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Aligning socio-economic and governance criteria to support better integration marine spatial planning, marine protected areas and other conservation approaches

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ABSTRACT

Connecting Marine Spatial Planning (MSP), which adopts a broader management approach, with Marine Protected Areas (MPAs), which focus on environmental conservation, is essential to ensure coherence between these instruments operating within the same marine space. To achieve this, a set of criteria encompassing socioeconomic and governance dimensions was analyzed. However, there is often a lack of comprehensive knowledge regarding these aspects, which could support the design, implementation and monitoring of MSP and MPAs. Addressing this gap, this research aims to develop and provide criteria to support managers/policy makers in integrating MSP and MPA processes within marine planning frameworks. The methodology is structured around three steps: (1) screening and grouping of key socio-economic and governance criteria derived from relevant policy documents; (2) expert evaluation of their relevance to MSP and MPAs; and (3) correlation analysis to explore the relationships between criteria prioritization across different types of spatial management, and to identify trends, therefore potential synergies/opportunities.

The results show a different correlation between MSP and different types of MPAs, suggesting that tailored approaches may be required to address the conservation targets within the scope of MSP. More specifically, there is a moderate negative correlation, in terms of socioeconomic criteria, between MSP and strict MPA, that is not observed between MSP and multiple-use MPAs. Although implemented on different scales, marine planning tools can work together to achieve their objectives if tailored to the specific socioeconomic dimension of the territory, with governance aspects such as adaptive management and stakeholder engagement serving as key elements in both processes. By framing ecosystems as social-ecological systems, the study demonstrates that socio-economic criteria can act as a bridge between sustainable development and conservation, therefore supporting the development of the Ocean European Pact and the revision of the MSP Directive.

1. Introduction

Marine Spatial Planning (MSP) and Marine Protected Areas (MPAs) are two important spatial tools for managing human activities and conserving marine biodiversity. Although often treated as separate instruments—due to their different origins and operational scales, they also share similarities and potential synergies. Understanding how to coordinate MSP and MPA efforts can enhance the effectiveness of both approaches, optimize the use of institutional and human resources, and promote coherent governance across sectors that depend on the same marine ecosystems.

MSP is a public initiative designed to assess and organize the spatial and temporal distribution of human activities in marine environments, to meet ecological, economic, and social objectives typically established

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through a political process (Ehler and Douvere, 2009). MPAs, meanwhile, are essential to marine conservation, with scientific evidence indicating they provide ecological, economic, and social benefits when properly designed and managed (Giakoumi et al., 2018; Ban et al., 2019). In this sense, both approaches, at different levels and emphasis, have largely been used in the world with the aim of safeguard the sustainability and health of the marine ecosystem and its use.

Although the objectives are broader, several studies demonstrate that MSP can facilitate the creation of new MPAs and establish ecological corridors to enhance marine conservation through an ecosystem-based approach (Borges et al., 2020; Vaughan and Agardy, 2020; Trouillet and Jay, 2021; Podda and Porporato, 2023; Nuno et al., 2024). Podda and Porporato (2023), for example, emphasize MSP's role in supporting connectivity between MPAs via ecological corridors, linking fragmented habitats and fostering biodiversity across larger spatial networks. Similarly, discussion on how an ecosystem-based approach within MSP and ocean zoning organize marine space can support archiving conservation of ecosystem services while promoting socio-economic activities (Ansong et al., 2017; Borges et al., 2020). These examples highlight MSP's potential to reinforce the effectiveness of MPAs by structuring spatial planning in a way that promotes both ecological connectivity and sustainable resource use. However, Trouillet and Jay (2021) and Frazão-Santos et al. (2025) argue that MSP and MPA frameworks often lack convergence due to their differing purposes. Nonetheless, both works emphasize the potential for synergies through spatial, temporal and governance relationships.

The term MPA is often used broadly, but significant distinctions between various MPA types must be clarified to optimize their integration within the MSP framework. MPAs range in protection levels, from fully protected areas to minimally protected areas where activities such as fishing and mining may be allowed (Grorud-Colvert et al., 2021). The International Union for Conservation of Nature (IUCN) developed a classification system for MPAs to define varying levels of conservation that align with specific goals and management practices (Day et al., 2019). Notably, while this classification is respected globally, it has not been formally adopted as a universal standard, meaning that other systems are also used. The IUCN classification ranges from strict nature reserves to areas that allow sustainable resource use, providing a structured approach to balance biodiversity preservation with compatible human activities (Dudley, 2008).

Regarding the effectiveness of these areas in conserving natural features, Turnbull et al. (2021a,b) shows that, in contrast to fully protected areas, which provide ecological benefits, partially protected areas do not demonstrate significant social or ecological advantages compared to open areas (i.e., areas without any conservation mechanism). As a result, these partially protected areas are often not well understood by the public. However, Gill et al. (2024) indicate that multiple use MPA can produce similar outcomes to no-take MPAs when adequately staffed and appropriate use regulations were applied.

MSP has seen significant global adoption as a framework for managing marine resources and activities. According to the State of the Ocean Report (IOC-UNESCO et al., 2024), 126 countries and territories had implemented area-based policies through MSP as of 2023. Despite this progress, many MPAs remain unimplemented or permit activities that undermine conservation efforts, such as dredging, mining, or destructive fishing practices (Pike et al., 2024; Aminian-Biquet et al., 2024). An analysis of the 100 largest MPAs revealed that 25 % remain unimplemented, and 30 % allow activities detrimental to conservation. Fully protected areas, which provide the greatest long-term socio-ecological benefits, are particularly underrepresented (Garraud et al., 2023). Achieving global targets like the GBF 30 × 30 with 10 % full protection requires MSP-driven improvements to ensure MPAs deliver concrete conservation outcomes.(Garraud et al., 2023; Pike et al., 2024).

