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A guide to support the integration of marine protected areas into maritime spatial planning

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Marine protected areas can contribute to achieving biodiversity targets, especially when embedded in maritime spatial planning (MSP). Drawing on a screening of European MSP, this work presents a framework spanning pre-planning, planning and implementation. At each stage, it combines Strategic Environmental Assessment, a Criteria Checklist, and Strategic Recommendations to align conservation objectives, blue-economy activities and the rights and needs of coastal communities, supporting a more just, healthy and productive ocean.

Governments have committed to ambitious ocean conservation targets while simultaneously promoting rapid growth of marine industries. Global biodiversity frameworks call for at least 30% of the ocean to be effectively protected, while offshore energy, shipping, tourism and other "blue economy" sectors are expanding quickly[1,2]. Marine protected areas (MPAs) sit at the heart of this tension: they are expected to conserve biodiversity, support climate resilience, and sustain livelihoods; yet, are often planned and managed separately from the main arena where the ocean space is allocated and regulated—i.e., maritime spatial planning (MSP)[3,4].

In many countries, MPAs pre-date MSP initiatives, with the former being designated through ad hoc processes or sectoral conservation policies[5,6]. In such cases, when MSP initiatives begin, MPAs frequently appear as static polygons to be "respected" by new ocean uses and activities, rather than dynamic elements that shape the overall structure of the maritime spatial plan[3,6]. Conversely, in areas where MSP initiatives emerge first, MPAs are often designated only at a late stage of the process[3,7], therefore having limited influence on main spatial decisions, with patterns of use and infrastructure development already "locked in". In both cases, the integration of MPAs and MSP is only partial, and often contested[6,8]. Nevertheless, experiences in which conservation has played a central role in shaping MSP, or in which MSP and MPA designation have been developed jointly, such as in Australia, demonstrate that more integrated approaches are possible[9].

Bringing MPAs and MSP together goes beyond a purely technical challenge. It expands to legal mandates, institutional power, knowledge systems, and the distribution of costs and benefits across society[10,11]. Traditional planning guidance tends to focus either on conservation design principles for MPAs, or on generic MSP procedures for organising uses and activities in the ocean[5,12]. Consequently, what has been, and still is, missing is an operational "bridge" that shows *how* MPAs can be integrated into MSP processes from the start, using tools that practitioners already recognise, but often apply in isolated ways.

The proposed framework builds on a structured screening of national MSP processes in 20 of the 22 coastal EU Member States; Croatia and Greece were excluded because their MSP processes were still at an early stage of development. The screening combined a review of MSP documentation with local expert input and a checklist of 93 criteria covering environmental, socioeconomic, policy and governance, and planning-process dimensions, including legal and institutional alignment, ecological coherence and connectivity, spatial analysis, stakeholder participation, ecosystem-based management, monitoring, review and SEA[13]. The screening revealed uneven MPA–MSP integration and recurring gaps in coordination, ecological coherence, implementation and adaptive management, informing the framework's organisation around SEA, a Criteria Checklist and Strategic Recommendations across pre-planning, planning and implementation[13] (Fig. 1).

The framework organises the integration of MPAs into MSP in each of the three main stages of the planning cycle: pre-planning, planning and implementation. Although pre-planning often occurs before a formal plan is available for consultation, and therefore easily overlooked, it is a fundamental stage that determines who participates in the process, which issues are considered legitimate what are the dimensions to be evaluated in SEA and which objectives are defined. If MPAs are absent from pre-planning, their capacity to influence core MSP decisions later is compromised. The planning stage represents the most visible face of MSP, encompassing maps, scenarios, negotiation processes, and ultimately the development of a formal plan. At this stage, MPAs can either become the backbone of a sustainable ocean strategy or remain marginal conservation measures surrounded by incompatible uses. Finally, implementation is where the credibility and efficacy of both MPAs and MSP are tested. When measures remain only on paper, conflicts are likely to resurface and trust in the planning process tends to decline.

Rather than presenting a complex methodology, the proposed framework reorders and connects three key elements already applied by many countries, offering a clear and coherent structure for integration, as well as a transparent chain from early scoping to adaptive review[13]. These key elements are:

(1) Strategic Environmental Assessment (SEA), integrating environmental considerations into policies, plans and programs;
(2) Criteria Checklist, used to assess enabling conditions and guide decision-making; and

Fig. 1 | A three-stage framework for integrating marine protected areas into maritime spatial planning. The three key elements—Strategic Environmental Assessment (SEA), Criteria Checklist, and Strategic Recommendations—are repeatedly used in the main stages of a maritime spatial planning process, namely pre-planning, planning and implementation. Source: ref. 13.

