LIFE24-PRE-IT-LIFE-MAPPER

Guidelines for **MAP**ping, **P**rot**E**cting, and **R**estoring Marine Ecosystems

Deliverable or Milestone	MS 5: Interviews with principal investigators of both EU and non-EU restoration projects
Prepared by	UNIVPM
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Issue date	29/04/2026

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MS 5: Interviews with principal investigators of both EU and non-EU restoration projects	Security: public
WP3: Assessing marine restoration efforts and developing best practices	Version: 1.0

History of changes			
Version	Date	Change	Page
1.0	29.04.2026		

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1 Executive Summary

Within Work Package 3 of LIFE-MAPPER ("Assessing marine restoration efforts and developing best practices"), and as foreseen by the Grant Agreement, activities are complemented by interviews with principal investigators (PIs), work-package leaders and senior practitioners actively involved in marine restoration. Milestone 5 reports the outputs of this interview programme.

A first round of semi-structured interviews has been conducted in March 2026, designed around a common guide of twelve thematic blocks covering different restoration aspects: site selection, mitigation of degradation drivers, restoration methodologies and innovations, stakeholder involvement, monitoring and success criteria, maintenance, policy alignment, funding, challenges, climate change and connectivity, recommendations for SMEs, and a closing SWOT-style reflection. The expertise of the interview panel was deliberately diverse, spanning different habitats, from coastal seagrass meadows and oyster reefs to mesophotic and deep-sea coral gardens, soft sediments and abyssal plains, different EU regional seas and contrasting professional perspectives, including active restoration practitioners, ecological-monitoring infrastructure leaders, deep-sea reference-ecosystem scientists, restoration governance experts and the cross-cutting practitioner-network perspective.

This document presents an overview of the panel and of the interview structure, and a cross-cutting synthesis of the drivers of success and failure that emerge across the interviews. The synthesis is built on the union of the conversations and is reported at an aggregated level, without attribution to any individual interviewee.
Three take-home messages are highlighted: (i) restoration succeeds where drivers of degradation are addressed first, with active intervention complementing , not substituting , the removal of pressures; (ii) long-term monitoring is the single most under-resourced determinant of failure, structurally truncated by the misalignment between funding cycles and ecologically meaningful time scales; (iii) stakeholder integration must be built into design and budget as a core methodological component, not retrofitted at the dissemination stage.

2 Objective

The objective of this document is twofold.
First, it provides a generic overview of the thematic structure of the semi-structured interviews and of the perspectives covered by the panel of interviewees. Second, and most importantly, it presents a cross-cutting synthesis of the drivers of success and failure that emerge consistently , or, where relevant, divergently, across the interviews, and it distils three take-home messages to be carried forward into the systematic review (D3.1), the revision of protocols (T3.2) and the upscaling chapter (T3.3) of WP3.

3 Coverage of the interview panel

The interview panel was designed to span a deliberately diverse cross-section of the marine restoration field, covering different habitats and marine basins (Mediterranean, Atlantic, Arctic and North Sea). It includes principal investigators and senior practitioners with experience in: active restoration of benthic habitats and ecosystem-based management in fisheries restricted areas (FRAs), ecological monitoring through autonomous platforms, cabled observatories, image-based analysis, acoustic telemetry and digital-twin frameworks; definition of reference habitats, basin-scale reference baselines and recovery trajectories for deep-sea ecosystems; multi-site observatory networks bridging coastal and deep-sea restoration sites across EU regional seas; restoration governance, marine spatial planning and the social-science perspective on the active/passive restoration distinction; and the cross-cutting role of restoration networks (e.g. SER Europe and habitat-specific alliances) in linking science, policy and practice across EU projects.

This diversity is intentional: it allows the milestone to surface drivers of success and failure that recur across very different settings, and to identify where habitat-, scale- or governance-specific factors break the cross-cutting pattern.

4 Structure of the interviews

Interviews were semi-structured, lasted approximately 30 minutes each, were audio-recorded with informed consent and subsequently transcribed and editorially cleaned. A common interview guide of twelve thematic blocks structured every conversation, while leaving space for project-specific narratives and for the interviewee's own framing of the issues.