In Europe, the need to streamline fragmented marine policies into a coherent governance strategy has led to the adoption of the European Ocean Pact, a non-legislative framework designed to align ocean health, socio-economic priorities such as coastal community well-being, blue economy and ocean literacy, and governance objectives, while also preparing the revision of the MSP Directive to strengthen maritime planning and the designation of MPAs (European Commission, 2025).

Socio-economic factors and how they are addressed are critical to the success of MPAs and their environmental outcomes (Garraud et al., 2023). Giakoumi et al. (2018) demonstrate that inadequate stakeholder engagement often leads to MPA failure, underscoring its importance as a socio-economic criterion for achieving sustainable conservation outcomes. Moreover, integrating socio-economic and governance criteria can better align ecological objectives with local socio-economic realities, thereby enhancing resilience and promoting sustainable resource use. Giakoumi et al. (2018) further emphasize that incorporating socio-economic and ecological data enables MPAs to adapt dynamically to unique socio-cultural and legislative contexts, ultimately fulfilling both conservation and socio-economic objectives.

In this sense, the integration of MPAs and MSP can benefit from a clear understanding of the socio-economic and governance criteria that distinguish these different approaches and contribute to the success of the planning process. Such integration can support potential MPA networks and appropriate protection types, enhancing synergies among conservation efforts, while addressing the social layer. Socio-economic criteria are essential in linking ecological and social aspects within MSP and MPA frameworks.The work of Pegorelli et al. (2024) identified 20 socio-economic criteria from European Union policies and international agreements, connecting these with ecosystem services that enhance human well-being within local and regional settings. This alignment supports community engagement, equitable access to resources, and sustainable conservation practices. In the context of this document, the term *criteria* refer to recommendations, strategic principles, or guidelines derived from key international and European policies, agreements, regulations, or other relevant documents that are applicable to all MSP and MPA initiatives within European countries.

This work will provide a new perspective to support the integration of MSP and MPA using socio-economic and governance criteria that are fundamental for the development and implementation of both approaches. Building on the work of Pegorelli et al. (2024), the present research expands the list of socio-economic criteria to include governance criteria essential for guiding MPA and MSP processes. A systematic review of these criteria establishes common ground between MSP and MPA frameworks, using the IUCN typology to identify points of convergence and divergence. By examining the criteria for MPA and MSP development across various governance structures, legal frameworks, and international agreements, this study offers practical insights into enhancing MPA effectiveness and coverage from a socio-economic perspective. By identifying specific common grounds for each type of MPA based on varying levels of restriction, the findings promote improved coordination between MSP and MPA frameworks, fostering sustainable marine resource management and biodiversity conservation.

2. Methodology

The methodology for this study is grounded in the use of "criteria" as key aspects to guide the integration of MSP and MPA. Those criteria have been identified, grouped and organized from the main international agreements, policies, treaties, directives and so that should be applied by the different European countries. The term "criteria" is used here to denote specific standards or principles that facilitate the evaluation and alignment of different components within MSP and MPA processes. Examples of such criteria include ecological considerations, such as biodiversity and habitat connectivity (not addressed within this work), governance elements like public participation and monitoring, and socio-economic factors, including cultural heritage and the presence of iconic species. By employing these criteria, this study aims to establish a structured approach for analyzing the integration of MSP and MPA frameworks.

The analysis builds on the list of socio-economic criteria identified by Pegorelli et al. (2024) and follows its proposed methodology by expanding the criteria incorporating governance aspects derived from various European Union policies and international agreements related to marine conservation and spatial planning. This screening analysis (Step 1) was conducted as a desktop study as part of the MSP4BIO project (www.msp4bio.eu), which includes a component addressing the socio-economic aspects of MSP and MPAs. The methodology involved consultations with experts in marine conservation and planning to identify the most relevant criteria for different MPA types according to IUCN categories and MSP requirements (Step 2). A summary of the proposed methodology is illustrated in Fig. 1, with further details provided below.

STEP 1 - Socio economic and governance criteria

The identification of governance criteria followed the methodology developed by Pegorelli et al. (2024) for socio-economic criteria, ensuring consistency across both types in this analysis and establishing a cohesive framework for integrating MPA and MSP processes. The socio-economic criteria list was derived from Withouck et al. (2023), whose *Summary Report of Existing Criteria, Species, and Habitat Lists Used in Conservation and Restoration Initiatives* (version July 31, 2023) compiled approximately 1000 criteria encompassing socio-economic, environmental, and governance dimensions, sourced from various European directives and legislation, and international documents. From this extensive list, 20 socio-economic criteria specifically relevant to marine planning and management were selected, while governance and biodiversity-related criteria were excluded to maintain a focused scope. These criteria were further refined to enhance clarity and stakeholder engagement without compromising their alignment with the original sources. Detailed information on each socio-economic criterion and its corresponding source is provided in the Complementary Material – Table 1.

Based on this work and the guidelines provided in Calado et al. (2023) within MSP4BIO, 12 governance criteria relevant to marine planning and conservation were also identified (Complementary Material – Table 2), forming, together with the socio-economic criteria, the foundational basis for subsequent stages of the methodology.

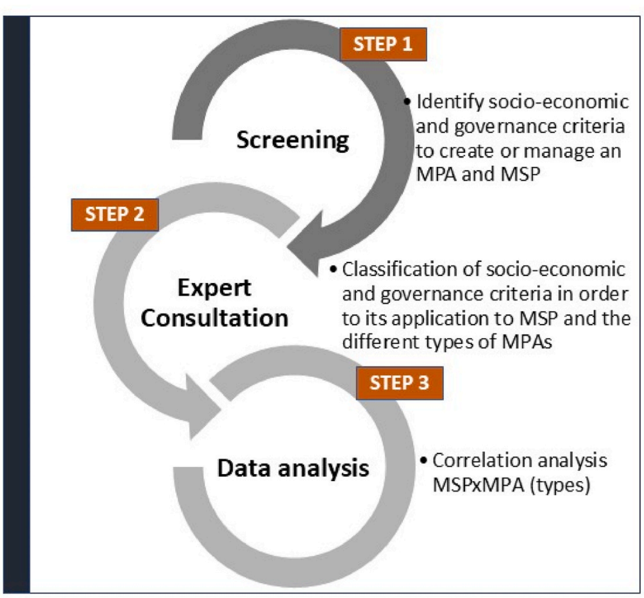

Fig. 1. Summarized methodology.