(3) Strategic Recommendations, which translate assessments and criteria into actionable guidance.

While these key elements are systematically used in the different stages of planning (Fig. 1), their roles change as the process evolves as discussed in the following sub-sections. The elements are presented by analytical components, i.e., SEA, the Criteria Checklist and Strategic Recommendations, in order to highlight their transversal role across all planning stages and clarify how each instrument operates throughout the full MSP cycle, namely pre-planning, planning and implementation. Table 1 provides a concise overview of the role, key questions and expected outputs associated with each element.

Strategic environmental assessment

Pre-planning. At the pre-planning stage, SEA functions as a scoping and framing tool, enabling the early incorporation of conservation objectives into MSP. Authorities can use SEA early in the process to evaluate a number of baseline aspects, rather than assessing environmental effectiveness of a near-final draft plan. By evaluating these aspects in an integrated manner, SEA has the potential to shape the mandate for MSP, ensuring that conservation and social justice are embedded in the "*why*" and "*what*" of the process, instead of appearing only as constraints at later stages.

Key functions of SEA at pre-planning include.

(1) *Identifying what is to be protected* by identifying key ecological features and processes that are important for MPA planning and for wider ecosystem health[14]; such ecological features and processes may include biodiversity hotspots, fragile habitats, spawning and nursery grounds, migratory pathways, carbon-rich ecosystems, and areas of high ecological connectivity;

(2) *Identifying the main pressures and risks affecting elements to be protected* by mapping existing and emerging human activities, such as fishing, aquaculture, shipping, energy, extraction and tourism, alongside environmental conditions, thus revealing where ecological values and human uses already collide, and where future conflicts are likely to arise if current trends persist; and

(3) *Evaluating who depends on these ecosystems and how* by explicitly considering ecosystem services and social dependence from such services, ranging from food security for small-scale fisheries to cultural and spiritual values, coastal protection, recreation and employment, among others. This consideration of services and benefits is fundamental to avoid framing MPAs as "empty" spaces and to recognise communities as rights-holders, and not only as stakeholders[15,16].

Planning. At the planning stage, SEA shifts from a framing context to the comparative analysis of spatial management options. To this purpose, it brings together both ecological and socioeconomic information that allow decision-makers to explore trade-offs and synergies among different spatial configurations.

Key functions of SEA at planning include.

(1) *Cumulative impact assessments* (evaluating how multiple sectors jointly affect ecological features, both inside and outside MPAs, including pressures from activities that may be individually modest but collectively significant);

(2) *Scenario analyses* (comparing alternative spatial arrangements of activities such as energy zones, shipping corridors, fisheries closures, tourism hotspots, and networks—or corridors—of MPAs; these scenarios may explore options that expand protection, shift uses, and/or promote co-location under strict conditions); and

(3) *Sensitivity and risk analyses* (identifying where MPAs are most vulnerable to specific human pressures, as well as future changes such as climate-driven shifts in species distributions, ocean warming and acidification, or increased intensity of extreme events).

Where ecological knowledge remains limited, the precautionary principle should guide spatial decision-making. Importantly, SEA at this stage is not limited to biophysical indicators. It also considers other distributional effects, such as how livelihoods and cultural values are affected, and which communities or groups bear disproportionate costs.

Implementation. At the implementation stage, SEA functions as a dynamic tool supporting adaptive management, monitoring, and review

Table 1 | Synthesis of the proposed integration of (1) strategic environmental assessment (SEA), (2) Criteria Checklist and (3) strategic recommendations across main stages of maritime spatial planning (MSP)—pre-planning, planning, and implementation—for embedding marine protected areas (MPAs)

