Inventory report on restoration needs, competencies, and capacity building in Mediterranean MPAs

Prepared by Michael Tanner and Patricia Puig Marti, Oceanogami

Edited by Susan Gallon & Pierre Vignes, MedPAN

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Restoration of MPAs can greatly benefit from recent advances in techniques, finance, and governance developed through EU projects linked to the Green Deal. Initiatives such as REST-COAST have contributed to enhancing large-scale ecosystem restoration by improving financial sustainability, governance frameworks, and innovative methodologies. Leveraging these achievements can strengthen restoration efforts in MPAs, ensuring long-term ecological and socio-economic benefits while aligning with European restoration objectives.

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Executive Summary

The Mediterranean Sea is a globally significant marine ecosystem, supporting approximately 7% of the world's marine biodiversity within less than 1% of the ocean's surface. However, this rich biodiversity is under severe pressure from overfishing, pollution, habitat destruction, and climate change, necessitating urgent conservation and restoration efforts. Marine Protected Areas (MPAs) play a crucial role in mitigating these threats, but in many cases, natural recovery alone is insufficient. Active and passive restoration interventions have become increasingly important to accelerate ecosystem recovery, enhance resilience, and ensure the continued provision of ecosystem services, such as fisheries productivity, carbon sequestration, and coastal protection.

This report provides a comprehensive assessment of marine and coastal restoration efforts in Mediterranean MPAs, combining insights from a stakeholder survey of MPA managers and other restoration practitioners with a systematic literature review. It identifies key barriers, capacity gaps, and best practices, offering evidence-based recommendations for improving the effectiveness of restoration initiatives.

Key Findings

1. Gaps in Training and Capacity-Building

A significant **82%** of surveyed MPA managers reported never having received formal training in marine and coastal restoration. Key areas requiring capacity-building include policy frameworks, monitoring techniques, and stakeholder engagement.

Findings from the "MPA managers' training needs" section confirm that the highest-ranked priority is "Habitat or Species Restoration," receiving the most Rank 1 responses (13), demonstrating a strong demand for technical expertise in restoring degraded marine ecosystems. This is followed by "Planning and Management," with 8 Rank 1 responses, underscoring the need for structured approaches to designing and implementing restoration projects.

The literature review further supports the importance of developing structured training programs, with an emphasis on field-based learning and case study approaches to effectively bridge the gap between theory and practice.

2. Funding and Institutional Support as Major Barriers

Funding limitations were consistently identified as a primary obstacle to restoration, preventing MPAs from implementing or scaling up efforts. The lack of targeted financial mechanisms, such as grants, subsidies, and public-private partnerships, constraints long-term sustainability. Additionally, many restoration initiatives operate without strong institutional support or integration into national conservation priorities, limiting their impact and scalability.

3. Lack of Policy Integration and Coordination

While restoration efforts are being implemented across multiple MPAs, many operate without alignment to national or regional conservation strategies. The literature review highlights the importance of cross-border cooperation in the Mediterranean, particularly for transboundary ecosystems that require coordinated management. Stronger policy integration at both national and regional levels would improve the regulatory framework for restoration, ensuring greater legal and financial support for MPA-based initiatives.

4. Weak Monitoring and Evaluation Strategies

A significant proportion of MPA managers lack reliable data on restoration success, with many unsure whether their projects are achieving long-term ecological benefits. The absence of standardized monitoring protocols and long-term tracking mechanisms leads to inconsistencies in evaluating restoration effectiveness. Developing standardized indicators and adopting new technologies, such as remote sensing and ecological modeling, could improve data reliability and allow for adaptive management strategies.

5. Dominance of Habitat-Based Restoration with Limited Ecosystem-Wide Approaches

Current restoration efforts in Mediterranean MPAs are heavily focused on habitat restoration, particularly for seagrass meadows (*Posidonia oceanica*) and coralligenous reefs. However, the literature review underscores the importance of ecosystem-based approaches, integrating biodiversity conservation, ecological connectivity, and climate resilience into restoration planning. Moving beyond single-species and single-habitat approaches could significantly enhance the effectiveness and sustainability of restoration efforts.

Moreover, the distribution of MPAs in the Mediterranean is highly uneven, with a much higher concentration in European waters compared to the southern Mediterranean, particularly the North African coast. Countries such as France, Spain, and Italy account for a large share of MPA coverage and restoration projects, while MPAs in Tunisia, Algeria, and Morocco face significant gaps in both designation and active restoration efforts.

This disparity is further reflected in the proportion of restoration efforts, where a substantial number of initiatives focus on European MPAs. The survey data indicate that 64% of stakeholders engaged in restoration projects in the Mediterranean region, have a strong focus on Spain, Italy, Greece, and France. While some restoration efforts are taking place in Tunisia and Algeria, they remain limited compared to their northern counterparts.

To bridge this gap, it is essential to increase restoration funding, capacity-building initiatives, and knowledge-sharing networks between European and North African MPAs. Strengthening cross-border collaboration and supporting regional restoration frameworks can improve ecological connectivity and enhance the resilience of Mediterranean marine ecosystems.

6. Limited Success in Restoration Efforts

While restoration initiatives are expanding, survey responses indicate that their success remains limited. For fish species, 45% of respondents reported minimal success (below 50%), while only 27% considered restoration fully successful (above 80%). Similarly, for marine turtles, 40% of respondents assessed restoration efforts as minimally successful (below 50%), with only 20% reporting full success. These findings highlight the challenges in achieving significant ecological recovery and emphasize the need for improved methodologies, monitoring frameworks, and long-term restoration strategies to enhance effectiveness.

Best Practices and Recommendations

Building on insights from both the survey findings and the literature review, this report highlights key recommendations to enhance the effectiveness of marine restoration in Mediterranean MPAs. Successful case studies illustrate that capacity building is essential, and structured training programs should be established to improve restoration expertise among MPA managers. These programs should not only focus on ecological

restoration techniques but also include a dedicated module on funding mechanisms. Understanding financial sustainability is crucial, as many restoration initiatives struggle with limited funding. Training should equip participants with knowledge of available restoration-specific grants, EU and national funding opportunities, and strategies for securing long-term financial support. Practical exercises, such as proposal writing and identifying appropriate financial instruments, will enable practitioners to navigate funding landscapes more effectively.

Beyond individual training efforts, developing sustainable funding mechanisms remains a priority. Restoration efforts must be supported by targeted financial strategies, including long-term subsidies and public-private partnerships. Expanding knowledge about existing financial opportunities and ensuring that practitioners are trained in financial planning can enhance their ability to secure resources and scale up restoration actions. Without stable funding, many promising restoration initiatives risk being short-lived or unable to achieve their full potential.

Policy alignment and regional cooperation are also necessary to strengthen the role of MPAs in large-scale restoration efforts. Integrating restoration into national and regional conservation frameworks will create greater cohesion among Mediterranean countries, ensuring that restoration initiatives are not fragmented or operating in isolation. Improved cross-border collaboration will facilitate knowledge exchange, regulatory alignment, and the development of joint restoration projects that address transboundary ecological challenges.

Another critical aspect is the implementation of standardized monitoring and evaluation frameworks to assess the success of restoration efforts. While 54.5% of MPA managers reported already implementing monitoring and evaluation plans, there is considerable variation in the techniques used. Remote sensing, photogrammetry, and acoustic surveys are widely adopted, with 76.5% of managers using them to track ecological changes. However, more traditional in-situ methods such as quadrats and transect surveys remain underutilized, with only 23.5% of MPAs employing them. Expanding the use of standardized protocols and integrating innovative monitoring technologies will not only enhance comparability between projects but also provide stronger data to inform adaptive management strategies. Ensuring consistency in how restoration success is measured will improve decision-making and allow practitioners to refine techniques based on empirical evidence.

Finally, a shift towards holistic, ecosystem-based restoration is essential. Moving beyond isolated habitat interventions, restoration strategies should

incorporate species conservation, ecosystem connectivity, and climate adaptation. A more integrated approach will strengthen the resilience of Mediterranean marine ecosystems, ensuring that restoration efforts do not just target individual habitats but contribute to broader ecological stability.

Marine and coastal restoration in Mediterranean MPAs is gaining momentum, yet major barriers persist in terms of capacity, funding, policy coherence, and monitoring. Addressing these challenges requires a multi-stakeholder approach that brings together governments, conservation organizations, scientists, and local communities. By investing in training, securing sustainable funding, strengthening policies, and enhancing scientific monitoring, MPAs can play a transformative role in ecosystem recovery. This report serves as a practical resource for policymakers, MPA managers, and conservation practitioners, offering evidence-based recommendations to scale up and strengthen restoration efforts across the Mediterranean.