Table 1
IUCN's Protected Areas Management Categories, protected areas are classified according to their management goals. Adapted from Dudley (2008).

IUCN MPA	Name	Description	This study
i-a	Strict nature reserve	Strict protection	MPA1 (Strict Protection)
i-b	Wilderness area	Strict protection	
ii	National park	Ecosystem conservation and protection	MPA2 (Conservation Focus)
iii	National monument or feature	Conservation of natural monument or feature	
iv	Habitat/species management area	Conservation through active management	
v	Protected landscapes or seascapes	Landscape/seascape conservation and recreation	MPA3 (Multiple-use)
vi	Protected areas with sustainable use of natural resources	Sustainable use of natural resources	
–	Other Effective Area-Based Conservation Measures	Different types of conservation measures are possible	OECM

Table 2
Example of results showing the relevance of process criteria for implementing and designing MPAs or MSP - Socio-economic Criteria. Where: 0 - Not applicable; 1 - Partially; and 2 - Fully.

Socio-economic criteria	MSP	IUCN MPA Category		
		Ia. Ib	II, III, IV	V, VI
Area is important for the generation of employment and income linked to no traditional activities	0	0	0	1
Area is important for fishery activity	2	0	0	1

STEP 2. Analysis of socio-economic and governance criteria for their application to MSP and the different types of MPAs.

Based on the established criteria list, experts in MSP and MPAs from diverse countries were invited to assess each criterion's applicability. The evaluation utilized a scale of 0 for "Not applicable," 1 for "Partially applicable," and 2 for "Fully applicable," in relation to both MSP and MPA processes. To support this assessment, the authors provided explicit definitions for each criterion, with the goal of determining each criterion's relevance to MSP and/or MPA frameworks to support integrated management of protected areas and spatial planning.

During this process, experts could suggest additional criteria. Given that the initial list is derived from a literature review by Calado et al. (2023) and Withouck et al. (2023), experts were asked to provide brief rationales for any new criteria proposed to ensure alignment with the study's objectives.

To assess the relevance of each criterion to MPAs, it is essential to consider the different types of MPAs, ranging from no-take zones to sustainable-use areas. For the purpose of this paper and to facilitate the assessment of the different types of MPA, the IUCN MPA categories were grouped into the following three types based on their similar conservation measures—no-take zones to sustainable-use zones (Table 1). In addition to the three MPA categories, and to account for the complexities of marine planning and conservation, this analysis also includes criteria related to Other Effective Area-Based Conservation Measures (OECMs). An OECM is defined as "an area other than a Protected Area that is governed and managed in ways that achieve positive and sustained long-term outcomes for the in-situ conservation of biodiversity, along with associated ecosystem functions, services, and, where relevant, cultural, spiritual, socio-economic, and other locally significant values"(Convention on Biological Diversity, 2018) .

Tables 2 and 3 illustrate examples of how experts evaluated criteria for MSP and MPA management. Experts completed these tables to share insights on the applicability of each criterion to different management types, providing a clearer perspective on their relevance within various MPA categories and spatial planning frameworks. The list of governance and socio-economic criteria relevant for MSP and MPA process assessed by experts are available on Complementary Material- – Tables 4 and 5.

2.1. Expert consultation

To achieve a diverse consultation process, experts were selected based on two main criteria: (i) direct experience with MSP and/or MPA, and (ii) broad geographic representation across sea basins, including the South Atlantic Ocean (Brazil), Mediterranean (France and Italy), Baltic (Finland, Estonia), North Sea (Belgium), Black Sea (Romania), and North Atlantic (Portugal and Spain). Most of the experts consulted are partners in the MSP4Bio Project. However, to include a non-European perspective, two experts from Brazil — where the MSP process is in its initial stages — were contacted.

Eleven experts were interviewed, with backgrounds encompassing various disciplines within MSP, MPA management, and governance, contributing a range of regional perspectives that enhance the analysis (Complementary Material – Table 3). The interviews were conducted both online and in person, using a semi-structured questionnaire as the basis (STEP 2). Data collection was systematically structured, with experts' responses recorded in tabular form. This format facilitated a clear synthesis of perspectives, supporting a multi-dimensional analysis of the criteria essential for to support the integration of MSP and MPA management.

STEP 3. DATA ANALYSIS

The subsequent data analysis procedures encompassed a range of statistical tests, including but not limited to descriptive statistics (average, standard deviation and occurrence) and correlation analysis. These aimed to uncover insights, trends, and relationships within the dataset, providing discussion support into the research questions and objectives.

The results are presented in an integrated manner in order to emphasize overarching patterns and shared perceptions. This approach also helps to illustrate how differences between governance and socio-economic criteria are understood across different types of marine planning and management tools.

The analysis was used as an exploratory tool to identify general trends in the alignment of socio-economic and governance criteria across management approaches. The results are interpreted with caution and considered indicative rather than conclusive.

2.2. Correlation analysis

In this study, correlation analysis was employed to discern the relationship between criteria prioritization for various types of spatial management, namely MSP, MPA1, MPA2, MPA3 and OECMs. The analysis aimed to identify correlations between these criteria, shedding light on the distinct characteristics inherent in each spatial management approach. To achieve this, Spearman's correlation coefficient for the following datasets.

- Average of socio-economic criteria relevance values for: MSP and MPA1, MSP and MPA2, MSP and MPA3, and MSP and OECMs.
- Average of governance criteria relevance values for: MSP and MPA1, MSP and MPA2, MSP and MPA3, and MSP and OECMs.

