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Ocean Literacy as a Strategic Asset for Regional Marine Policy: Insights From an Implementation Case Study

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Abstract

Ocean literacy (OL) has increasingly been recognised as a key enabler of participatory marine governance, with potential synergies with maritime spatial planning (MSP). These links are particularly evident in stakeholder engagement processes, which are mandated by the European MSP Directive and supported by international institutional guidelines. OL can facilitate these processes by fostering informed participation, enhancing public awareness, and supporting educational and cultural goals aligned with Sustainable Development Goal 14 "life below water." Within the framework of the EU-funded Regions to Boost National Maritime Spatial Planning-MSP project, a methodology was developed to support the design of a Regional Ocean Literacy Strategy aimed at strengthening MSP implementation at the sub-national (NUTS-2) level. This article outlines the development of a structured toolbox to support regional OL strategies and presents the results of its empirical testing in the Sardinia region. The findings indicate that regional actors acknowledge the relevance of OL for marine management and that existing assets—such as environmental education networks and cultural initiatives—can be effectively mobilised through a strategic framework. The study demonstrates the feasibility and replicability of the approach, offering a model that can be adapted and transferred to other regional contexts across Europe.

Keywords

environmental awareness; maritime spatial planning; ocean citizenship; ocean governance; ocean literacy; policy design; regional governance

1. Introduction

Ocean literacy (OL), initially developed in 2004 through collaborations between educators and marine scientists in the US, was conceived as a response to the marginal presence of ocean sciences in formal education (McKinley et al., 2023). This initiative produced a structured framework aimed at embedding ocean science into public education and promoting ocean-related knowledge, awareness, and responsibility. While OL's early purpose was largely pedagogical (UNESCO-IOC, 2017), the concept has since evolved to encompass broader socio-political dimensions, including public engagement, policymaking, and sustainable marine governance (S. Liu et al., 2023; McKinley et al., 2023).

In recent years, OL has gained recognition as an enabler of transformative change in ocean policy. S. Liu et al. (2023) argue that OL now plays a vital role in shaping inclusive governance and policy design. In this context, this article explores the application of OL within a specific ocean management framework: maritime spatial planning (MSP). MSP is a key policy instrument aimed at promoting the sustainable use of marine space through coordinated spatial governance (Directive 2014/89/EU, 2014). While the MSP Directive (Directive 2014/89/EU, 2014) does not explicitly reference OL, its emphasis on participatory, knowledge-based processes and coherent governance aligns closely with OL principles, particularly the sixth OL principle: "The ocean and humans are inextricably interconnected" (Halversen et al., 2021).

The connection between OL and MSP has been recognised by multiple European initiatives. For instance, the Sea Change project (French et al., 2015) analysed European marine policies and identified implicit alignment between OL and the objectives of the MSP Directive. Similarly, the 2024 Venice Declaration on Ocean Literacy and Ocean Governance called for OL to be integrated into policymaking and planning, highlighting the importance of involving stakeholders and the general public in the design of marine and coastal policies (Casati et al., 2024). These developments have elevated OL from a communication or education tool to a strategic mechanism for public participation and policy coherence.

Despite the growing interest in OL as a policy asset, most OL initiatives remain disconnected from decision-making processes. This disconnect is particularly relevant for MSP, which depends on inclusive stakeholder engagement to ensure legitimacy and effectiveness (Pomeroy & Douvere, 2008; Shellock et al., 2024). OL can enhance this process by equipping citizens and stakeholders with the knowledge and capacities needed to contribute meaningfully to marine governance (French et al., 2015; Kelly et al., 2021). Moreover, OL has been identified as a socio-cultural enabler of MSP, capable of fostering shared understanding and facilitating co-designed planning processes (McKinley et al., 2019, 2023).

An interesting international example is provided by *Land, Water, Ocean, Us: A Canadian Ocean Literacy Strategy* (Canadian Ocean Literacy Coalition, 2021), a national initiative developed outside the EU framework. While not aligned with EU Directives, the Canadian strategy offers a valuable source of inspiration. It adopts a broad, culturally grounded understanding of OL, extending beyond ocean sciences to embrace inland waters, Indigenous knowledge systems, and civic relationships with the ocean continuum. Such inclusive perspectives highlight the potential for OL to support cross-sectoral engagement and foster the social, cultural, and ecological dimensions of marine governance—an approach that resonates with ongoing European efforts to expand the scope of OL within participatory planning frameworks.

Recent literature underscores the role of OL in supporting participatory governance and integrated ocean management. For instance, Jacobs et al. (2015), T. K. Liu et al. (2023), and McRuer et al. (2025) demonstrate that OL can improve stakeholder engagement and foster science–policy–society integration. In this sense, OL acts as a bridge between people and policy, promoting inclusive dialogue and collective stewardship of marine resources. As McKinley (2024) argues, successful ocean governance depends fundamentally on understanding and improving human–ocean relationships.