1. Introduction

1.1. Background

The Mediterranean Sea is a biodiversity hotspot, hosting approximately 17,000 marine species, which represent around 7% of global marine biodiversity despite covering less than 1% of the ocean's surface. This rich but fragile ecosystem is under increasing pressure due to human activities, including overfishing, coastal development, pollution, and the escalating impacts of climate change. These threats not only degrade marine habitats but also compromise the ecosystem services that coastal communities rely on, such as fisheries, carbon sequestration, and coastal protection.

Marine Protected Areas (MPAs) have been established as a key conservation tool to mitigate human impacts and promote marine ecosystem recovery. However, in many cases, natural regeneration alone is insufficient due to severe degradation and ongoing pressures. As a result, active and passive restoration efforts have become an essential component of MPA management, aiming to enhance ecosystem resilience and restore degraded habitats and species.

This report explores the current role of restoration within Mediterranean MPAs, focusing on the challenges, opportunities, and capacity-building needs necessary for effective implementation. Drawing from a literature review and insights from stakeholder engagement, the study aims to provide a comprehensive assessment of the state of marine restoration,

the competencies required, and the strategies needed to strengthen restoration efforts in MPAs.

1.2. The role of restoration in MPAs

Restoration within MPAs is not just a conservation measure but a proactive strategy for conserving biodiversity, maintaining ecosystem functionality, and enhancing climate resilience. While MPAs primarily focus on protection, restoration goes a step further by actively intervening to accelerate ecosystem recovery, ensuring that degraded habitats regain their ecological integrity and continue providing essential services such as habitat provision, water quality regulation, and fisheries productivity.

At the global level, restoration initiatives are increasingly embedded in major conservation policies. The European Union's Biodiversity Strategy for 2030, for example, calls for the restoration of at least 30% of degraded marine and coastal habitats, highlighting the growing recognition of restoration as a necessary complement to traditional protection measures. In the Mediterranean, restoration efforts have gained momentum, particularly in seagrass meadows (*Posidonia oceanica*), coralligenous reefs, and Cystoseira forests, all of which are critical for marine biodiversity but remain highly vulnerable to human activities and climate change.

Despite this progress, scaling up restoration in MPAs presents several challenges. Limited technical capacity, inconsistent funding, and fragmented policy frameworks continue to hinder widespread implementation. Addressing these barriers requires stronger institutional support, improved monitoring systems, and enhanced cross-border cooperation to ensure that restoration initiatives are effective, sustainable, and integrated within broader conservation strategies. Strengthening these foundational aspects will be key to maximizing the long-term success and resilience of MPAs in the Mediterranean and beyond.

1.3. Key Habitats and Target species for restoration

Restoration efforts in the Mediterranean have focused on key habitats and species that play essential ecological roles. The most frequently targeted habitats include:

- **Seagrass meadows (e.g., *Posidonia oceanica*)**: These meadows provide nursery grounds for fish, stabilize sediments, and store carbon, making them a priority for conservation and restoration

efforts.

- **Coralligenous reefs**: These complex underwater structures support high biodiversity but are highly sensitive to climate change and physical disturbances.

- ***Cystoseira* forests**: These macroalgal forests contribute to coastal productivity and biodiversity, but their decline due to pollution and habitat loss has raised concerns over their restoration.

- **Deep-sea ecosystems**: Including cold-water coral reefs and seamounts, these habitats remain largely unexplored but are increasingly recognized as conservation priorities.

- Alongside habitat restoration, specific keystone and threatened species have also been the focus of conservation efforts. These include:
    - **The Mediterranean monk seal (*Monachus monachus*)**, one of the world's most endangered marine mammals.
    - **Loggerhead sea turtles (*Caretta caretta*)**, which rely on coastal MPAs for nesting and protection.

- Commercially important fish species, such as the **dusky grouper (*Epinephelus marginatus*)**, which are targeted for population recovery through habitat protection.

1.4. Challenges and knowledge gaps

Despite growing interest in marine restoration, numerous challenges remain that limit the effectiveness and scalability of restoration efforts in MPAs. These include:

- **Climate change pressures**, such as ocean warming and acidification, which affect habitat recovery.

- **Limited funding and institutional support,** making it difficult to sustain long-term restoration initiatives.

- **Gaps in technical expertise and capacity,** particularly in monitoring, adaptive management, and policy integration.

- **Lack of standardized monitoring protocols,** preventing the evaluation of restoration success across different MPAs.

- **Weak policy coordination and cross-border collaboration**, leading to fragmented and isolated restoration efforts.

Addressing these challenges requires a coordinated strategy that integrates scientific research, policy alignment, capacity building, and sustainable financing mechanisms. By identifying key competency gaps, institutional barriers, and opportunities for scaling up restoration, this study aims to contribute to a more effective and science-based restoration framework for Mediterranean MPAs.

2. Methodology

2.1. Objectives of the Report

This report provides a detailed inventory of restoration needs, practices, and competency levels across Mediterranean Marine Protected Areas (MPAs), offering actionable insights to address restoration challenges. The objectives of this report are to:

- **Assess** current restoration practices by documenting active, passive, and hybrid restoration techniques and the habitats and species they target.

- **Evaluate** competency levels among MPA managers and practitioners, focusing on core skills such as project planning, monitoring, stakeholder engagement, and policy alignment.

- **Identify** challenges and barriers to effective restoration, including funding constraints, limited staffing, regulatory challenges, and data deficiencies.

- **Determine** training and capacity-building needs to bridge competency gaps and strengthen restoration outcomes.

- **Support** strategic integration of restoration activities within broader MPA management frameworks, ensuring alignment with conservation policies and regional objectives.

2.2. Data Collection Sources

The data collection process combined multiple sources to ensure a comprehensive understanding of restoration practices, challenges, and competency levels across Mediterranean MPAs. **Three primary approaches were used:**

1. **A literature review**

2. **Structured survey**

3. **Expert interviews**

The literature review established a foundational understanding of restoration techniques, regional challenges, and best practices. It synthesized information from published marine restoration guidelines, regional case studies, and evaluations of restoration outcomes. It focused on the **restoration of key habitats** such as seagrass meadows, coralligenous reefs, and deep-sea ecosystems, conservation efforts for endangered species such as the Mediterranean monk seal (*Monachus monachus*) and commercially significant fish species, and emerging tools and technologies such as artificial intelligence for monitoring and innovative materials for habitat creation.

A **structured survey** (Annex 1) was distributed to MedPAN's network to collect first-hand insights from professionals involved in marine conservation and restoration. The survey gathered responses from 347 stakeholders across 27 countries, with the highest participation from France, Croatia, Italy, Spain, and Greece, which together accounted for over 60% of responses.

Respondents were categorized into **two main groups**.

1. The first group consisted of **MPA managers and co-managers**, representing **55** individuals **(15.85%)**. Within this category, **43** individuals were from MPA management bodies, **8** were from organizations co-managing MPAs, and **4** were from protected area (PA) management bodies.

2. The second and largest group included **other stakeholders**, comprising **292** individual**s (84.15%)**. Among them, **106** respondents **(30.5%)** were affiliated with universities, scientific and research institutions, and their networks, while **47 (13.5%**) came from private environmental consultancy firms and independent experts. National and local NGOs involved in nature conservation accounted for **37** respondents (**10.7%**), whereas **30** respondents **(8.6%)** represented ministries, governmental agencies, and institutes responsible for MPAs.

Additionally, **26** individuals **(7.5%)** self-identified as belonging to **other categories,** and **21** respondents **(6.1%)** were from Mediterranean or international NGOs engaged in conservation efforts. A smaller proportion included 8 respondents **(2.3%)** from ministries and agencies responsible for sectors other than conservation, **8 (2.3%)** from intergovernmental organizations, **3 (0.9%)** from sub-national and local authorities, **3 (0.9%)** from philanthropic organizations and donors, and **3 (0.9%)** from networks of MPA managers and stakeholders.

A **treemap** was created to visually represent this distribution, illustrating the proportional representation of each stakeholder group within the survey.

The survey gathered comprehensive data on participants' experience levels in ecosystem restoration projects, detailing the restoration techniques employed and distinguishing between active, passive, and hybrid approaches.