Spearman's correlation coefficient (ρ) quantifies the strength and direction of the relationship between two variables, ranging from −1 to 1. The results provides valuable insights into the interrelationships among the criteria sets. The value of ρ is given by:

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

, where.

- ρ is Spearman's rank correlation coefficient.
- d_i is the difference between the ranks of corresponding data points for the two variables.
- n is the number of data points.
- d^i represents the sum of the squared differences in ranks.

It is important to mention that the consistency among expert scores was assessed using Kendall's W. The results indicated a statistically significant level of agreement, supporting the use of average scores for subsequent analyses, including Spearman correlation.

Table 3
Example of results showing the relevance of process criteria for implementing and designing MPAs or MSP - Governance Criteria. Where: 0 - Not applicable; 1 - Partially; and 2 - Fully.

GOVERNANCE CRITERIA	MSP	IUCN MPA Category			OECMs
		Ia. Ib	II, III, IV	V, VI	
Ecosystem based management approach	2	0	1	2	0/1
Long term strategic adaptive management	2	2	2	2	1

3. Results and discussion

3.1. Relevance socio-economic criteria (SEC) in relation to MSP and MPA process

The correlation analysis between MSP and different types of protected or conserved areas (MPAs and OECMs) revealed varying strengths and directions of relationships. The correlation analysis of socio-economic criteria between MSP and various protected area types reveals predominantly weak relationships, particularly with stricter MPAs for both socio-economic and governance criteria.

Fig. 2 shows that for MPA1 (Strict Protection), a moderate negative correlation with MSP (ρ = -0.76) indicates fundamental conflicts between MSP's socio-economic priorities and the strict conservation focus of MPA1. This means that the criteria that are more relevant and taken into consideration for these two marine management frameworks diverge. Similarly, MPA2 (Conservation Focus) exhibited a moderate negative correlation (ρ = -0.68), reflecting limited compatibility as MSP's broader economic goals may overshadow MPA2's conservation objectives. In contrast, MPA3 (Multiple-Use) displayed a weak negative correlation (ρ = -0.03), suggesting closer alignment with MSP's sustainable use focus, though some differences in prioritization remain. In turn, OECMs, with a weak positive correlation (ρ = 0.17), showed modest alignment due to their flexible approach to conservation that accommodates socio-economic activities.

More specifically, the analysis highlights distinct patterns in their prioritization (Table 4). MSP demonstrated the highest applicability for economic-focused criteria, with **fishery activity** (SEC_2) and **blue economy development** (SEC_3) scoring the maximum value (**2.00**), reflecting a majority role in supporting sustainable economic growth and resource management over conservation discussed in many works, e.g., Jones et al. (2016).

For MPAs, **MPA1** (strict protection) scored lower for these criteria (**0.82** and **0.55**, respectively), consistent with its focus on minimizing human use. Conversely, **MPA3** (multiple-use) showed stronger

Table 4
Prioritization Analysis: value of socio-economic criteria (SEC) in relation to MSP, MPA and OECMs. Color range varies from green (Fully applicable) to red (not relevant or applicable).

Code	MSP	SD	MPA 1	SD	MPA 2	SD	MPA 3	SD	OECMs	SD
SEC_1	1,75	0,62	0,64	0,81	0,91	0,83	1,25	0,62	1,17	0,57
SEC_2	2,00	0,00	0,82	0,98	1,27	0,65	1,75	0,45	1,67	0,53
SEC_3	2,00	0,00	0,55	0,82	1,27	0,65	1,83	0,39	1,83	0,53
SEC_4	2,00	0,00	0,73	0,79	0,73	0,65	1,25	0,75	1,00	0,57
SEC_5	1,83	0,39	0,55	0,82	0,73	0,90	0,83	0,83	0,83	0,59
SEC_6	1,75	0,45	0,55	0,82	1,00	0,63	1,58	0,51	1,83	0,48
SEC_7	1,25	0,75	1,55	0,69	1,64	0,50	1,67	0,65	1,17	0,80
SEC_8	1,58	0,67	1,00	0,89	1,36	0,67	1,50	0,67	1,67	0,53
SEC_9	1,58	0,51	1,18	0,75	1,55	0,69	1,67	0,65	1,50	0,52
SEC_10	1,58	0,51	0,73	0,79	1,09	0,70	1,58	0,67	1,50	0,52
SEC_11	1,67	0,49	0,82	0,75	1,27	0,65	1,67	0,65	1,50	0,53
SEC_12	1,17	0,83	1,64	0,67	1,64	0,50	1,67	0,65	1,33	0,84
SEC_13	1,33	0,65	1,18	0,75	1,55	0,52	1,67	0,65	1,33	0,82
SEC_14	0,83	0,83	1,00	0,89	1,36	0,81	1,58	0,79	1,33	0,89
SEC_15	1,42	0,67	2,00	0,00	2,00	0,00	1,75	0,45	1,83	0,53
SEC_16	1,58	0,67	0,82	0,87	1,00	0,77	1,25	0,87	1,33	0,52
SEC_17	1,83	0,39	0,82	0,98	1,36	0,81	1,83	0,39	1,33	0,52
SEC_18	1,42	0,67	1,45	0,82	1,64	0,67	1,58	0,67	1,83	0,52
SEC_19	1,00	0,85	1,09	0,83	1,36	0,81	1,42	0,90	1,00	0,67
SEC_20	1,33	0,78	1,82	0,60	1,64	0,50	1,67	0,49	1,17	0,48

MPA1. The IUCN categories of marine protected areas Ia and Ib are included. Therefore, MPA1 refers to marine protected areas that prioritize strict environmental protection above other uses.
MPA2. The IUCN categories of marine protected areas II, III, and IV are included. Therefore, MPA2 refers to marine protected areas that prioritize the conservation of ecosystems or natural monuments, which can be achieved through active management.
MPA3. The IUCN categories of marine protected areas V and VI are included. Therefore, MPA3 refers to marine protected areas of multiple uses where the goal is the sustainable use of natural resources.
SD. Standard deviation
MSP. Maritime Spatial Planning
OECMs. Other Effective Conservation Measures

alignment with socio-economic priorities, with SEC_2 scoring **1.75** and SEC_3 reaching **1.83**, indicating a balanced approach to sustainable use and conservation. OECMs similarly prioritized economic factors, scoring **1.67** for SEC_2 and 1.83 for SEC_3, emphasizing their role in integrating community needs with conservation objectives.