Nonetheless, institutional frameworks for MSP vary widely across EU member states, particularly in how they structure stakeholder engagement and integrate sub-national actors (Casimiro & Guerreiro, 2019; Friess & Grémaud-Colombier, 2021). While the directive calls for coherence and cooperation, regional implementation remains a critical challenge (Zaucha et al., 2025). The need for participatory, multi-level governance is particularly acute when considering the inclusion of cultural knowledge, social values, and local expertise—dimensions that OL can help to surface and mobilise (Wedding et al., 2024). These are also aligned with the recent emphasis in the UN Ocean Decade on co-production of knowledge and inclusive marine science (Glithero et al., 2024).

This study builds on the premise that in the EU, regional and local institutions—particularly at the sub-national (NUTS-2) level—are key actors in the implementation of MSP and have untapped potential to support MSP goals through structured OL efforts. Specifically, it addresses the question:

> Can OL become a functional tool to support the implementation of marine policies, particularly MSP, at the regional level?

The hypothesis tested is that it is possible to compile a regionally tailored OL strategy, supported by an operational and replicable toolbox (Regional Ocean Literacy Strategy for MSP [ROLS-MSP]), which can assist regions in both designing and implementing OL-informed marine governance frameworks. Rather than testing a fully pre-existing strategy, this study evaluates the development, co-design, and testing of a novel toolbox intended to guide regional authorities in integrating OL into their MSP activities. The approach combines insights from policy design theory (Junginger, 2014, as cited in Bason, 2014), system dynamics (Brennan et al., 2019), and multi-level governance to support a process of iterative, context-sensitive strategy development. It responds directly to calls for more systemic, locally relevant, and empirically grounded approaches to embedding OL in governance processes (Ferreira et al., 2021; Paredes-Coral et al., 2021). By investigating the application of the toolbox in different regional contexts—particularly through its testing in Sardinia—this study contributes to the emerging body of literature on OL as a governance mechanism. It offers evidence on how OL can function beyond education, as a lever for participatory marine planning, policy coherence, and regional capacity building. In doing so, it explores the potential for a more integrated science–policy–society interface in ocean governance.

2. Methods

This study was conducted within the framework of the project Regions to Boost National Maritime Spatial Planning (REGINA-MSP), which aims to enhance the role of regional (NUTS-2) authorities in the development and implementation of MSP. The methodological approach adopted here follows a structured and iterative design process, drawing on the principles of policy design (Junginger, 2014, as cited in Bason, 2014) and rooted in transdisciplinary inquiry.

The main objective was to design and test a replicable Regional Ocean Literacy Strategy for MSP (ROLS-MSP) toolbox to guide regional authorities in developing OL strategies aligned with MSP implementation. The methodology involved three main phases: (a) development of the ROLS-MSP toolbox, (b) participatory review and refinement through expert workshops, and (c) pilot testing in the Sardinia region. The full process is summarised in Figure 1.

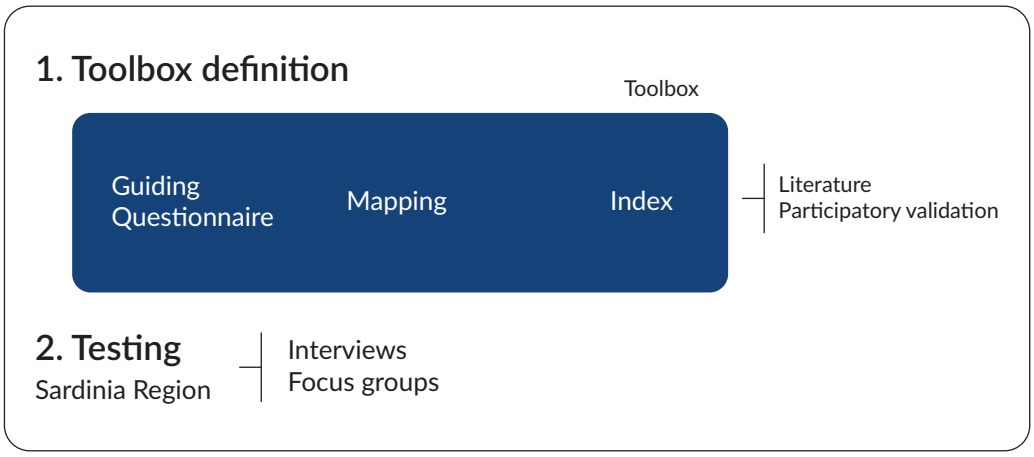

Figure 1. Methods and their sequential employments to test the toolbox.