Respondents provided information on monitoring and evaluation (M&E) practices, highlighting how restoration outcomes are measured and identifying best practices, limitations, and potential gaps in effectiveness. Self-assessments of competency levels in key skills such as project planning, stakeholder engagement, and policy alignment were also recorded, enabling an evaluation of expertise distribution across different professional backgrounds. Additionally, the survey helped **identify training needs and areas requiring further support**, pinpointing specific skill gaps where additional capacity-building efforts could enhance restoration effectiveness.

To complement the survey findings, **expert interviews** were conducted with professionals involved in Mediterranean restoration initiatives, including key members from the REST-COAST project and IUCN Malaga. These discussions provided additional qualitative insights on the policy and governance challenges affecting restoration efforts, as well as strategies for improving the integration of restoration within MPA management objectives and aligning efforts with broader conservation frameworks.

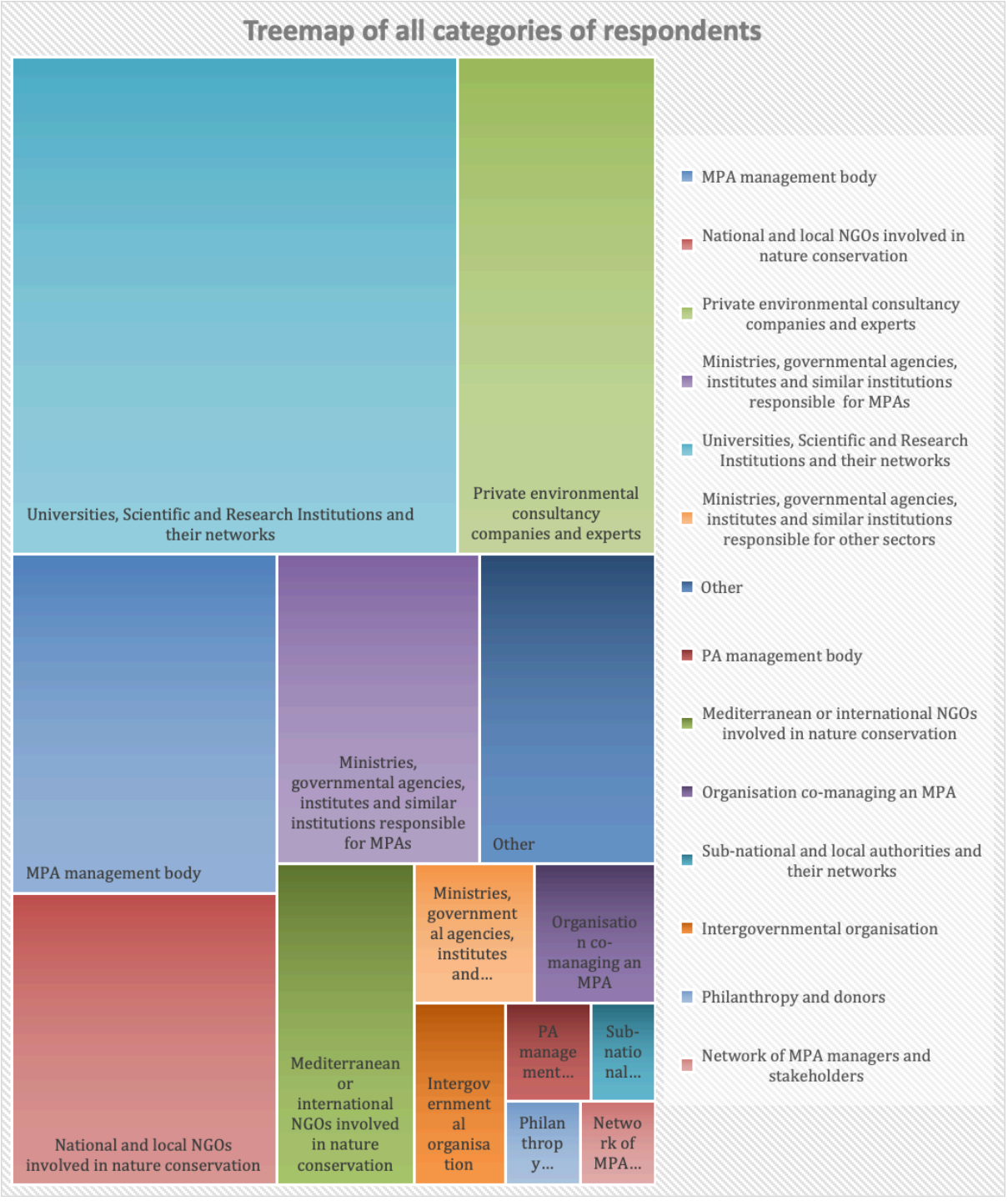


Figure 1. Distribution of survey respondents across different stakeholder categories, showing proportional representation of MPA managers, co-managers, and other stakeholders such as universities, NGOs, consultancy firms, governmental agencies, and international conservation organizations.

2.2. Analytical Framework

The collected data was analyzed using a structured framework designed to assess restoration needs, categorize restoration techniques, evaluate competency levels, and identify challenges and opportunities for improvement.

Restoration practices were classified into **three main approaches:**

1. **Active restoration**, which involves direct interventions such as transplantation, artificial reef construction, and habitat engineering.
2. **Passive restoration**, which relies on natural recovery processes facilitated by habitat protection, fisheries restrictions, and pollution reduction.
3. **Hybrid approaches**, which integrate both active and passive methods, tailored to specific ecological and management objectives.

Each approach was assessed for its effectiveness, feasibility, and challenges within Mediterranean MPAs, based on survey responses and expert insights.

Competency levels were analyzed across **six key skill areas:**

1) **Project planning**: understanding the ability of practitioners to design and implement restoration initiatives.
2) **Monitoring and evaluation:** assessing knowledge of restoration tracking and measuring ecosystem recovery.
3) **Stakeholder engagement:** evaluating how well practitioners collaborate with local communities, governments, and conservation partners.

4) **Policy integration:** examining how restoration aligns with conservation policies at national and international levels.

5) **Restoration technique proficiency:** assessing familiarity with and application of different restoration methods.

6) **Funding and resource mobilization:** evaluating the ability to secure financial and technical support for restoration projects.

The analysis also identified major challenges that hinder restoration efforts. Recurring issues included financial constraints, limited human resources, and regulatory barriers that complicate restoration planning and implementation. These insights were contextualized within broader MPA management objectives to ensure that recommendations align with regional conservation priorities and international biodiversity targets.

2.3. Limitations of the Methodology

While this methodology provides a comprehensive overview of restoration practices and challenges in Mediterranean MPAs, **certain limitations** should be acknowledged:

1. Despite broad participation, some stakeholder groups and geographic regions may be underrepresented, potentially affecting the representativeness of the findings. Additionally, the availability of baseline ecological data varies across MPAs, which may impact the precision of restoration needs assessments.

2. Expert insights, while valuable, are based on specific project experiences and may not fully capture the diversity of challenges across the Mediterranean. These limitations highlight the need for continued engagement with stakeholders and further research to refine restoration strategies and ensure that training and policy recommendations remain relevant and impactful.

By employing this structured methodology, the report delivers a comprehensive, data-driven, and actionable analysis of the current state of restoration in Mediterranean MPAs, helping to inform future capacity-building initiatives and guide strategic decision-making in marine

ecosystem restoration.

3. Results and Analysis

A total of **347 completed surveys** were received from a diverse range of Mediterranean stakeholders, broadly categorized into MPA managers and co-managers (55 respondents, 15.85%) and other stakeholders (292 respondents, 84.15%) involved in marine conservation and policy.

The survey encompassed professionals in MPAs from **27** countries, with the highest representation from France, Croatia, Italy, Spain, and Greece, collectively accounting for over **60%** of responses. The survey was conducted in both **English** (217 responses) and **French** (129 responses). In terms of gender distribution, **138** respondents identified as female, **207** as male, and **2** as other.