MSP stage	Tool	Main function in the stage	Key questions/criteria addressed	Typical outputs
Pre-planning	SEA	Scoping and framing the integration agenda	What are we trying to protect? Where are the main pressures and risks? Who depends on these ecosystems and how?	Maps of key ecological features and processes, pressure and conflict hotspots, ecosystem service dependence profiles, integrated problem framing.
	Criteria Checklist	Checking readiness/ enabling conditions	Are legal and policy mandates aligned? Are institutional roles clear? Is baseline knowledge sufficient? Are key groups identified and included?	Readiness checklist; gap analysis of mandates, data, stakeholder representation and geographical scope.
	Strategic recommendations	Organising how the planning process will run	How should legislation/policy be adjusted? How will coordination work? What participation strategy is needed? How to align MSP and MPA timelines?	Proposals for legal/policy clarifications, inter-agency coordination bodies, participation strategy, synchronised MPA–MSP timelines and work programme.
Planning	SEA	Comparing spatial options and trade-offs	What are cumulative impacts of different uses on MPAs and wider ecosystems? How do scenarios differ in ecological, social and distributional terms?	Scenario-based assessments of environmental and socioeconomic effects; maps of high-risk areas and climate-sensitive zones; identification of trade-offs and synergies among options.
	Criteria Checklist	Defining what counts as a "good" spatial outcome	Do options meet ecological criteria (representation, connectivity, refugia)? Social/equity criteria? Economic/feasibility and climate resilience?	Multi-criteria evaluation framework; qualitative or quantitative scoring of scenarios; explicit statement of trade-offs and preferred option(s).
	Strategic recommendations	Translating preferred options into zoning and measures	Where should MPAs be designated, expanded or reconfigured? Where are buffers/corridors needed? Which uses are compatible in/around MPAs?	Draft zoning scheme; proposals for new/expanded MPAs; identification of buffer zones and corridors; guidance on compatible uses and regional coordination.
Implementation	SEA	Monitoring and periodic review of plan performance	Are ecological indicators inside and outside MPAs improving? How are new projects/uses affecting MPAs and ecosystem services?	Periodic SEA-style review reports; trend analyses; early warnings about emerging conflicts or pressures requiring closer investigation.
	Criteria Checklist	Judging effectiveness and need for adjustment	Are MPAs ecologically effective? Are rules complied with and enforced? Are social outcomes and governance quality acceptable and fair?	Evaluation scorecards against ecological, compliance, social and governance criteria; prioritised list of issues for corrective action.
	Strategic recommendations	Closing the adaptive loop and revising measures	Which boundaries, conditions or measures should be revised? What co-management or enforcement is needed? What funding/ monitoring reforms are needed?	Proposed revisions to zoning and regulations; new or strengthened co-management and enforcement arrangements; updated indicators and data-sharing setups.

cycles. Coordinated or unified monitoring mechanisms are essential to ensure coherence between MSP and MPA management and to inform structured revisions of spatial measures over time.

Key functions of SEA at implementation include.

(1) *Tracking trends in ecological indicators* both inside and outside MPAs, including habitat condition, species abundance, and connectivity proxies;
(2) *Assessing how changes in human activities*, new projects, or unforeseen interactions are affecting conservation outcomes, ecosystem services and associated socioeconomic conditions; and
(3) *Reviewing whether spatial measures outside MPAs* (e.g., related to shipping routes, fisheries management, pollution controls) effectively support conservation objectives or undermine them.

Where data are limited, SEA can use a combination of monitoring results, expert judgement and local knowledge to identify early warning signs and priorities for more detailed investigation.

Criteria checklist

Pre-planning. A short and focused set of pre-planning criteria can be used as a checklist to verify whether the enabling conditions for integration of MPAs into MSP are (or not) present. These criteria are not intended to support the selection of spatial management options, but to assess if optimal conditions are present to support a meaningful process.

Key dimensions of the criteria checklist at pre-planning include.

(1) *Legal and policy alignment*—for example, the extent to which biodiversity commitments, MPA obligations, and MSP legislation are mutually supportive (or instead create conflicting signals), or if MSP is explicitly required (or not) to contribute to conservation objectives;
(2) *Institutional clarity*—such as the extent to which the roles of MSP authorities, MPA agencies, sectoral ministries, and local governments are clearly defined, or the existence of a designated mechanism for coordinated decision-making;
(3) *Baseline knowledge and data access*—for example, the presence of a minimal shared understanding of environmental status, existing and proposed MPAs, other effective area-based conservation measures (OECMs), and key socio-economic conditions;
(4) *Stakeholder mapping and inclusion*—for example, extent to which groups that may be strongly affected by MPAs and MSP (e.g., small-scale fishers, Indigenous Peoples, local communities, and women's organisations) have been identified and involved in the process from the beginning; and
(5) *Geographical and governance scope*—such as the extent to which the process considers land–sea interactions, offshore and coastal areas, and relevant transboundary or regional contexts.