2.1. Toolbox Development

The toolbox was developed through an integrative process involving a literature review, expert consultation, and design synthesis. The review phase examined core OL concepts and frameworks, including the UNESCO-IOC (2017) OL toolkit, key scholarly contributions (e.g., French et al., 2015; Kelly et al., 2021; McKinley et al., 2019), and relevant policy documents such as the MSP Directive (2014/89/EU, 2014) and the European Commission's Communicating MSP guidelines (Executive Agency for Small and Medium-sized Enterprises , 2020). The literature also informed the proposed conceptual alignment between OL and MSP, positioning OL not simply as an educational agenda but as a governance asset capable of enhancing stakeholder engagement and policy coherence. Specific attention was given to the multidimensionality of OL, including scientific, educational, cultural, and participatory components (Halversen et al., 2021; UNESCO-IOC, 2017). Inspired by policy design theory, the design process emphasised iterative testing, stakeholder input, and contextual sensitivity (Junginger, 2014, as cited in Bason, 2014). From this foundation, a strategic toolbox was constructed comprising three main tools: a guiding questionnaire (see Section 2.3.1), to assess the region's OL capacity and identify entry points for integration into MSP; a mapping tool (see Section 2.3.2), to spatially visualise OL-related assets and detect regional imbalances; a strategy index (see Section 2.3.3), to guide regional authorities in structuring their OL strategy across multiple thematic areas. The tools were designed to be applicable across diverse regional contexts and to facilitate the co-design of OL strategies that reflect local assets, institutional capacities, and stakeholder networks.

2.2. Toolbox Objectives and Thematic Threads

The toolbox was designed with a specific user group in mind: regional and local institutions responsible for MSP-related implementation. Its overarching purpose is not to disseminate OL in isolation but to use OL strategically to strengthen MSP governance and societal engagement.

To ensure the toolbox responded to practical governance needs, seven specific objectives were identified based on a synthesis of the MSP Directive (EU, 2014), the UNESCO-IOC toolkit (2017), and the UN Sustainable Development Goals (UN, 2015). To operationalise these objectives, the toolbox is structured around four thematic "threads of opportunity": education, research, culture, and regulation. These threads were derived from the seven perspectives of OL described in the UNESCO-IOC (2017) framework and serve to guide strategy formulation based on existing assets and institutional priorities.

2.3. Toolbox Components

2.3.1. Guiding Questionnaire

The questionnaire was designed to help regional officers assess the status of OL in their territory and identify strategic priorities. It employs a structured YES/NO format with follow-up filters (Brancato et al., 2006) and includes 11 questions, each linked to one of the four thematic threads. Each response generates tailored recommendations, and some answers trigger cascaded sub-questions to probe further into existing practices (Taherdoost, 2022). The questionnaire is informed by existing tools in public policy assessment and OL monitoring (Boparai et al., 2018) and was constructed to ensure usability by non-experts. The questionnaire serves as both a diagnostic and planning tool.

2.3.2. Mapping Tool

The mapping component supports the spatial visualisation of OL initiatives and assets across regional territories. It allows authorities to identify geographic gaps, assess coverage, and support spatially balanced MSP-related communication and education. This tool is grounded in landscape and seascape character assessment methodologies (Natural England, 2012; Tudor, 2014) and adapted from spatial approaches used in French and Spanish MSP practices (Barianaki et al., 2024). Short questionnaires (see Supplementary Files) were used to collect geolocated data on OL initiatives, including providers, institutional types, funding, target audiences, and pedagogical methods.

2.3.3. Strategy Index

The strategy index (see Supplementary Files) provides a structured template for drafting a comprehensive OL strategy aligned with MSP goals. It includes:

- An introduction and vision section;
- A state-of-the-art review (social, environmental, cultural, and policy context);
- Thematic strategies across education, research, culture, and communication;
- Monitoring and evaluation criteria;
- Guidelines for regional cooperation and best practice sharing.

The index also provides a logic model for linking OL activities with MSP implementation goals, including stakeholder engagement during key planning phases and plan review periods.

2.4. Participatory Refinement and Expert Validation

To enhance the scientific robustness, contextual relevance, and user applicability of the ROLS-MSP toolbox, a participatory refinement process was integrated into the methodology. This process drew on the principles of policy co-design and transdisciplinary inquiry (Junginger, 2014, as cited in Bason, 2014; Ten Holter, 2022), allowing for iterative adjustments to the toolbox prior to its empirical testing.