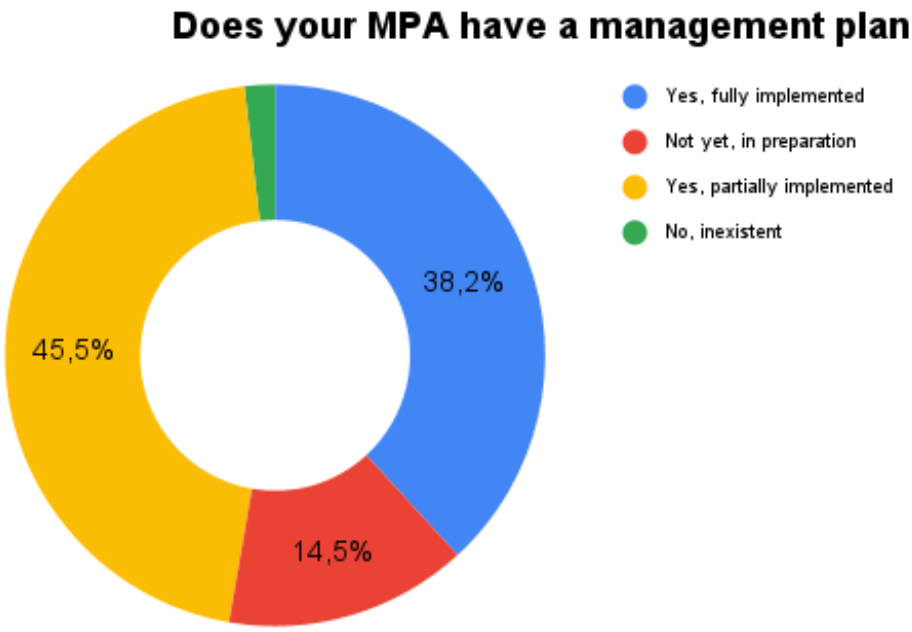
The dataset provides a structured insight into stakeholder composition, distinguishing between MPA managers and co-managers, who oversee marine protected areas directly, and a broader group of stakeholders engaged in restoration efforts. Within the MPA management group, respondents include representatives from MPA management bodies, co-management organizations, and networks of MPA practitioners. Meanwhile, other stakeholders encompass a wide spectrum of actors, such as conservation scientists, policy advisors, governmental agencies, NGOs, research institutions, environmental consultancies, and philanthropy representatives, all contributing to restoration initiatives.

3.1. Respondent Demographics and Experience Levels: MPA managers and co-managers

The analysis of MPA managers and co-managers, who represent 15% of all respondents, provides insights into their management practices and experience with restoration activities. Among them, 83% oversee MPAs with an existing management plan, though the extent of implementation varies. While 35% reported full implementation, a larger portion, 45%, stated that their management plans are only partially implemented. Additionally, 15% indicated that they are in the process of developing a management plan, while a small number of respondents reported that no plan is currently in place.

A similar pattern emerges regarding restoration activities. A total of 62% of MPA managers confirmed that restoration activities are being or have been implemented in their respective MPAs. However, the approaches to restoration differ. Passive restoration was the most frequently cited method, reported by 20% of respondents, while 16% implemented active restoration. A more integrated approach was noted by 24% of managers, who reported using both passive and active techniques within their MPAs.

Despite these efforts, restoration remains a work in progress for many MPAs. 18% of respondents indicated that restoration activities are planned for the future, but not yet initiated, while another 18% reported that no restoration efforts are currently in place.



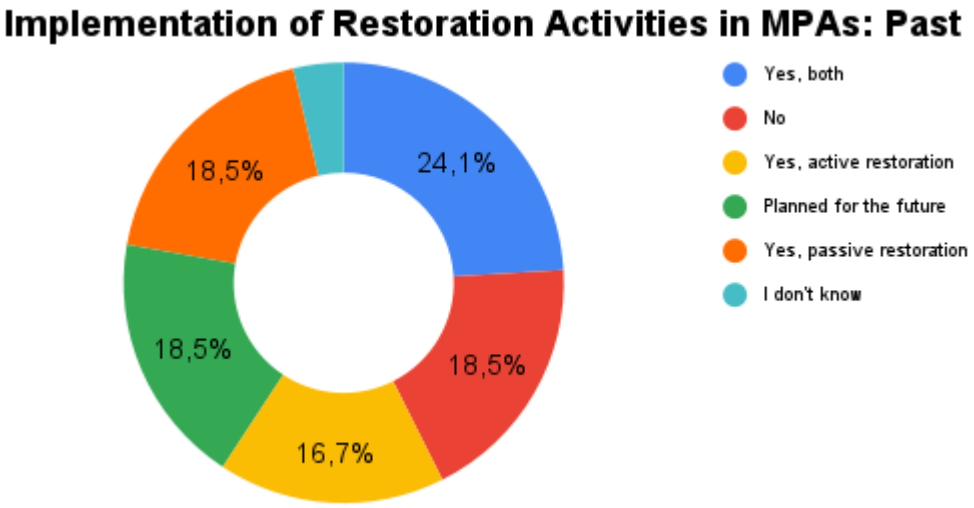


Figure 2. Proportion of MPA managers with management plans in place, indicating whether these plans are fully implemented, partially implemented, under development, or nonexistent.

MPA managers of MPAs with restoration activities

When asked whether restoration activities in their MPAs were implemented as part of a national restoration plan or program, responses varied significantly across regions. Among the 33 MPA managers surveyed, **36.4%** (12 individuals) confirmed that their restoration activities were aligned with a national plan, with all of these respondents based in France.

In contrast, **57.6%** (19 individuals) stated that their restoration activities were not part of any national restoration framework. This group represented a broader geographic distribution, including MPAs in Lebanon, Italy, Cyprus, Greece, Croatia, and France, suggesting inconsistencies in policy integration across Mediterranean countries.

Additionally, **6.1%** (2 respondents) indicated that they were not aware of whether their restoration efforts were linked to a national plan, highlighting potential gaps in communication or policy dissemination among MPA managers.

MPA managers overseeing MPAs with no restoration activities

Among MPA managers responsible for sites where no restoration activities are currently implemented, key barriers preventing restoration efforts were identified. When asked about the reasons for this absence, the most

significant constraints reported were a lack of resources and insufficient knowledge.

Of the 10 managers overseeing MPAs without active restoration, **70%** (7 individuals) cited resource limitations as the primary obstacle, while **50%** (5 individuals) pointed to a lack of knowledge as a key challenge. In contrast, only one respondent indicated that restoration was not necessary in their MPA. This overwhelmingly suggests that the lack of restoration activities is not due to a perceived absence of need but rather a shortage of capacity and expertise to implement effective interventions.

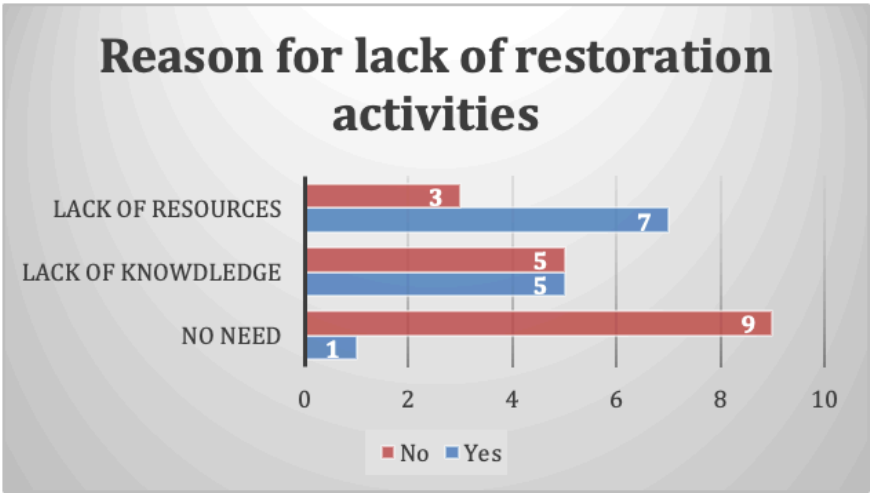


Figure 3. Key barriers preventing the implementation of restoration activities in MPAs, highlighting lack of resources and knowledge as the primary constraints.

Primary Targets of Conservation

MPA managers engaged in restoration efforts prioritize habitat restoration as the primary conservation focus, with 77% of respondents indicating it as their main target. Species restoration follows closely, identified as a priority by 65% of managers.

In contrast, ecosystem functions receive significantly less attention, with only 26% of managers considering them a primary focus. Similarly, the restoration of entire ecosystems is a lower priority, with 34% of respondents emphasizing it in their efforts.

These findings suggest that while conservation initiatives in MPAs predominantly focus on restoring specific habitats and species, broader ecological functions and ecosystem-wide approaches receive comparatively less emphasis. Strengthening ecosystem-based restoration

strategies could enhance long-term resilience and connectivity within Mediterranean MPAs.