Using a structured criteria checklist at the pre-planning stage allows for the early identification of fundamental gaps, such as missing mandates, unclear responsibilities, no trustable data, or unrepresented groups. These are the issues that, if not properly addressed, often derail integration at a later stage.

Planning. At the planning stage, a criteria checklist is expected to articulate what a "good" spatial outcome should achieve, moving from analysis to actual decision-making. These criteria can guide the evaluation of options and allow for explicit value judgements.

Key dimensions of the criteria checklist at planning include.

(1) *Ecological criteria*—for example, representation of key habitats and species, replication of conservation features, connectivity within and among protected areas, protection of climate refugia, and adequate size and configuration to allow for ecological processes to function;
(2) *Social and equity criteria*—such as protection of food security and livelihoods, recognition of customary rights and cultural values, fair distribution of benefits and burdens, and avoidance of disproportionate impacts on already marginalised groups;
(3) *Economic and feasibility criteria*—for example, long-term viability of important sectors, compatibility among uses, minimisation of avoidable conflicts, and costs of transitions or relocations; and
(4) *Climate and resilience criteria*—for example, contribution to climate mitigation (such as safeguarding carbon-rich habitats), facilitation of climate adaptation, and robustness of MPAs and other spatial measures to future environmental change.

By quantitatively or qualitatively assessing scenarios against these criteria, planners and stakeholders can clearly and simply evaluate which options perform better (and worse) and where compromises are needed. At this stage, criteria are intended to structure the debate and support decision-making, rather than to produce an automatic answer.

Implementation. In terms of implementation criteria, the focus should be on translating monitoring information into assessments of performance and determining the need for adjustments.

Key dimensions of the criteria checklist at implementation include.

(1) *Ecological effectiveness*, for example, the extent to which MPAs and associated measures are contributing to tangible improvements in ecological status and resilience, as well as reductions in key pressures;
(2) *Compliance and enforcement*, the extent to which rules are widely understood, respected and enforced, and the occurrence and frequency of infractions, whether isolated or systematic;
(3) *Social outcomes*, such as the extent to which expected benefits for communities and sectors have materialised, the degree to which negative impacts have been mitigated and/or fairly compensated, and whether new inequalities have emerged; and
(4) *Governance quality*, for example, level of transparency in decision-making, stakeholder involvement in implementation and review, and accessibility of information, data and results.

These criteria can inform formal evaluations of the maritime spatial plan at predefined intervals or support a more continuous assessment of the overall health of the system.

Strategic recommendations

Pre-planning. At the pre-planning stage, a number of strategic recommendations can be developed, based on both the early findings of the SEA and the results of the criteria check, to support authorities in optimizing and organizing how the pre-planning process takes place.

Key areas of strategic recommendations at pre-planning include.

(1) *Proposing amendments or clarifications to existing legislation and policies* in order to ensure that MSP explicitly recognises conservation targets and supports the implementation of MPAs;
(2) *Establishing formal coordination bodies*, or inter-agency working groups, which encompass both MPA managers and representatives from key ocean-use sectors;

(3) *Designing participatory strategies* that combine broad public engagement and targeted dialogues with communities that are most affected by MPAs and MSP;
(4) *Aligning timelines* to ensure that MPA planning (e.g., design of new MPAs or expansion of existing ones) and MSP cycles inform each other—rather than proceeding in an isolated, independent way;
(5) *Effective transboundary cooperation*, particularly where ecological connectivity and cumulative pressures extend across national borders; and
(6) *Strengthening binding legal frameworks* to ensure that conservation objectives are formally embedded within MSP mandates.

By the end of this stage, the process should have explicitly recognised MPAs as central components of the future maritime spatial plan and created the institutional and social conditions for MPAs to be significant.

Planning. At the planning stage, strategic recommendations translate preferred scenarios into concrete directions for the maritime spatial plan under development.

Key areas of strategic recommendations at planning include.
(1) *Proposals for new MPAs*, together with the expansion or reconfiguration of existing ones, to strengthen representativeness, connectivity and climate resilience;
(2) *Identification of buffer zones and ecological corridors* where specific ocean uses and activities are to be limited, redirected, or constrained;
(3) *Identification of compatible ocean uses and activities* that can take place within and around MPAs, including multi-use arrangements with low-impact activities that support conservation and local livelihoods; and
(4) *Regional or transboundary recommendations*, such as harmonising protective measures across borders, or coordinating corridors for migratory species and shipping.