It is noteworthy that MSP and MPA3 exhibit a positive correlation, sharing similar economic criteria as the most relevant factors. Comparing these findings with the work of Turnbull et al. (2021a,b), who argue that MPA3—referred to in their study as partially protected areas—do not demonstrate significant social or ecological advantages compared to open areas, highlights important considerations about the role of MPA3 as a conservation mechanism for marine areas. Turnbull et al. (2021a,b) also contend that this type of MPA can provide misleading information, as it is often perceived as contributing to marine conservation goals due to its inclusion in commonly used conservation performance indicators, such as the percentage of protected jurisdiction. This flags important questions about the effectiveness of MPA3 in achieving marine conservation objectives, particularly in the

Table 5
Prioritization analysis: value of governance criteria (GC) in relation to MSP, MPA and OECMs. Color range varies from green (Fully applicable) to red (not relevant or applicable).

Code	MSP	SD	MPA 1	SD	MPA 2	SD	MPA 3	SD	OECMs	SD
GC_1	1,67	0,49	1,27	0,79	1,64	0,50	1,67	0,49	1,55	0,60
GC_2	1,83	0,39	1,73	0,47	1,82	0,40	1,67	0,65	1,40	0,52
GC_3	1,83	0,39	1,27	0,79	1,55	0,52	1,50	0,52	1,40	0,70
GC_4	2,00	0,00	1,36	0,81	1,64	0,50	1,75	0,45	1,80	0,42
GC_5	1,58	0,51	1,27	0,65	1,36	0,50	1,50	0,67	1,50	0,53
GC_6	1,83	0,39	1,64	0,67	1,73	0,47	1,50	0,67	1,70	0,48
GC_7	1,92	0,29	0,73	0,90	1,18	0,60	1,50	0,52	1,40	0,52
GC_8	1,75	0,45	0,73	0,90	1,45	0,69	1,75	0,45	1,40	0,52
GC_9	1,33	0,49	1,09	0,83	1,09	0,83	1,08	0,90	1,10	0,88
GC_10	1,67	0,49	1,27	0,47	1,45	0,52	1,33	0,49	1,40	0,52
GC_11	1,75	0,45	1,55	0,52	1,55	0,52	1,50	0,52	1,60	0,52
GC_12	2,00	0,00	1,27	0,79	1,45	0,69	1,58	0,67	1,40	0,52
GC_13	1,67	0,49	1,55	0,69	1,73	0,47	1,75	0,45	1,50	0,71

MPA1. The IUCN categories of marine protected areas Ia and Ib are included. Therefore, MPA1 refers to marine protected areas that prioritize strict environmental protection above other uses.
MPA2. The IUCN categories of marine protected areas II, III, and IV are included. Therefore, MPA2 refers to marine protected areas that prioritize the conservation of ecosystems or natural monuments, which can be achieved through active management.
MPA3. The IUCN categories of marine protected areas V and VI are included. Therefore, MPA3 refers to marine protected areas of multiple uses where the goal is the sustainable use of natural resources.
SD. Standard deviation
MSP. Maritime Spatial Planning
OECMs. Other Effective Conservation Measures

context of targets like the 30x30 conservation goals. However, Gill et al. (2024) highlight that MPA3 can produce similar outcomes to MPA1 when adequately regulated. In this sense, a clearer understanding of the role of MPA3 and MSP can support the more successful delivery of conservation targets.

Pennino et al. (2021) mentions that socio-ecosystems approach is the first step in making the MSP process successful on both the human and the natural fronts. Differences in socio-economic criteria reveal that localized management approaches like MPA3 place a stronger emphasis on integrating values such as cultural heritage and symbolic significance, aligning closely with local community interests (Complementary Material - Table 4). These distinctions suggest that MSP could enhance its approach by incorporating such socio-cultural values more fully, enabling a more holistic and context-sensitive strategy for MSP that better integrates diverse stakeholder priorities and ecological objectives. This perspective aligns with Pennino et al. (2021), who warn that without equitable engagement, MSP risks facilitating "ocean grabbing", where resource control is concentrated among a select minority, often displacing local communities and exacerbating poverty. This emphasizes the need for MSP to move beyond purely economic priorities and adopt a more holistic approach that accounts for sociocultural dependencies and local ecological knowledge.

3.2. Relevance governance criteria (GC) in relation to MSP and MPA process

Regarding governance criteria, the analysis shows that the negative correlation between MSP and MPA 1 (Fig. 3) underscores the lack of significant alignment between their governance strategies. It reveals that MSP's governance framework is generally more compatible with multiple-use and flexible conservation frameworks, such as MPA3 and OECMs, compared to strictly protected areas like MPA1. The positive relationships with MPA3 and OECMs suggest that MSP's governance structures—which emphasize adaptability, stakeholder participation, and conflict management—align well with frameworks that incorporate sustainable use and local engagement. Specifically, the high correlation between MSP and MPA3 in governance criteria highlights a strong alignment in their spatial management approaches, indicating that sustainable development goals are more evident in both governance structures. While MSP operates at a broader national or regional scale and MPA3 is more localized, their governance frameworks share a commitment to sustainable resource management.