2.4.1. International Interdisciplinary Workshop

The workshop was held in Sardinia in May 2023 and brought together 34 participants, including representatives from UNESCO-IOC, regional administrations, universities, NGOs, marine parks, science communicators, and environmental educators. The session served to validate the conceptual basis and structure of the toolbox, as well as to assess the coherence of its components with real-world OL practices and MSP processes. During the workshop, regional partners presented exemplary OL initiatives from their territories. These were documented using a standardised factsheet, which included details such as institutional context, target audience, funding model, thematic content, and degree of relevance to MSP. Following the presentations, a structured review of the draft toolbox was conducted through facilitated discussions. Feedback focused on improving the cultural adaptability, operational clarity, and communication features of the tools.

The workshop outcomes directly informed revisions to the guiding questionnaire (e.g., simplifying language and adding examples), the thematic threads (e.g., integrating cultural heritage), and the strategy index (e.g., including evaluation mechanisms and cross-sectoral partnerships).

2.5. Empirical Testing: The Sardinia Case Study

The ROLS-MSP toolbox was subsequently tested in a real-world setting to evaluate its usability and functionality in supporting the development of an OL strategy aligned with MSP. Sardinia, a NUTS-2 level Italian region, was selected as the pilot site due to its advanced involvement in MSP processes (Ramieri et al., 2024), well-established environmental education infrastructure (such as the Programmi Regionali di Informazion, Formazione ed Educazione all'Ambiente e alla Sostenibilità [INFEAS]), and active participation in the REGINA-MSP project.

2.5.1. Case Selection and Contextual Fit

Sardinia was identified as an appropriate test case based on a confluence of favourable contextual conditions. The region has consistently demonstrated institutional engagement with national marine spatial planning efforts and has developed internal capacities through existing governance structures, including several departments with relevant mandates in environmental sustainability, education, transport, and communication. Moreover, the strong collaboration between regional institutions and research centres—such as the National Research Council's Institute for the Study of Anthropic Impacts and Sustainability in the Marine Environment (CNR-IAS) and the IMC Foundation—offers a noteworthy example of an effective science–policy interface. This collaboration, which was also evident in the REGINA-MSP project, supports both research and dissemination activities in the marine domain. In addition, Sardinia benefits from an

extensive environmental education network—namely the INFEAS system—which includes the Centri di Educazione alla Sostenibilità (CEAS). This network represents an established channel through which marine and sustainability-related knowledge is already disseminated at the regional and local levels. The presence of this infrastructure offered a unique opportunity to explore how OL principles might be systematically incorporated into MSP-related strategies and communication. The inclusion of interdepartmental coordination mechanisms and stakeholder engagement platforms further enhanced the suitability of Sardinia for this pilot test. These characteristics made it possible to apply the toolbox across multiple governance levels and thematic domains, ensuring a comprehensive assessment of its practical functionality and replicability.

2.5.2. Data Collection Methods

The testing phase employed qualitative methods, namely structured interviews and focus groups, using the ROLS-MSP toolbox components both as research instruments and as decision-making frameworks. The research team coordinated closely with Sardinian institutional stakeholders and regional actors to implement the following two data collection activities. First, structured interviews with representatives from six regional departments: environment and sustainability, transport infrastructure, maritime and air transport, tourism, communication, and institutional planning. Each interview was guided by the toolbox questionnaire and supplemented by questions tailored to the department's thematic domain. Second, two focus groups were conducted, each composed of approximately 20 participants from the fisheries and aquaculture sectors. These sessions were designed to test the accessibility and relevance of the toolbox's thematic threads (education, regulation, culture, and research) from the perspective of end users and stakeholders directly affected by marine spatial policies. Mapping exercises were conducted to spatially identify and categorise existing OL-related assets in the region. These included marine education centres, NGOs, museums, academic institutions, and communication platforms. Data collection followed a predefined questionnaire and was visualised through an open-source geospatial platform (Google Maps), accessible to the regional administration. Strategy drafting, in which the research team synthesised the data collected into a coherent ROLS-MSP, based on the structural guidance provided by the strategy index. All interviews and focus groups were recorded and transcribed with the participants' consent, and anonymised notes were used to ensure data confidentiality. Supplementary materials, including questionnaires and strategy templates, were provided to all participants to support transparency and replicability.

2.5.3. Analytical Approach

The qualitative data obtained during the Sardinia testing phase were subjected to thematic analysis, with attention to three main dimensions: institutional readiness to support OL strategies, stakeholder perceptions regarding OL's role in supporting MSP objectives, and practical barriers and opportunities for cross-departmental coordination and policy integration. The draft strategy that emerged from this process constitutes the primary output of the empirical phase. As such, it serves not only as a demonstration of the toolbox's operational functionality but also as a basis for assessing its replicability in other regional contexts. The findings and reflections arising from this test case are presented in Section 3.