The first set of blocks addressed the design and execution of restoration. This included project context and site selection, how habitats and specific sites were identified, with attention to baseline ecological surveys, historical data, degree of degradation, ecological connectivity, climate refugia, accessibility and logistics, and local-community considerations, followed by the actions taken to mitigate drivers of change, such as pollution, overfishing, land-based runoff and others, before or during restoration, and the relative weight of passive versus active intervention. A dedicated section on restoration methodology and innovations covered the chosen techniques, the use of innovative or low-cost technologies, refined monitoring protocols, and multi-species or ecological-engineering approaches. Stakeholder involvement and co-production was treated as a separate block, examining engagement of local communities, fishers, NGOs and authorities at each project stage, including co-production and co-management arrangements, benefits, and conflicts.

A second set of questions addressed evaluation, governance and forward-looking issues. Monitoring and success criteria were explored through SMART objectives, ecological and socio-economic indicators, baseline or reference conditions, and the duration, frequency and adequacy of monitoring; this was followed by maintenance and adaptive management, focused on follow-up activities, adjustments based on monitoring, and responsibilities. Protection and policy alignment covered the legal and policy mechanisms safeguarding the restoration site, including MPAs, fishery closures and buffer zones, alignment with the Nature Restoration Regulation and the Common Fisheries Policy, and the risk of greenwashing or bluewashing , while funding and financial mechanisms examined sources, adequacy for long-term restoration, barriers and enabling instruments. The interviews then turned to challenges and barriers (technical, ecological, socio-economic, governance and climatic) and to climate change and future resilience, including climate refugia, extreme-event preparedness, and cultural and social dimensions. Each conversation closed with practical recommendations for small and medium enterprises and other practitioners, and with a SWOT-style reflection on strengths, weaknesses, opportunities and threats of marine restoration as a whole.

5 Cross-cutting synthesis: drivers of success and failure

Read together, the interviews converge, sometimes precisely, sometimes only in tendency , on a coherent set of drivers of restoration success and failure. This section organises that material thematically, highlighting where the panel agrees, where it disagrees, and where it raises issues that

have not yet been mainstreamed in the field. It is the primary input that Milestone 5 contributes to D3.1, T3.2 and T3.3.

5.1 Site selection: between baselines, accessibility and politics

There is broad recognition that site selection is rarely a purely ecological exercise. The dominant practical drivers are accessibility, logistics and the existence of historical data and monitoring infrastructure. The panel differs, however, in how it interprets the consequences of this factor. From operational standpoints rooted in long-running monitoring programmes, the structural alignment between site selection and existing infrastructure is treated as a strength: established no-take-zone networks, multi-decadal survey series and observatory platforms become stable scaffolds onto which European projects can be built on.
From baseline-oriented standpoints, the key contribution is to fill gaps where no historical reference exists, by systematically visiting the relevant geomorphological structures within a given basin. From governance and network-level standpoints, the same dynamic is read more critically: restoration tends to happen "where it can", not where ecological connectivity or representativeness would suggest.

Point of convergence among interviews: site selection is structurally shaped by infrastructure and local governance. On the other side, point of divergence is whether this is treated as an enabling condition or as a structural bias to be corrected through more representative, connectivity-driven design.

5.2 Degradation drivers and the active/passive distinction

There is a clear and almost unanimous message that mitigation of root causes , and the use of passive restoration when feasible, must precede or accompany active intervention. In fishery no-take zones, area closures and changes in gear (mesh size, mesh geometry) precede or run in parallel with active reseeding of bycatch organisms. In coastal restoration sites, sewage pollution, land-based runoff and chemical inputs are addressed in parallel with restoration. In deep-sea sites, removal of pressures (above all bottom-contact gear) is presented as the strategy whose feasibility is best demonstrated. From a governance perspective, passive restoration is often the most realistic public-policy instrument because it relies on designation and enforcement, which the state can in principle provide.

The panel unanimously rejects a binary framing of "active versus passive". Active restoration without degradation drivers mitigation is widely viewed as a near-guarantee of failure; pure passive restoration is recognised as insufficient when ecosystem engineers and three-dimensional habitats have been removed and natural recovery is too slow on management-relevant time scales. Where the panel diverges is in the weight it gives to active intervention as such: deep-sea-oriented standpoints remain explicitly cautious about whether large-scale active deep-sea restoration is yet feasible at all, while standpoints rooted in coastal and mesophotic restoration give numerous concrete examples of active intervention already producing measurable effects, particularly when integrated with low-cost methods and stakeholder participation.