More specifically, for governance criteria (Table 5), MSP demonstrated high scores for criteria such as **conflict management (GC_17)** and **adaptive management (GC_2)**, with values reaching **1.83** and **1.75**, respectively. These scores reflect MSP's role in coordinating multiple uses and addressing spatial conflicts across marine areas. In contrast, **MPA1** and **MPA2** placed greater emphasis on **scientific interest (GC_20)** and **long-term ecological monitoring (GC_12)**, with scores of **1.82** and **1.64**, respectively, consistent with their conservation-focused mandates. **MPA3** scored moderately high on governance criteria, such as **stakeholder participation (GC_4, 1.67)** and **co-management (GC_9, 1.67)**, reflecting its emphasis on integrating diverse user groups. OECMs showed similar trends, scoring **1.67** for both

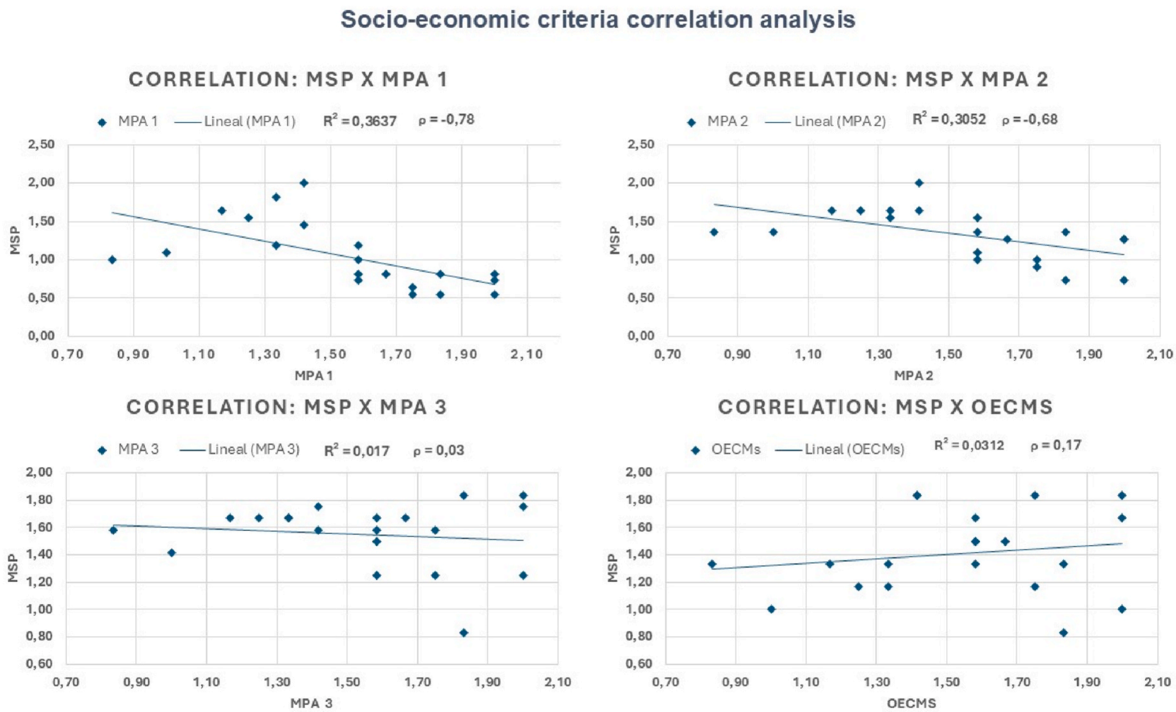

Fig. 2. Socio-economic criteria correlation analysis. **R2** is the coefficient of the correlation varying from 0 to 1, where 0 means no relation and 1 full relation. ***ρ*** is the result of Spearman's analysis, varying from −1 to 1 and measures the strength and direction of the relationship between two variables. **MPA1 -** The IUCN categories of marine protected areas Ia and Ib are included. Therefore, **MPA1** refers to marine protected areas that prioritize strict environmental protection above other uses. **MPA2** - The IUCN categories of marine protected areas II, III, and IV are included. Therefore, **MPA2** refers to marine protected areas that prioritize the conservation of ecosystems or natural monuments, which can be achieved through active management. **MPA3 -**The IUCN categories of marine protected areas V and VI are included. Therefore, **MPA3** refers to marine protected areas of multiple uses where the goal is the sustainable use of natural resources. **MSP** Maritime Spatial Planning. **OECMs** Other Effective Conservation Measures.

GC_4 and **GC_9**, underscoring their flexibility in involving communities while achieving conservation outcomes.

The governance analysis reveals both alignments and divergences among MSP, MPAs, and OECMs (Complementary Material - Table 5), emphasizing the shared priority of stakeholder participation (GC_4) and adaptive management (GC_2). While these frameworks underscore the importance of inclusive governance, MSP faces significant challenges due to its broader scale, where logistical and financial constraints complicate meaningful engagement, particularly in resource-limited regions. Poor coordination of overlapping stakeholders across MSP and conservation frameworks can lead to engagement fatigue and confusion (Vaughan and Agardy, 2020). To address this, integrating stakeholder strategies and aligning localized and broader governance needs are critical. Well-structured and participatory engagement processes enhance compliance, trust, and shared understanding of goals, reducing conflicts between socio-economic and conservation objectives (Pennino et al., 2021). Strengthening these approaches fosters robust governance systems that balance ecological preservation and sustainable development.

3.3. Relevance of shared criteria to facilitate coherence between marine management approaches

The socio-economic and governance criteria analyzed in Tables 4 and 5 respectively highlight shared priorities and distinct focuses across MSP, MPAs, and OECMs. This discussion explores these differences and similarities, highlighting how various marine planning and management frameworks prioritize socio-economic and governance aspects to achieve their goals. Based on these results, the work intends to find potential ways to support a better integration of MSP and MPA, therefore adding to the work of Trouillet and Jay (2021) that analyzed the link of MSP and MPA process by emphasizing their relationships regarding space and time. These findings highlight the need for a differentiated approach when integrating MSP with MPAs, particularly MPA 1 and MPA 2, which exhibit a notable disparity in their socio-economic and governance goals compared to MSP.