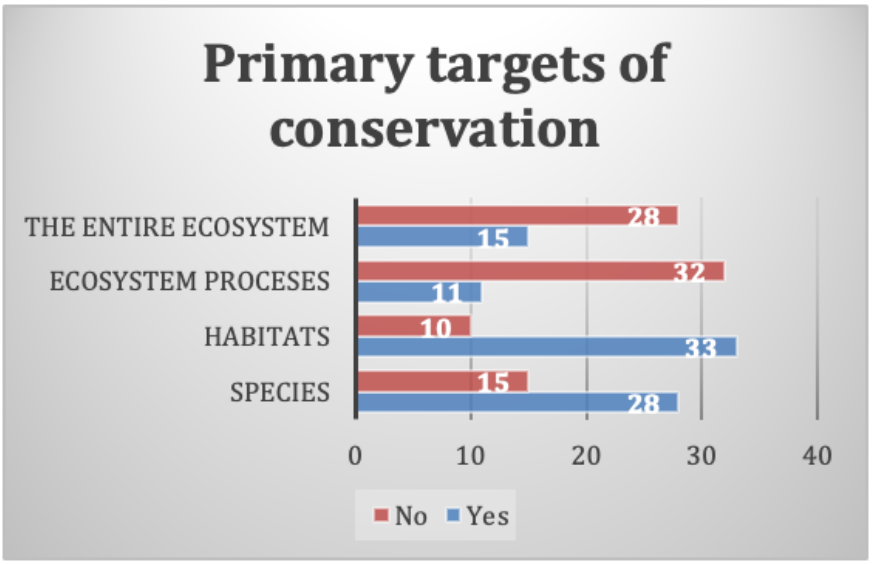


Figure 4. Distribution of restoration priorities in MPAs, indicating the relative emphasis placed on habitat restoration, species restoration, ecosystem functions, and whole-ecosystem approaches.

Ecosystems with most restoration efforts in MPAs

When analyzing which ecosystems receive the most restoration efforts in MPAs, managers reported that seagrasses, particularly ***Posidonia oceanica***, are the primary focus, with **79%** of efforts directed toward their restoration. This is followed by **coralligenous reefs at 54% and *Cystoseira* belts at 25%**, while all **other ecosystems receive approximately 15%** of restoration efforts. Notably, deep-sea ecosystems are not the focus of any restoration activities in the surveyed MPAs, according to the managers. Please refer to the figure below for further details.

Regarding the success of restoration activities, we present responses for the two ecosystems that received the most restoration focus.

Among respondents who identified **seagrass meadows** (*Posidonia oceanica*) as a restoration target, **40%** stated they did not know the success of the restoration efforts, while **20%** believed the success to be minimal (below 50%). Additionally, **20%** assessed the success as partial, while **26%** considered the restoration highly successful (above 80%).

For **coralligenous reefs**, the second most frequently restored ecosystem, a similar pattern emerged. **40%** of respondents stated they do not know the

success of the restoration efforts, while **30%** assessed the success as minimal (below 50%), and **30%** considered it a partial success.

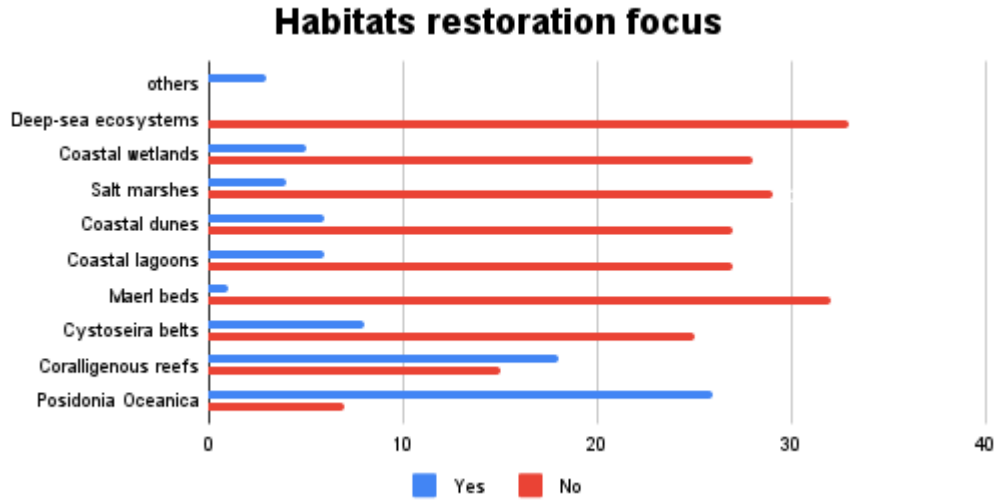


Figure 5. Percentage of MPAs targeting specific ecosystems for restoration, with a primary focus on seagrass meadows (*Posidonia oceanica*), coralligenous reefs, and *Cystoseira* belts.

Other target species for conservation

A similar analysis, now focusing on **target species for conservation**, is presented in the graph below. Over **60%** of MPA managers reported that fish species are the primary focus of restoration efforts, while marine turtles accounted for **28%**, marine mammals approximately **21%,** and shellfish around **14%**.

This finding is particularly notable, as fish species are often associated with provisioning services linked to fisheries, which could explain their prioritization in restoration efforts.

Beyond these main categories, the "**Other" category for restoration and conservation targets** encompasses a diverse range of marine and coastal organisms. These include marine vegetation, such as *Posidonia oceanica*, *Cymodocea species*, and *Ericaria amentacea*; invertebrates, including *Pinna nobilis* and red coral (*Corallium rubrum*); various fish species, such as juvenile coastal fish and commercially important stocks; sharks and rays; and cetaceans, notably the common bottlenose dolphin (*Tursiops truncatus*). Several **bird species** were also identified as conservation targets, including seabirds (*European shag*), shorebirds (Limicoles), Scopoli's shearwater, and the osprey. Additionally, conservation efforts extend to sub-Mediterranean forests and broader biodiversity categories.

Focusing on the two most targeted species for conservation, we present the results of restoration success.

For **fish species, 45%** of respondents reported minimal success (below 50%), while **27%** considered the restoration fully successful (80% and above). Additionally, **9%** assessed the success as partial, and 9% stated they did not know. For **marine turtles, 20%** of respondents reported full success (80% and above), while **40%** assessed the success as partial, and **40%** considered the restoration minimally successful (below 50%).

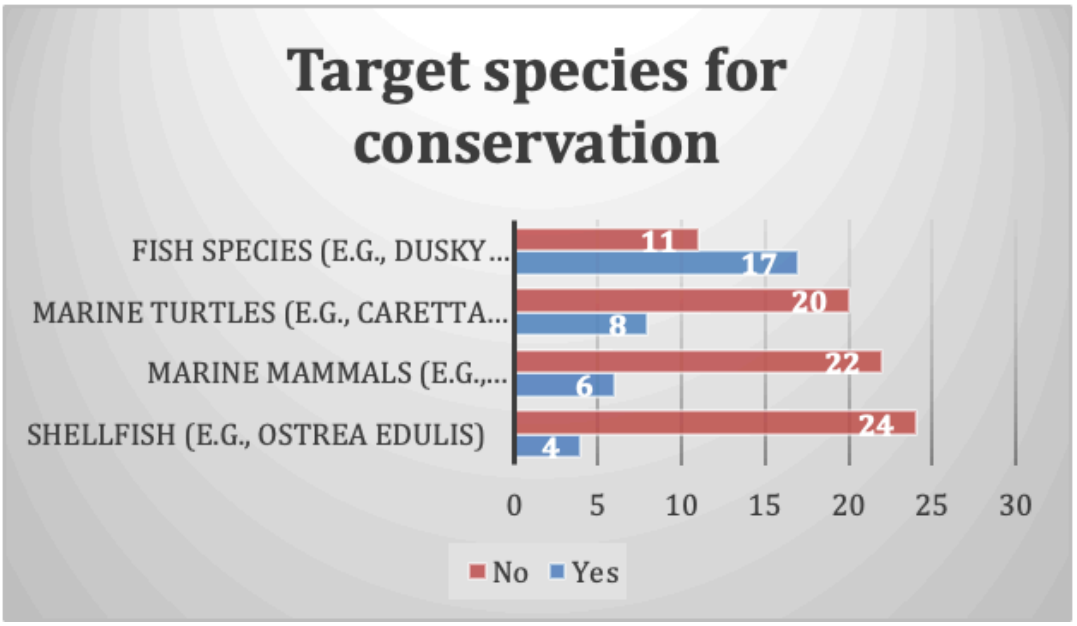


Figure 6. Reported success rates of restoration efforts for seagrass meadows and coralligenous reefs, highlighting significant uncertainty in measuring outcomes.

Restoration of whole ecosystems

Furthermore, we analyzed MPA managers who focused on the restoration of **whole ecosystems** to better understand their specific restoration priorities.