3. Results

The findings presented in this section derive from the participatory validation of the ROLS-MSP toolbox and its empirical testing in the Sardinia region. These results are organised in two parts: the international workshop and the Sardinian case study. The section reports evidence of the toolbox's perceived utility, adaptability, and limitations in real-world contexts, and the outcomes of its application as a strategy-building instrument.

3.1. Results From Participatory Validation: International Workshop

The international interdisciplinary workshop conducted in Sardinia provided both content and structural feedback to refine the toolbox. Representatives from the eight REGINA-MSP regions, UNESCO-IOC, research institutes, NGOs, and educational institutions contributed examples of OL initiatives currently implemented in their respective territories. The presentations showcased a wide diversity of practices, ranging from formal educational programmes (e.g., Blue Schools in Italy and the Calypso initiative in France) to museum-based heritage outreach (e.g., ARQVA Underwater Museum in Spain), artistic engagement (e.g., the Irish Fair Seas campaign), and gender-inclusive science communication (e.g., Oceanicas by the Spanish Institute of Oceanography). Several of these initiatives exhibited implicit or explicit links with MSP-related goals, such as fostering marine stewardship, promoting marine spatial awareness, and enabling participatory management. Participants expressed strong interest in the toolbox as a means of structuring and scaling such activities. They highlighted the importance of broadening the OL framework beyond traditional environmental education, including underexplored domains such as cultural heritage, culinary traditions, and creative industries. Moreover, the workshop revealed a general demand for regionally adaptable tools that could facilitate cross-sectoral collaboration and policy integration. These inputs were instrumental in adjusting the guiding questionnaire for clarity and inclusivity, refining the thematic threads to accommodate cultural perspectives, and expanding the strategy index to include new forms of regional engagement. The workshop also confirmed the feasibility of using the toolbox across different national systems and administrative structures.

3.2. Sardinia Case Study: Application and Outcomes

The Sardinian pilot served as the empirical application of the toolbox, culminating in the development of a draft ROLS-MSP. The process confirmed the toolbox's practical utility in guiding the formulation of a regional strategy rooted in existing assets and institutional structures. Structured interviews were conducted with six departments of the Sardinian regional administration. These included the Servizio Sostenibilità Ambientale, Valutazione Strategica e Sistemi Informativi, the Servizio Infrastrutture di Trasporto e della Sicurezza Stradale, the Servizio per il Trasporto Marittimo e Aereo e Continuità Territoriale, the Assessorato del Turismo, Artigianato e Commercio, and the Servizio Comunicazione Istituzionale. The interviews, structured around the guiding questionnaire, allowed for the identification of OL-relevant assets and institutional responsibilities, as well as for the assessment of departmental awareness of and engagement with MSP objectives. In addition, two focus groups were organised in October 2023 in Asinara and the Gulf of Olbia, targeting the fisheries and aquaculture sectors, respectively. Each session included approximately 20 participants. These focus groups used selected sections of the toolbox as facilitation instruments and revealed the relevance of OL themes—such as sustainability, regulatory literacy, and cultural heritage—to stakeholder experiences. Participants emphasised the importance of using simple language, locally relevant

examples, and practical illustrations of OL-MSP connections. The mapping exercise enabled the spatial identification of OL practices and infrastructures across the Sardinian territory. Using an open-access format on Google Maps, the regional team produced an interactive visual representation of key assets. These included the CEAS, marine research institutions, museums, parks, and non-formal education providers. This mapping activity helped reveal spatial disparities and underutilised areas and was considered a valuable tool for inclusive regional planning (Figure 2).