The divergence in these correlations underscores the necessity of tailored MSP plans that consider the specific conservation approaches and socio-economic contexts of each MPA. An example of this is the Seychelles Marine Spatial Plan (SMSP), which built on existing marine protection and planning efforts. Its main objectives are to protect 30 % of the EEZ divided into high biodiversity protection and medium biodiversity protection, support climate adaptation, and promote the blue economy. Through extensive stakeholder engagement, 13 marine protected areas were legally designated. Management plans have been developed for more than half of these areas, and a monitoring program is planned to support implementation (Frazão Santos et al., 2025).

Moreover, while the results underscore fundamental divergences between strict MPAs (MPA1) and MSP, they also point to opportunities for alignment through improved communication and clearer articulation of outcomes. For instance, the "spillover effect", a well-documented benefit of strictly protected areas, demonstrates how such MPAs can indirectly support socio-economic goals like fisheries and tourism (Medoff et al., 2022; Garraud et al., 2023). This highlights the importance of reconciling conservation and development narratives, particularly by ensuring that the ecological contributions of MPAs, from an economic perspective, are better communicated and valued within the MSP framework. Similarly, MSP's strategic, large-scale planning must incorporate ecological health considerations to sustain its supporting sectors, such as fisheries and the blue economy. Additionally, MSP's large-scale approach is critical in promoting ecological connectivity by establishing MPAs and OECMs, which are essential for biodiversity conservation and landscape planning (Podda and Porporato, 2023).In this sense, integrating MSP with MPAs requires a differentiated

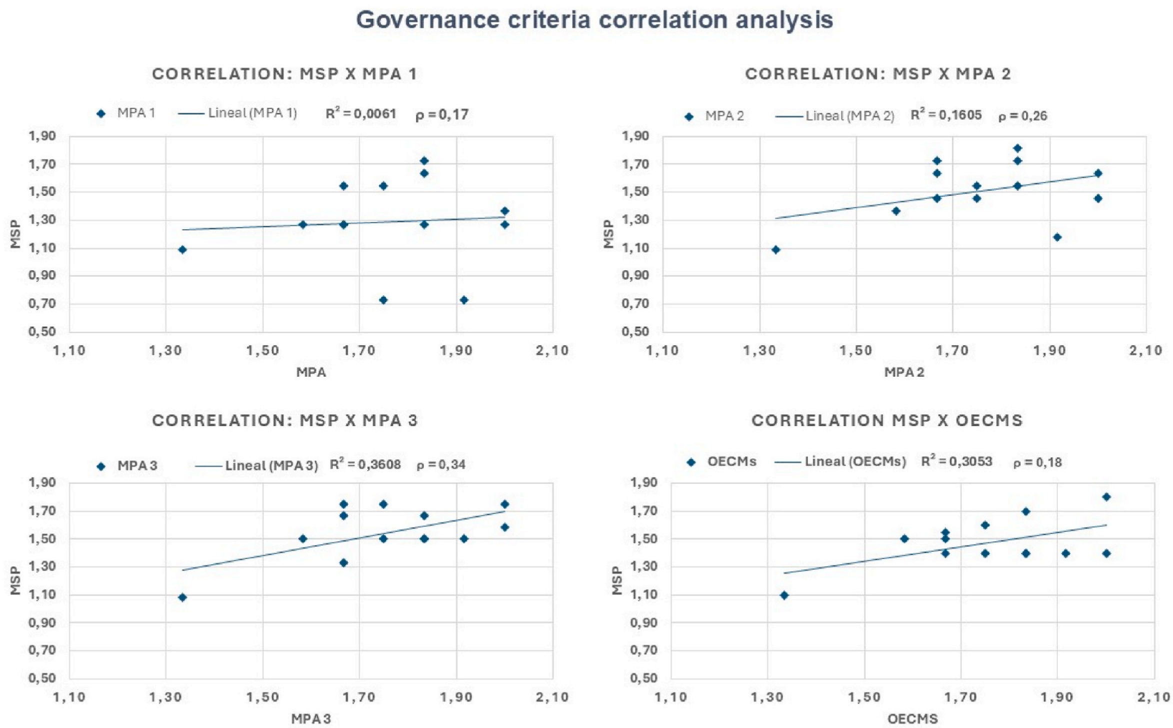

Fig. 3. Governance criteria correlation analysis. R2 is the coefficient of the correlation varying from 0 to 1, where 0 means no relation and 1 full relation. ρ is the result of Spearman's analysis, varying from −1 to 1 and measures the strength and direction of the relationship between two variables. **MPA1 -** The IUCN categories of marine protected areas Ia and Ib are included. Therefore, **MPA1** refers to marine protected areas that prioritize strict environmental protection above other uses. **MPA2** - The IUCN categories of marine protected areas II, III, and IV are included. Therefore, **MPA2** refers to marine protected areas that prioritize the conservation of ecosystems or natural monuments, which can be achieved through active management. **MPA3 -**The IUCN categories of marine protected areas V and VI are included. Therefore, **MPA3** refers to marine protected areas of multiple uses where the goal is the sustainable use of natural resources. **MSP** Maritime Spatial Planning. **OECMs** Other Effective Conservation Measures.

approach, as suggested by Trouillet and Jay (2021), that considers each Area's specific conservation objectives and socio-economic contexts.

Embedding sociocultural layers into MSP is essential for reducing governance rigidity and enhancing adaptability. This includes dedicating resources to collect sociocultural data, engaging underrepresented groups, and co-producing knowledge with stakeholders to ensure that MSP frameworks are inclusive and equitable (Grimmel et al., 2019; Pennino et al., 2021). For example, UNESCO-IOC and SWAM (2024) show that in Kenya, Tanzania, and Madagascar, MSP decisions can have profound impacts on local communities, particularly marginalized groups such as women, youth, small-scale fishers, and indigenous peoples. Excluding socio-economic considerations risks overlooking how changes in marine resource access, employment opportunities, and governance structures can exacerbate existing inequalities.