5.3 Methodology and innovation: low-cost and replicable

A recurring and emphatic message is that the most useful innovations are low-cost, replicable and scalable, not necessarily technologically advanced. Examples cited across the panel include redeployment of sessile, bycatch organisms through low-cost, participatory methods involving local fishers; recycled-steel domes attractive to oyster larvae; artificial reefs deployed under existing aquaculture infrastructure; in-house drift-cams for deep-sea baseline imaging; and citizen-science apps engaging dive centres and recreational divers. Several interviews explicitly framed this as the core opportunity for the field: simple, charismatic, deployable solutions that can be implemented in many countries, including those with limited access to expensive equipment.

The deep-sea-monitoring perspective is more complex and nuanced. Deep-sea restoration cannot rely on cheap, replicable, citizen-led methods alone, because the sites are mostly inaccessible to them by definition; ROVs, autonomous crawlers, cabled observatories, landers and acoustic telemetry are a hard requirement, and these are expensive. The convergent recommendation is therefore not that all restoration should be cheap, but that cost should be matched to the access constraints of the site and that low-cost solutions, when available, should not be displaced by high-cost ones for reasons of prestige, visibility or fundability.

5.4 Monitoring and success criteria

Monitoring and the definition of success are simultaneously the area of strongest agreement and the area of most explicit divergence. The panel converges on three things: (i) monitoring is structurally underfunded, especially after the formal end of a project; (ii) classical SMART objectives, paired with ecological indicators (survival, biomass, biodiversity, ecosystem functioning), are necessary but insufficient; and (iii) success criteria need a temporal horizon longer than typical project duration.

Beyond this consensus, the panel diverges on what "success" should mean. Operational standpoints offer pragmatic criteria: enforcement of closures; biomass export from MPAs; survival, reproduction and associated biodiversity in restored patches; well functioning monitoring infrastructure as a precondition for any indicator. Deep-sea-oriented standpoints insist that success is only definable against a clearly stated reference ecosystem and a documented restoration trajectory, and that, on the millennial time scales relevant to certain deep-sea taxa, no project-bounded definition of success can be honest. Network-level standpoints frame success as a multi-dimensional, partly subjective construct, point to the SER Ecological Recovery Wheel and the Restorative Continuum as practical, if imperfect, tools, and warn that the National Restoration Plans now in preparation risk codifying inadequate definitions of success that will be hard to undo. Governance-oriented standpoints refuse a generic definition altogether: success is what locally agreed objectives, regulations and enforcement instruments make it, a position that does not necessarily contradict the targets of EU directives, but rather reframes them as a normative ceiling that must be operationalised through site-specific governance arrangements.

A further, less symmetric point of disagreement concerns the role of socio-economic and cultural indicators alongside ecological ones. Field-level monitoring perspectives place a clear emphasis on

ecological proxies and on technological enablers of monitoring as a precondition for any indicator at all. Network and governance-level perspectives, by contrast, treat socio-economic and cultural indicators as integral, not optional: ownership of restoration outcomes by local actors, accessibility of results to non-academic audiences, and the capacity of the restored system to remain politically defensible after the project ends. The two positions are not contradictory but mark a real difference of priority that the WP3 protocol revision will need to address explicitly.

A single operational definition of "successful restoration" applicable to seagrass meadows, oyster reefs, coralligenous habitats and deep-sea ones is not realistic; what is realistic is a structured set of criteria, paired with explicit reference ecosystems and time horizons, and aligned with existing SER frameworks where possible. Where projects use the language of SMART objectives, the WP3 review will examine whether the time-bound dimension is genuinely calibrated to ecological recovery times, or whether it has been adjusted downwards to fit project duration , a recurrent risk flagged by the panel.

5.5 Stakeholders: equity, integration and the limits of consultation

The panel agrees that stakeholder engagement is a primary determinant of success and that it cannot be treated as a late-stage communication exercise. It also agrees that engagement is structurally underfunded relative to its importance, and that it depends on building trust over years rather than over project lifetimes. Where engagement is structurally integrated, for example through multi-year co-design of MPAs with fishing guilds, or through embedding restoration tasks into the daily routines of local actors , restoration outcomes are more robust and more politically durable.

