infrastructures in the area. This helped define primary areas of interaction between tourism and the environment [Fig. 4, p. 268]. The buffer zone made it possible to see possible impacts of touristic activities on the environment (e.g., habitat degradation, marine litter, and pollution), and to stimulate further research and monitoring that might reduce such impacts.

Land-based activities such as agriculture and industry indirectly affect maritime sectors, contributing to environmental degradation through the discharge of contaminants that reach the sea by rivers. This can lead to habitat loss and hypoxia/anoxia events (depletion of oxygen) as a result of eutrophication (dense vegetative growth) due to excessive nutrient loads entering the sea. Through a cascading effect, this environmental degradation can negatively affect maritime activities such as fish farming.(25) In the case study area, these interactions were mapped to delineate places where in-depth research is necessary to better understand environmental quality. Additional research could also support planning processes in addressing sustainability objectives more effectively. Some intensive fish farming facilities are already present in the area, but the establishment of further fish farms could have a detrimental impact on other activities in addition to impacting the overall environment. Through design we were able to show the interrelations between productive land-based and maritime activities, underlining interconnections between environmental components and demonstrating why these relations should be carefully assessed.

In this context, where interactions between land-based activities and the environment involve trade-offs, we were able to detect multiple connections in a dense potential network of interactions through mapping and design. This analysis helped us identify and design the main overlaps of interactions and fluxes [Fig. 5, p. 268]. The work involved a communicative, explorative approach, with the aim of structuring a series of measures to be included in the MSP pilot. (26) This phase was essential in approaching such a complex topic by unfolding new knowledge and connecting with local stakeholders. LSI was one of the significant components that reflected conflicts and synergies among uses and between uses and the environment.

CONCLUSION

Land and sea are connected via complex interactions. These interactions often influence people's livelihoods. Any strict division between land and sea domains, planning frameworks, and binaries is essentially an "artificial" construct that follows political-administrative demarcations and priorities. LSI research can help transcend land and sea binaries. It recognises the sea as a cultural space in which local needs, perceptions, and values should be taken into account.

In the case study, research by design allowed us to explore the value of the natural and anthropic environment and to consider benefits provided to local communities. It also allowed us to discern hot spots where activities overlap, possibly conflicting or complementing each other. Thematic maps based on the acquired spatial information helped overcome data limitations and underpin visual perceptions. In fact, they were highly effective in both communicating and analysing knowledge acquired of the area, as well as in suggesting potential solutions, especially in such a multi-sectorial context. Design allowed us to acquire a general understanding at the scale of our analysis, orienting future downscaling to deepen site-specific contexts with the support of more detailed data. Furthermore, this approach facilitated engagement with local stakeholders, enabling the co-production of knowledge throughout the overall planning process. We aimed to extend the analysis landwards, while being aware of the absence of definite terrestrial boundaries. We included some land activities and infrastructures in the analysis, looking for positive and negative interactions between them, as well as with the coastal environment and sea space. Within the poorly-defined LSI framework, our approach aimed at exploring the land-sea interface continuum, building a basis for the implementation of a LSI methodological framework in the context of MSP.

Land and maritime planning differ. They involve different priorities, institutional and legal frameworks, and conceptual approaches- aspects which are fundamental when considering the "urbanisation of the sea", in relation to both land and sea regimes. The need for new tools is evident. Land planning is focused on private rights while maritime planning focuses on controlling activities in the common space of the sea. This creates a complex socioeconomic picture with various communities, stakeholders, and actors interested in the same geographic space, while also creating difficulties in adapting traditional frameworks used in land planning to the maritime domain. Maritime and terrestrial planning systems require good coordination to produce aligned outputs and meet the goals of ecosystem-based management and sustainable development. Terrestrial planners need sufficient understanding of marine and maritime matters, while marine/maritime planners need to understand land-based implications of marine planning.

This exercise tried to overcome many of these differences, highlighting LSI effects and perceiving the main LSI hotspots through "unconventional" tools such as design. Research by design can help "translate" between disciplines. It can be adopted in data scarce conditions as well as on a large scale to address anthropogenic and natural processes and dynamics that cross land-sea boundaries (to improve reliability, this approach should be accompanied by science-based analytical approaches). The research-by-design approach applied to the LSI analysis turned out to be a highly communicative tool, able to incorporate not only spatial data but also socio-ecological perspectives in a way that was supportive of the MSP process. It was a reflective practice in which critical assessment took place through sketching, continuously going back and forth between inquiry and proposal. Testing such an approach in such complex planning contexts as the Tuscan Archipelago, can pave the way to better understanding and implementation of an LSI methodological framework, and to better coordination between land and sea planning regimes.

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