In Europe, Sweden is often cited as a benchmark for integration between MPAs and MSP and for its use of socio-economic and governance criteria. Swedish Marine Planning legislation and the Swedish Environmental Code explicitly support the creation and management of MPAs within MSP process. In practice, conservation areas are embedded into maritime spatial plans, and the MSP legal framework facilitates the establishment of MPAs where necessary. This case illustrates how an EU country operationalizes conservation and socio-economic criteria in its national MSP instrument – for example, by linking MSP objectives to MPA designation and ensuring that spatial plans reflect existing and potential marine protection areas, accompanied by socio-economic impact assessments (Calado et al., 2024).

Building on this, Frazão Santos et al. (2025) have highlighted the importance of distinguishing between MSP and MPAs, warning that conflating these governance approaches can lead to missed opportunities for sustainable ocean management. The present analysis contributes to the discussion by examining the complementarities and differences among MSPs, MPA types, and OECMs. By using socio-economic and governance criteria to compare these approaches, it can help identify synergies and improve coordination. This discussion is particularly timely in light of the European Ocean Pact, which brings together EU ocean policies under a single framework and prioritises both the revision of the MSP Directive and the establishment and management of MPAs. By embedding MSP within this broader governance agenda, the Ocean Pact underscores its role in achieving conservation targets, including the protection of 30 % of EU seas by 2030, with 10 % under strict protection.

The findings suggest that MSP can facilitate the designation of MPAs contributing to the 30 % target, particularly those of sustainable use where socio-economic considerations are more easily integrated. By contrast, meeting the stricter 10 % target requires more targeted strategies and robust trade-off management to reconcile ecological and socio-economic priorities. Addressing these tensions points to a broader governance challenge: while the MSP Directive includes a provision for public participation and the MSFD sets strong environmental objectives, both lack systematic integration of socio-economic dimensions. Incorporating socio-economic criteria—originating across different EU policies and documents—into these overarching directives could provide a bridge between sustainable development and conservation. As argued by Pegorelli et al. (2024), linking socio-economic criteria to ecosystem services offers a clearer pathway to connect human well-being with ecological outcomes, thereby strengthening the capacity of MSP and MPAs to jointly deliver on international and EU biodiversity commitments.

4. Conclusion

MSP serves as a high-level governance framework for organizing human activities in marine areas, offering flexibility to integrate with conservation-focused frameworks like MPAs and OECMs. However, the integration of these frameworks often lacks clarity and coherence, posing challenges in harmonizing management activities with conservation objectives. Taking into account the insights of Trouillet and Jay (2021) on spatial and temporal dynamics and Pennino et al. (2021) on socio-cultural inclusivity, this study adds a new layer to the discussion by proposing common socio-economic and governance criteria as foundational to support arguments for integrating MPAs and MSP. These strategies are essential for aligning conservation objectives with sustainable development goals, enabling MSP to fulfill its potential in supporting conservation efforts, safeguarding ocean health, and promoting sustainable use globally.

The results highlight points of divergence and alignment. The moderate negative correlation between MSP and stricter MPAs (MPA1 and MPA2) underscores the challenges of reconciling socio-economic priorities with strict conservation goals, whereas the alignment between MSP, multiple-use MPAs (MPA3), and OECMs demonstrates opportunities for collaborative efforts to bridge these gaps. This perspective is supported by Gill et al. (2024), who argue that different types of MPA can more effectively advance conservation and equity outcomes when coordinated under broader governance frameworks such as MSP. Strategic planning, adaptive management, and tailored communication are essential tools to achieve this integration (Trouillet and Jay, 2021; Pennino et al., 2021).

By identifying and addressing points of alignment and divergence, this study provides strategic elements to enhance the integration of MSP, MPAs, and OECMs. Embedding socio-cultural values into MSP frameworks can reduce governance rigidity, enhance adaptability, and foster stakeholder inclusivity. Moreover, articulating the ecological and socio-economic contributions of MPAs—such as their roles in supporting fisheries, tourism, and ecosystem services—further strengthens the case for integrated marine management (Grorud-Colvert et al., 2021).

Within the European context, the Ocean Pact (European Commission, 2025) adds urgency by setting priorities to revise the MSP Directive and encourage Member States to establish and manage MPAs in line with the 30 % and 10 % conservation targets. Yet, the MSP Directive has been criticized for insufficiently embedding socio-economic dimensions, while the MSFD focuses exclusively on environmental criteria. Embedding socio-economic and governance criteria—developed through different EU policies and documents—into both overarching directives could bridge sustainable development and conservation, advancing a social-ecological perspective that recognizes humans as integral components of ecosystems. As Pegorelli et al. (2024) demonstrate, linking socio-economic criteria to ecosystem services provides a clearer pathway to connect ecological functions with human well-being. A necessary step forward will be the design of robust indicators that can translate these criteria into measurable and operational tools, making them clearer and more actionable for planners and policymakers.

A clearer integration of MSP and MPA, guided by well-designed criteria and indicators, could foster more coherent, equitable, and effective marine governance. Strengthening the socio-ecological foundations of European marine policy is essential for delivering a healthy and sustainable ocean. The Ocean Pact represents an opportunity to: i) build a coherent ocean governance framework for European seas; and ii) incorporate a more integrated socio-ecosystem approach, to which this work contributes directly.

CRediT authorship contribution statement

Camila Pegorelli: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Javier García Sanabria:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization. **Maria de Andres:** Writing – review & editing, Supervision, Formal analysis. **Javier Garcia Onetti:** Writing – review & editing, Supervision, Formal analysis. **Liisi Lees:** Writing – review & editing, Data curation. **Helena Calado:** Writing – review & editing, Validation. **Débora Gutierrez:** Writing – review & editing, Data curation.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ocecoaman.2025.107985.

Data availability

Data will be made available on request.

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