Two more nuanced points were raised by network- and governance-level perspectives. First, equitable engagement requires actively reaching people whose knowledge is not encoded in formats compatible with project administration; engagement budgets should reflect this reality, and the field should treat outreach to communities in their own settings, rather than expecting them to come to scientific institutions, as standard practice. Second, the term "stakeholder" itself is too coarse: in any specific case, it covers actors with radically different power asymmetries (small-scale fishers, oil and gas operators, deep-sea-mining contractors, regional governments, NGOs, citizens), and the relevant question is whose voice is decisive, whose is consulted and whose is excluded, not whether "stakeholders" in general have been engaged.

5.6 Funding, policy alignment and structural barriers

The panel identifies the funding architecture itself as a primary driver of failure. The shared diagnosis is that public funding cycles are misaligned with restoration time scales, that there is no easy bridging mechanism between the end of a project and the next funding round, and that long-term monitoring is therefore systematically truncated. Several structural problems are added to this picture: parallel calls produce multiple solutions to the same problem with no streamlining; permitting regimes in some Member States require restoration structures to be removed at the end of the project, perversely penalising the most monitorable interventions; and the size of consortia required to win calls dilutes funding away from the field.

Convergence is essentially total on diagnosis. The panel diverges on remedy. Some standpoints place hope in national-level laws and ministry-level mechanisms aligned with the EU Nature Restoration Regulation; others place it in the Regulation itself as an external forcing on Member States to formulate National Restoration Plans; others again argue for centralised, pooled expertise, for communication and policy briefs , that projects can draw on, including via habitat-specific restoration alliances and via SER for habitats without one, such as the deep sea; governance-oriented standpoints frame the same question in narrative terms , funding is sustained where the story of the area is constructed in a way that allows multiple actors to find themselves in it.

On policy alignment, the panel concurs that the Nature Restoration Regulation is the single most important external incentive currently shaping the field, both for its forcing function on Member States and for its capacity to make restoration a recognised public-policy domain. The risk of greenwashing or bluewashing is acknowledged, but treated less as a risk inherent to public funding than as a downstream effect of vague success criteria and weak monitoring.

5.7 Climate change and connectivity

On climate change and seascape connectivity, the panel is remarkably unified in admitting that the field has not yet operationalised either dimension. Climate refugia are referred to as a research aspiration, not as a current management input. A recurrent methodological point is that climate projections at currently available spatial resolution and confidence are not yet good enough to underpin management decisions, and that producing such projections is a research priority in itself. Governance-oriented standpoints add that the time scales of climate change interact poorly with the time scales of democratic policy-making, which makes multidecadal planning structurally difficult in most national contexts. A partial reframing offered by the panel is that, rather than treating climate refugia as a global mapping exercise, restoration projects might more usefully identify "pressure refugia" , areas where the dominant local stressor (pollution, bottom contact, eutrophication) can be removed, as a more tractable and policy-actionable concept.

Connectivity is recognised as essential by the entire panel, particularly through larval dispersal, adult movement and the spatial design of MPA networks, but is not yet a primary site-selection criterion. Several standpoints converge on the observation that existing MPA and no-take-zone networks were not designed primarily for sessile-fauna connectivity, and that some restored patches are too isolated from neighbouring populations; expanding networks into corridors that span depth gradients, from the coast to the abyssal plain, is identified as a priority for the next generation of designs. Empirical work on adult movement and larval supply at relevant spatial scales is described as surprisingly thin, given the maturity of available molecular and tracking techniques. The shared message for WP3 is that the review and the protocol revision should treat climate adaptation and connectivity as research priorities embedded within restoration design, not as boxes to tick at the proposal stage.

6 Next steps

Milestone 5 will continue with additional interviews extending the geographical and habitat coverage of the panel, and complementing the EU sample with non-EU principal investigators as foreseen in the Grant Agreement. The cross-cutting synthesis presented here will be refined as new interviews are added, will feed directly into the systematic review (D3.1) under T3.1, and will inform both the workshop in Brussels foreseen under T3.2 and the upscaling chapter under T3.3.