Restoring ecological functions was the most commonly cited focus, highlighted by **73%** of respondents. Enhancing biodiversity and promoting sustainability were also important, each prioritized by **66%** of respondents. Improving resilience was considered by **33%**, making it the least emphasized focus area.

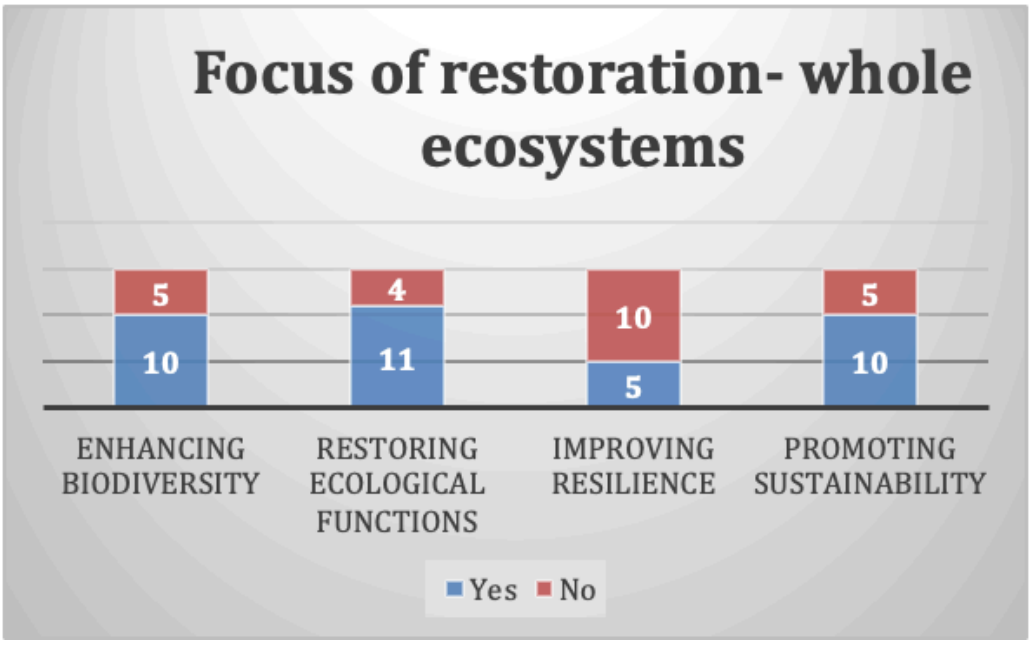


Figure 7. Restoration goals in MPAs where whole-ecosystem restoration is prioritized, showing emphasis on ecological function, biodiversity, resilience, and sustainability.

Restoration Techniques Employed

In this section, we analyze the use of different restoration techniques reported in the survey, categorizing them into **three main approaches:**

1. **Passive Restoration,** which includes actions such as habitat protection and the cessation of damaging activities;
2. **Active Restoration**, which involves direct interventions like transplantation and artificial reef structures; and
3. **Hybrid Approaches,** which combine elements of both passive and active restoration. By examining these techniques, we aim to understand the strategies employed by conservation practitioners and MPA managers to restore marine ecosystems and enhance their ecological resilience.

The results indicate that the majority of MPA managers **(81%)** rely on passive restoration techniques, while **46%** implement active restoration, and **30%** utilize hybrid approaches.

These findings highlight the predominant role of passive methods while also reflecting the growing adoption of more direct and combined

restoration strategies. See the graph below for a visual representation of these trends.

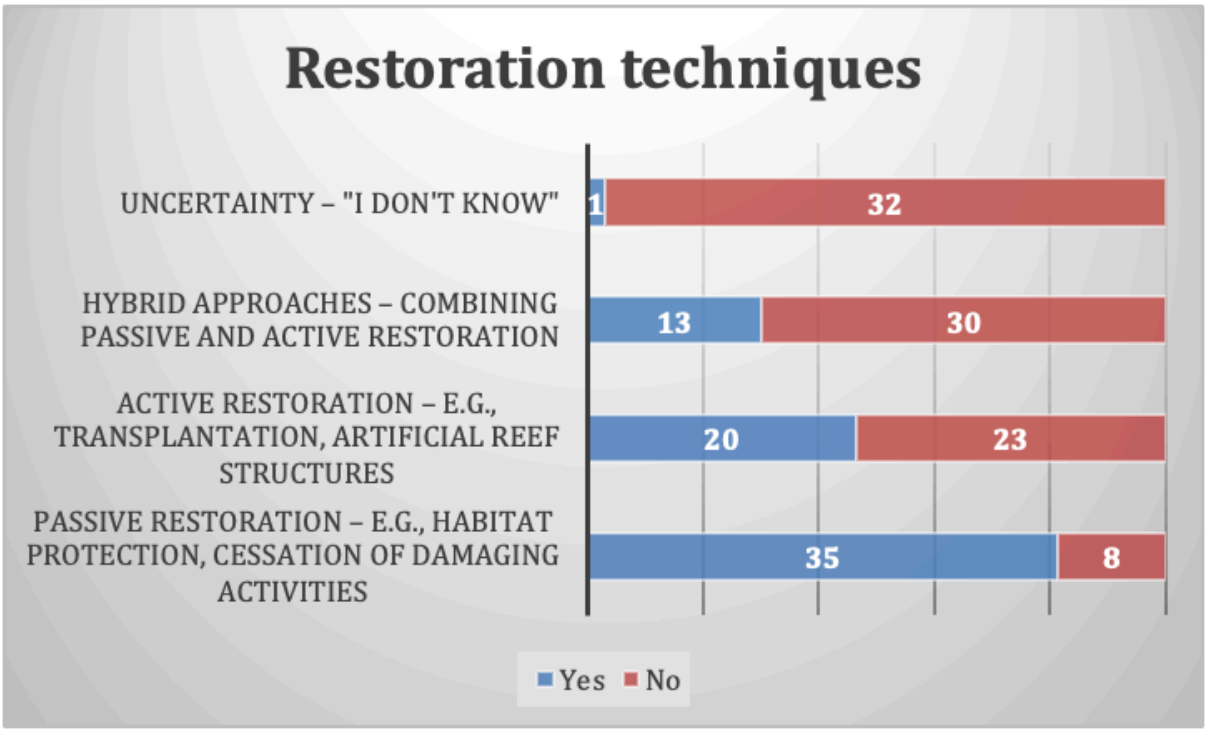


Figure 8. Proportion of MPA managers employing different restoration techniques, categorized into passive, active, and hybrid approaches.

Interview Questions

In this section, we analyze the results of **seven key questions** related to the criteria used for selecting sites for restoration activities.

Respondents were asked about their considerations when choosing restoration sites, including the historical presence of target species and habitats, the current environmental conditions, and the level of existing protection in the area. Additionally, we inquired about the role of natural recruitment potential, which assesses whether species can naturally recolonize a site, as well as accessibility for monitoring and implementation, which ensures long-term management feasibility.

The survey also examined the influence of stakeholder input in site selection decisions and identified cases where respondents expressed uncertainty about the selection process. The following results provide insights into how these factors are prioritized by MPA managers and conservation practitioners.

The most frequently mentioned criterion was historical presence of target species and habitats, cited by **81%** of respondents. This was followed by current environmental conditions at **67%** and level of existing protection at **60%**. Accessibility for monitoring and implementation and potential for natural recruitment were both considered by **42%** of respondents. Stakeholder input was a factor for **33%**, while **2%** of respondents indicated that they did not know which criteria were used.

These results illustrate the key considerations influencing site selection for restoration, with ecological factors playing the most significant role, followed by logistical and stakeholder-related aspects. See the graph below for a visual representation of these findings.