These recommendations form the backbone of the zoning scheme and regulatory measures included in the final maritime spatial plan. By being explicitly linked to SEA and the Criteria Checklist, they provide a traceable rationale that enhances transparency and allows stakeholders to understand why particular areas are protected, why certain uses are constrained, and how alternative options were considered throughout the process.

Implementation. Finally, at the implementation stage, strategic recommendations are meant to link evaluation back to action.

Key areas of strategic recommendations at implementation include.
(1) *Revising* zoning boundaries, as well as conditions for the development of activities, or management measures where impacts remain high and/or new conflicts arise;
(2) *Creating or strengthening* co-management arrangements, as well as community monitoring programmes, or cross-sectoral enforcement teams;
(3) *Securing long-term funding* for MPA and MSP management and implementation, including innovative finance mechanisms where appropriate; and
(4) *Adjusting* indicators, data-sharing protocols, or participatory structures, to better capture and respond to ecological and social changes.

Strategic recommendations support adaptive management through review cycles and coordinated monitoring mechanisms. They recognise that neither MPAs nor MSP processes are ever truly "finished", but must continuously evolve in response to climate change, shifting uses, and emerging knowledge. Recognizing that implementation is an active stage—rather than a quiet afterthought—is fundamental for maintaining legitimacy and effectiveness in planning.

Looking forward

Integrating MPAs into MSP is a long-standing aspiration in ocean governance, but in practice it has often been reduced to rhetoric. The recent framework outlined here demonstrates that progress does not necessarily need new instruments; instead, it may only require using familiar tools—SEA, Criteria Checklist, and Strategic Recommendations—in a consistent way across the entire planning cycle. In a nutshell, in pre-planning, early SEA, *readiness* criteria, and strategic recommendations ensure that conservation and social equity concerns are built into the foundations of MSP. In planning, more detailed SEA and *explicit* criteria guide the comparison of spatial options and unravel trade-offs, while strategic recommendations translate preferred scenarios into specific zoning and regulatory proposals. In implementation, SEA, Criteria Checklist, and Strategic Recommendations work together to ensure an adaptive feedback loop that considers monitoring and results back into planning revisions.

The framework is intended to support MPA–MSP integration by identifying potential pathways, gaps, and opportunities, rather than to resolve the broader governance challenges of any country. Its effectiveness will depend on the enabling conditions of each context. In some cases, barriers may be more foundational, including limited data and technical capacity, fragmented governance, or an early stage of MSP institutionalization[17,18]. In such settings, the framework can be applied incrementally, using the Criteria Checklist to identify priority gaps and Strategic Recommendations to sequence capacity-building and coordination measures. In others, established planning systems may already exist, but integration remains constrained by sectoral interests, institutional path dependence, economic incentives, or limited political commitment[6]. In conflictive contexts, the framework can use trade-offs and their distributional implications more explicitly to provide a transparent basis for negotiation, but it cannot by itself rebalance power or secure political commitment. Its application and outcomes will, therefore, vary according to local institutional, ecological, socioeconomic, and political conditions.

By making the reasoning behind decision-making processes transparent and repeatable, the proposed framework can support planners, MPA managers, local communities, and ocean-use sectors to work together with a shared understanding of what integration means in practice. This approach does not eliminate political disagreements. However, it provides a structured way to discuss and negotiate with better information and clearer rules. As nations move towards delivering on ambitious biodiversity and sustainability commitments under accelerating climate change[1], such a clear and operational structuring of marine governance tools and processes can be one of the most important contributions that planning science and practice can offer to support ocean sustainability.

Data availability

No datasets were generated or analysed during the current study.

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Author contributions

H.C., D.G., J.Q. and M.M. conceptualised the research. H.C. and C.P. prepared the first draft of the manuscript and carried out the revisions. D.G., J.Q., M.M. and C.F.S. provided comments on the initial draft and subsequent revised versions. All authors reviewed and approved the final version of the manuscript.

Competing interests

H.C. is Guest Editor and C.F.S. is Editor-in-Chief (co) of npj Ocean Sustainability, but were not involved in the peer-review process or decision-making for this manuscript. The authors declare no other conflicts of interest.

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