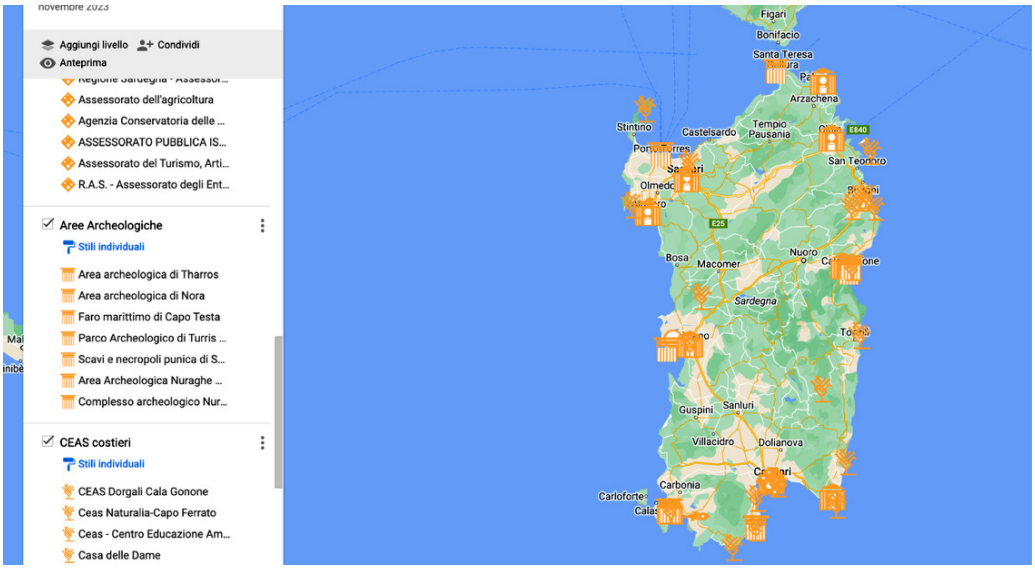

Figure 2. Sardinia ROLS-MSP interactive map. Note: Figure based on Soffietti et al. (2023).

The strategy's structure was developed using the strategy index component of the toolbox. This process enabled the formulation of a document that integrated the four thematic threads (education, culture, research, and regulation) with existing institutional capacities and potential cross-sectoral synergies. In particular, the INFEAS network and the CEAS centres were identified as foundational infrastructures for OL activities. Although Sardinia does not currently possess the administrative mandate or dedicated resources to formally adopt the strategy, the exercise demonstrated that OL assets could be systematically organised to support MSP implementation. Interviews with regional officers also revealed recurring governance challenges, including departmental fragmentation, coordination difficulties, and funding constraints—factors that could undermine long-term implementation without targeted institutional support.

Moreover, the test process underscored the strategic role of the INFEAS educational network, which appeared as the most consolidated regional framework relevant to OL. Its potential to act as a connective hub for other departments and initiatives was highlighted. The idea of establishing a unifying structure, such as a regional "District of the Sea" (as envisioned in the Italian MSP draft plans), was proposed as a mechanism for cross-sectoral integration and participatory engagement (see Figure 3).

Feedback from stakeholders also stressed the need to incorporate regional languages or dialects into public communication to improve community outreach and foster cultural proximity. Additionally, participants suggested that providing sector-specific examples of OL applications—such as tourism, fisheries, or education—could facilitate engagement by illustrating the direct benefits of the strategy. In summary, the Sardinia case validated the operational usability of the toolbox while also surfacing context-specific barriers