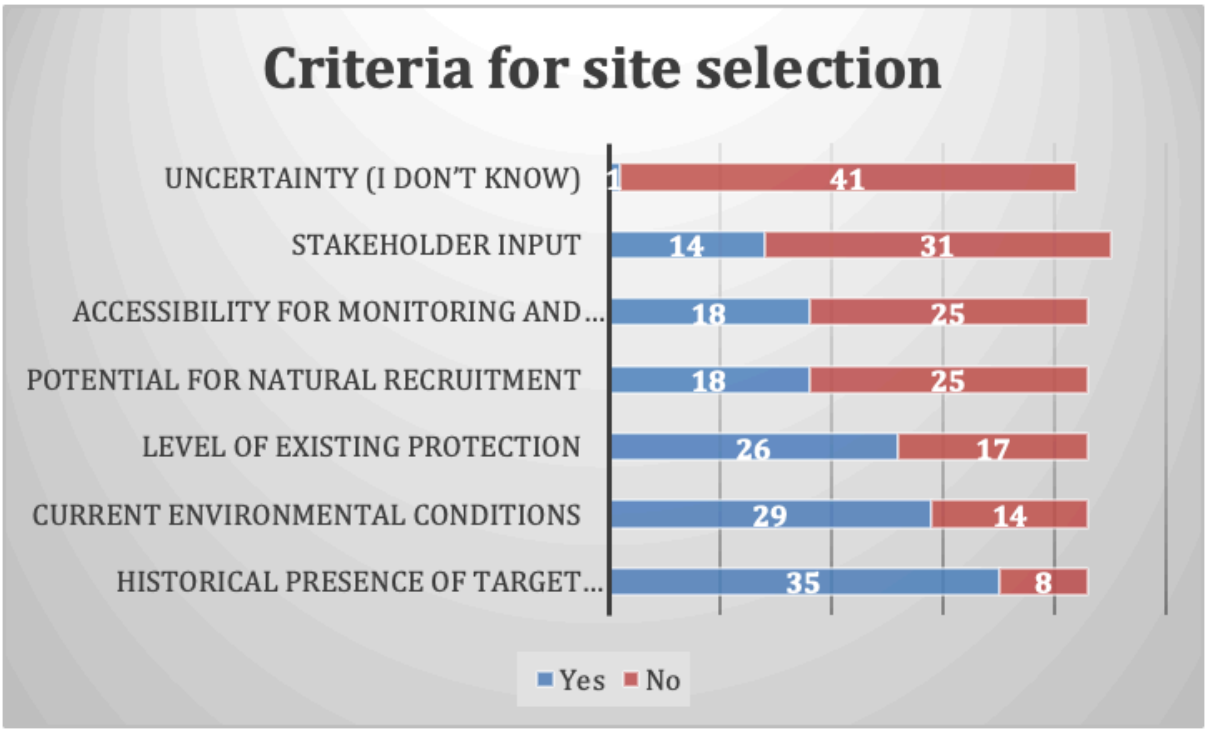


Figure 9. Criteria used for selecting restoration sites in MPAs, emphasizing the importance of historical presence of target species, environmental conditions, and protection status.

Monitoring Practices for Restoration Evaluation

We then examine questions regarding monitoring and evaluation, firstly by asking if MPA managers implement a monitoring and evaluation plan in the context of marine restoration.

- **22.7%** said "No,"

- **22.7%** said "Not yet, but these are currently under development," and
- **54.5%** said "Yes."

This reveals that a significant portion of MPA managers **(54.5%)** are actively implementing monitoring and evaluation plans, while **22.7%** are still in the development stage, and another **22.7%** have not yet implemented such plans. This suggests that while progress is being made, there is still work to be done in fully integrating monitoring and evaluation in marine restoration efforts.

MPA managers reveal that when assessing restoration practices, **76.5%** use Remote Sensing, Photogrammetry, and Acoustic Surveys, while **23.5%** do not. In contrast, **83.3%** do not use Underwater Visual Census, with only **16.7%** considering it for monitoring. Similarly, **76.5%** of managers do not use Quadrat and Transect Surveys, with only **23.5%** adopting this method. Long-term Monitoring Stations are used by **38.9%,** leaving **61.1%** who do not employ them. These results highlight varied practices in the assessment of restoration efforts across different techniques. See graph below for details

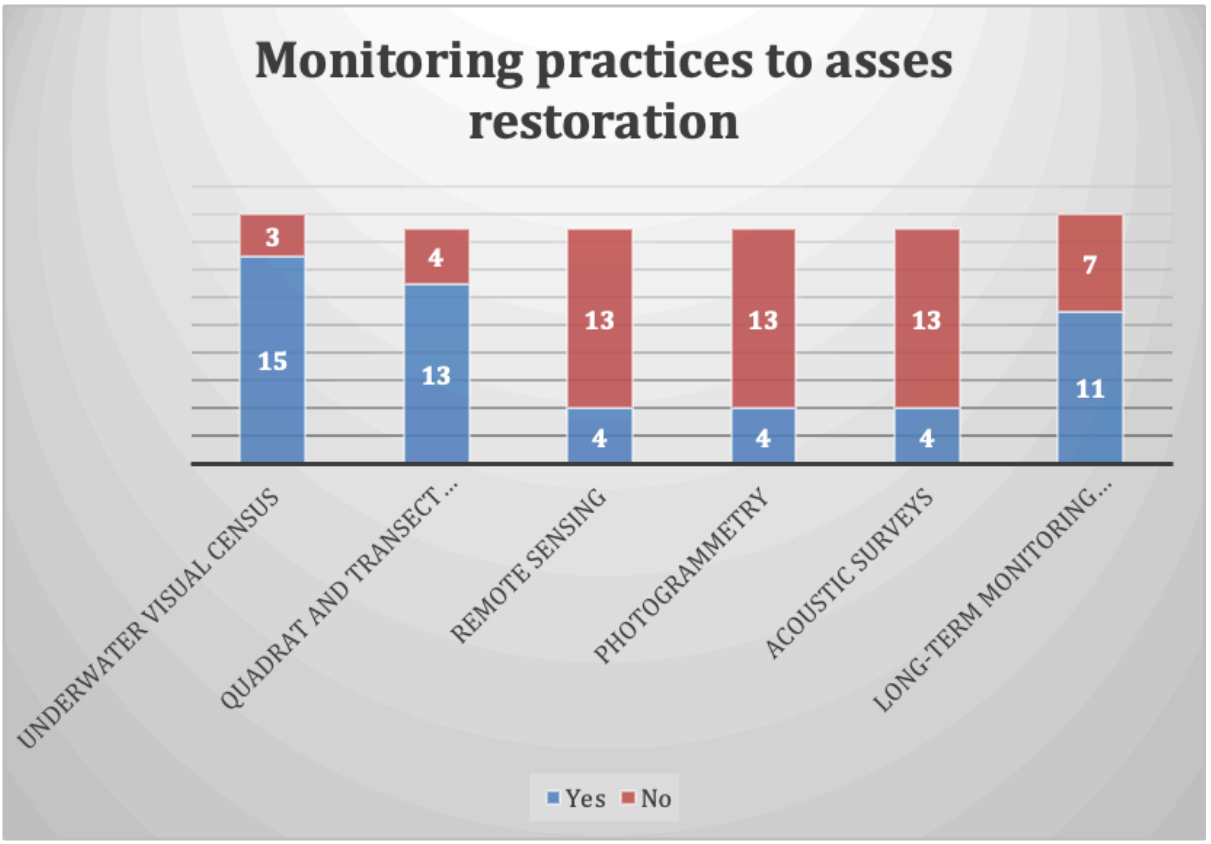


Figure 10. Adoption of various monitoring techniques in MPAs to evaluate restoration success, including remote sensing, photogrammetry, acoustic surveys, and underwater visual census.

The results indicate that MPA managers prioritize a range of ecological indicators to assess restoration progress.

- Habitat cover and extent is the most commonly monitored indicator, tracked by **88% of respondents**.
- Species abundance and diversity follows at **65%**, while biomass and size distribution is monitored by **53%.** Recruitment rates are considered by **24%,** and associated biodiversity by **35%**.
- **No respondents** selected "I don't know", indicating a clear understanding of key monitoring indicators.

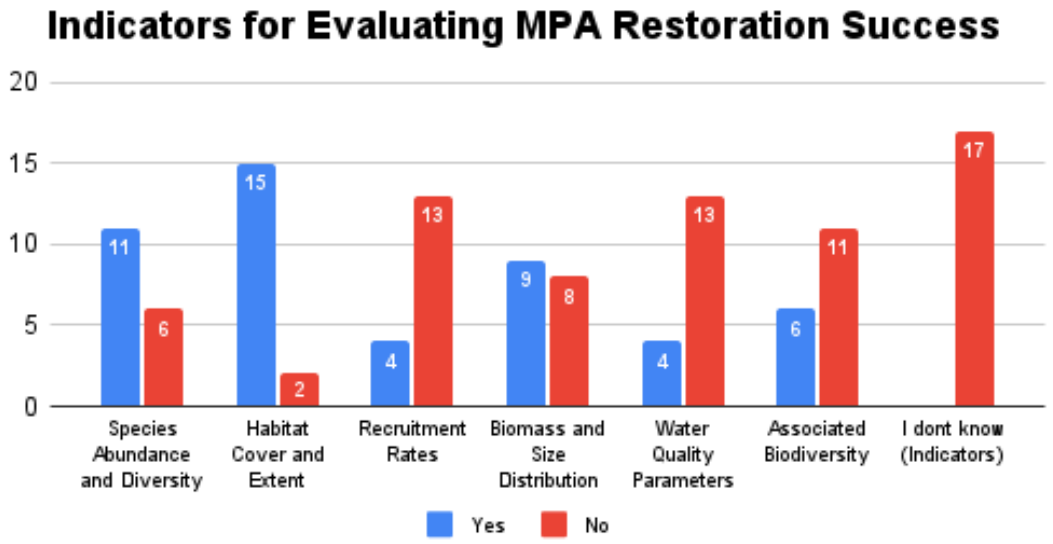


Figure 11. Ecological indicators used to monitor restoration progress, highlighting habitat cover, species diversity, biomass distribution, and associated biodiversity.