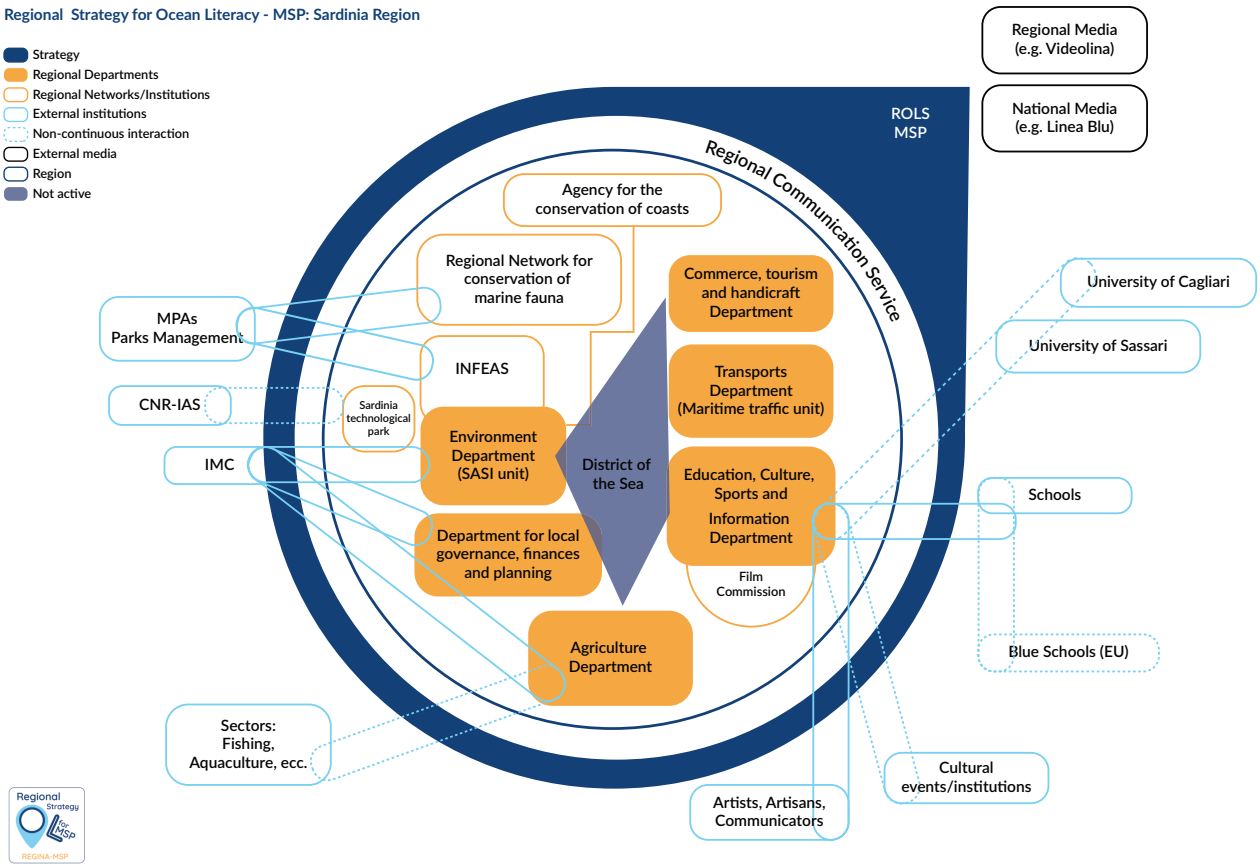

Figure 3. ROLS: Sardinia ROLS-MSP structure. Notes: This figure is based on Soffietti et al. (2023). CNR-IAS stands for Centro Nazionale delle Ricerche—Istituto per lo Studio Degli Impatti Antropici e Sostenibilità in Ambiente Marino (in English, National Research Council—Institute for the Study of Anthropic Impacts and Sustainability in the Marine Environment); IMC stands for Fondazione IMC—Centro Marino Internazionale ONLUS (in English, IMC Foundation—International Marine Centre NPO).

and recommendations. The resulting draft strategy provides a tangible model for regional OL integration within MSP, structured according to an empirically grounded and participatory methodology.

4. Discussion

The findings from the Sardinia test case, supported by the prior expert workshop, confirm that OL can be operationalised as a functional support tool for MSP at the regional level. The successful application of the ROLS-MSP toolbox demonstrates that, when OL is framed not solely as an educational resource but as a strategic governance instrument, it can enable regions to organise existing knowledge assets, strengthen public engagement, and contribute meaningfully to marine policy implementation. Nevertheless, there are structural similarities that can be observed across Italian regions, many of which also apply to other European contexts. One common challenge is the complexity of aligning the objectives and activities of various departments, which span areas such as marine protection, education, maritime economics, and spatial planning. While each administrative unit holds the potential to contribute to OL and MSP processes, coordination between them is often limited. Fragmentation, overlapping mandates, and varied operational cultures present persistent barriers to integration. In addition to these institutional challenges, financial

coordination across departments represents another hurdle, particularly in regions that rely on project-based or time-limited funding streams. As most regional administrations function through multiple, semi-autonomous departments, developing mechanisms to support interdepartmental collaboration is a necessary condition for strategy implementation.

The Sardinian case also reveals the importance of having an existing infrastructure—such as the INFEAS environmental education network—which can act as a foundation for OL initiatives. Leveraging such structures may accelerate implementation and reduce duplication of effort. However, even in regions with well-established educational or communication assets, the absence of formal integration into planning and governance processes limits OL's potential impact. As noted by S. Liu et al. (2023), without institutional recognition and strategic positioning, OL remains peripheral to decision-making. A key contribution of the toolbox is its ability to provide a replicable yet adaptable methodology that regional authorities can use to navigate this complexity. The structured approach of the guiding questionnaire and the strategy index enables departments to assess current efforts, identify gaps, and define a shared vision for OL, while the mapping tool supports equity and transparency in the spatial distribution of initiatives. This aligns with what Ferreira et al. (2021) have argued: that OL must be embedded in broader strategies, supported by well-defined objectives, and linked to operational tools. The empirical test also confirms the hypothesis that it is possible to produce a regionally tailored OL strategy through a structured, participatory process. Importantly, the strategy produced was not theoretical but grounded in the region's assets, capacities, and administrative architecture. The test further supports the idea that such a strategy can be both context-specific and potentially replicable in other settings, particularly if supported by enabling frameworks, such as interdepartmental working groups or dedicated regional coordination units. This finding resonates with recent developments in policy design theory, particularly in relation to iterative, multi-actor, and future-oriented processes (Bason, 2014). In this sense, the toolbox serves not only as a diagnostic device but also as a design instrument—one that helps institutions envision and co-produce pathways toward more inclusive and resilient ocean governance.

Furthermore, the Sardinia case underlines the relevance of OL at the science–policy–society interface. As highlighted by Paredes-Coral et al. (2021) and Shellock et al. (2024), OL should not be limited to increasing awareness but should facilitate knowledge co-production and informed participation. In this respect, the strategy's emphasis on cross-sectoral collaboration, use of local languages, and engagement with cultural heritage aligns well with recent calls to integrate social, cultural, and ecological knowledge into MSP (Glithero et al., 2024; Wedding et al., 2024). The process also suggests that OL can serve as an entry point for broader participatory governance in coastal and marine affairs. While MSP typically includes formal stakeholder consultation opportunities, these are often too infrequent or too technical to foster meaningful engagement (Twomey & O'Mahony, 2019). Embedding OL within MSP provides a means to prepare, educate, and empower stakeholders before and beyond these formal processes—thereby enhancing both the legitimacy and quality of marine planning. However, the test also highlights limitations. The successful drafting of a strategy does not automatically guarantee its institutional adoption. Even with interest from regional actors, implementation will depend on sustained political will, budgetary allocations, and possibly legal mandates. Moreover, as acknowledged by the research team, testing a toolbox is not equivalent to testing the long-term socio-cultural or economic impacts of the strategy it generates. While the Sardinia case indicates strong potential, further applications in diverse governance contexts are needed to fully assess the tool's versatility and resilience.

5. Conclusions

This study sets out to examine whether OL could be operationalised as a functional tool to support regional MSP processes in the EU context. In response to this research question, the study tested the hypothesis that a replicable, regionally adaptable OL strategy could be developed through a structured methodological toolbox (ROLS-MSP). The results of the Sardinia pilot and the preceding expert validation process confirm this hypothesis, demonstrating that OL can be leveraged not only as a communication or educational asset but also as an integrative framework for participatory ocean governance.

Building on prior literature that positions OL at the science–policy–society interface (Kelly et al., 2021; Paredes-Coral et al., 2021), this study reinforces the importance of shifting OL from the periphery of marine governance into the core of strategic policy design. Ferreira et al. (2021) emphasise the need for OL to be embedded within broader strategies defined by clear goals and objectives. In this context, the REGINA-MSP project contributed a practical approach: a structured toolbox capable of supporting regional authorities in formulating an OL strategy aligned with MSP objectives and the Sustainable Development Goals.

The empirical test in Sardinia confirmed the operational feasibility of the toolbox, despite the limitation of regional resources. Through a combination of structured interviews, focus groups, and mapping exercises, regional actors were able to identify existing assets, articulate shared objectives, and draft a comprehensive OL strategy. While the Sardinia Region does not currently possess the institutional mechanisms required to formally adopt the strategy, the process revealed both the interest and the latent capacity for implementation. The findings suggest that, even in the absence of dedicated OL policy frameworks, structured tools can facilitate interdepartmental collaboration, increase stakeholder awareness, and improve preparedness for future participatory processes. The study also highlights the importance of working with existing regional resources and infrastructures, particularly those already engaged in environmental education, sustainability, and cultural dissemination. This approach is supported by recent literature advocating for inclusive, locally anchored knowledge co-production in MSP (Glithero et al., 2024; Wedding et al., 2024). Moreover, as McKinley (2024) argues, balancing the tensions between growth, equity, and sustainability also requires acknowledging and leveraging existing strengths within governance infrastructures.

Nonetheless, the research recognises important limitations. Testing the toolbox does not equate to testing the long-term impacts of a fully implemented strategy. Future research will be needed to evaluate the effectiveness of such strategies in generating behavioural, institutional, or ecological outcomes, within full policy cycles. Furthermore, the study was limited to a single regional test. Expanding the application of the ROLS-MSP toolbox to additional regions across different governance settings—both within and beyond the Mediterranean basin—would provide a more robust basis for assessing its transferability and long-term utility. In this regard, it could also be valuable to explore comparisons with extra-EU experiences, such as *Land, Water, Ocean, Us: A Canadian Ocean Literacy Strategy* (Canadian Ocean Literacy Coalition, 2021), which offers an inspiring model of culturally grounded OL integration, albeit developed outside the EU's policy framework. Despite its limitations, this study provides both a methodological and conceptual contribution to the evolving field of OL and its integration into marine spatial governance. It introduces a replicable model for enhancing the institutional role of OL within ecosystem-based, participatory planning processes such as MSP. The Sardinian case study demonstrates that OL can be strategically mapped, coordinated, and mobilised to support marine policy development at the regional level. More broadly, the findings contribute

to advancing understanding of how cultural and educational assets can be meaningfully embedded in policy design and implementation, thereby improving the overall effectiveness and inclusivity of ocean governance.

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Conflict of Interests

The authors declare no conflict of interests.

LLMs Disclosure

Artificial Intelligence was only used to improve English style and correctness.

Supplementary Material

Supplementary material for this article is available online in the format provided by the author (unedited).

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