Additionally, the responses to whether MPA managers use monitoring data to adapt and adjust their restoration strategies show a majority incorporating monitoring results into their decision-making.

- **67%** of respondents answered "Yes", indicating that they actively use collected data to refine and improve their restoration efforts.
- Meanwhile, **25%** responded "No", suggesting that monitoring outcomes do not directly inform their restoration strategies in these cases.

- Additionally, **8%** of respondents selected "I don't know", reflecting some uncertainty regarding how or whether monitoring data is utilized for adaptive management.

These results highlight that while most restoration initiatives integrate monitoring feedback, there is still room for improvement in ensuring all data is effectively applied.

Finally, the alignment of restoration activities with broader conservation and management objectives of MPAs appears strong, with **75%** of MPA managers indicating their efforts are "Fully aligned", ensuring that restoration initiatives directly support overarching conservation goals. Meanwhile, **25%** reported their activities as "Partially aligned", suggesting that while their restoration work contributes to MPA objectives, some gaps or misalignments may exist.

Key Challenges

The following analysis examines the key challenges faced by MPA managers in marine restoration, ranking them by severity to highlight the most pressing obstacles that hinder effective restoration efforts. The ranking system used in the survey allows respondents to indicate the relative importance of each challenge, with Rank 1 representing the most pressing issue, Rank 2 indicating the second most significant challenge, and subsequent ranks capturing additional but less critical constraints. This prioritization helps to distinguish the most urgent barriers from those that, while still relevant, are of lower priority.

As shown in the graph below, lack of funding emerges as the most critical challenge, receiving the highest number of Rank 1 and Rank 2 responses. This underscores the financial constraints that significantly impact restoration initiatives, limiting the ability of MPA managers to implement, scale, and sustain restoration projects.

Insufficient staff follows as the second most pressing issue, also ranking high in both Rank 1 and Rank 2, indicating widespread workforce limitations. Many MPAs struggle with understaffing, reducing their capacity to plan, execute, and monitor restoration activities effectively.

Lack of baseline data ranks third, emphasizing the difficulty of establishing clear reference points for assessing restoration progress. Without comprehensive baseline ecological data, it becomes challenging to track

changes over time, measure success, and adjust restoration strategies accordingly.

Lack of equipment or resources comes next, suggesting that even when technical expertise is available, the absence of essential tools and infrastructure remains a significant barrier. Restoration activities often require specialized equipment for habitat restoration, monitoring, and enforcement, which many MPAs lack.

Other challenges, such as limited scientific knowledge, technical expertise, stakeholder conflicts, and regulatory barriers, are acknowledged but rank lower than the primary four concerns. While these issues still impact restoration efforts, they are perceived as less immediately pressing compared to financial constraints, workforce shortages, and data deficiencies.

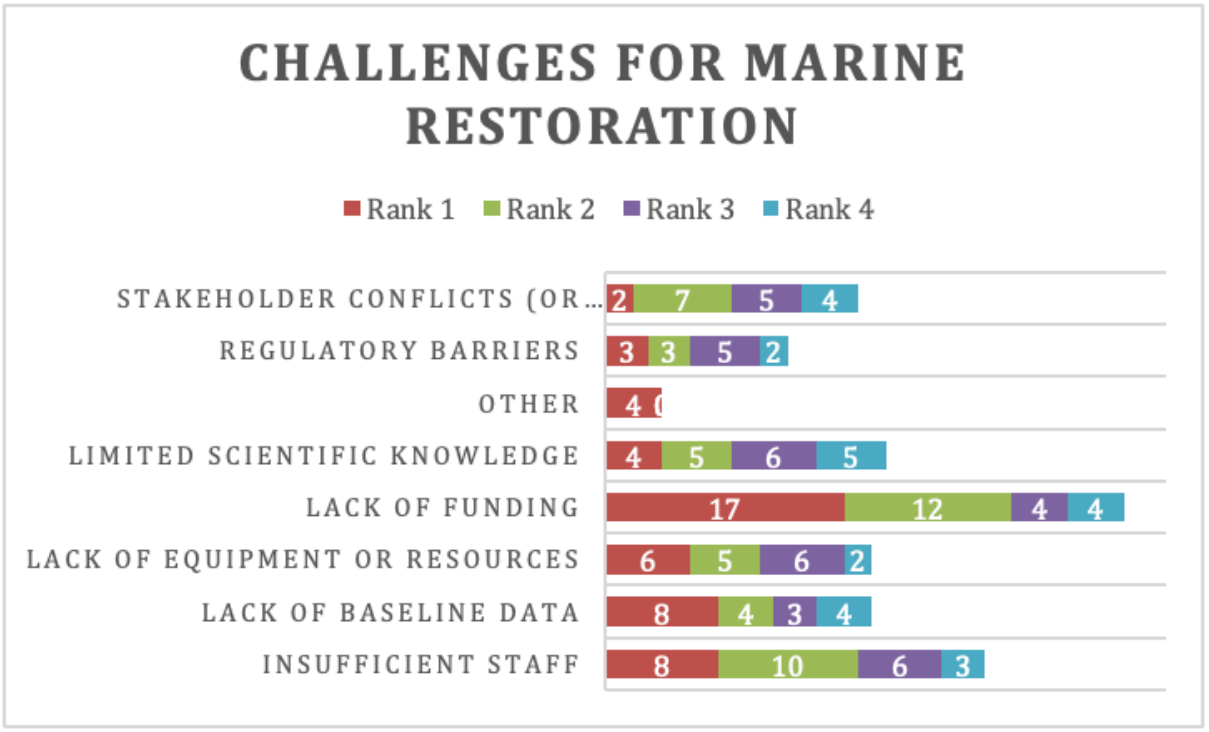


Figure 12. Ranking of key challenges faced by MPA managers in implementing restoration activities, with funding constraints emerging as the most critical issue.

Competency Levels in Restoration-Related Skills

Knowledge about EU NRL

The results for the question **"How would you rate your knowledge of the EU Nature Restoration Law (NRL) and its implications for marine and**

coastal ecosystem restoration?" indicate that awareness levels vary significantly among MPA managers.

- A total of **28%** of respondents were not aware of the NRL before this survey, highlighting a gap in knowledge regarding this regulatory framework.

- The majority of respondents, **42%**, had heard of the NRL but knew little about it, suggesting limited familiarity with its details and implications.

- Meanwhile, **25%** of MPA managers reported having a basic understanding of the NRL, indicating a moderate level of awareness.

- Only **5%** described themselves as well-informed, reflecting a small proportion of respondents who possess a strong understanding of the NRL and its role in marine and coastal restoration efforts.

These findings suggest a **need for increased outreach and educational initiatives** to ensure that MPA managers are adequately informed about the EU Nature Restoration Law and its potential impact on conservation and restoration activities.

Now, we will conduct a differentiated analysis for EU and Non-EU MPA managers, as potentially the overall results might be biased. Among the 42 EU MPA managers who responded to the survey, 7% (3 respondents) indicated that they are well-informed about the NRL and its implications, 36% (15 respondents) have a basic understanding of the NRL, 40% (17 respondents) have heard of the NRL but know little about it, and 17% (7 respondents) were not aware of the NRL before this survey.

In comparison, among the 7 valid responses from Non-EU MPA managers, 14% (1 respondent) is well-informed about the NRL, 43% (3 respondents) have heard of the NRL but know little about it, and 43% (3 respondents) were not aware of the NRL before this survey.

It's important to note that while the EU sample size is significantly larger, the responses indicate similar trends across both groups. However, the smaller sample size of Non-EU MPA managers must be kept in mind when interpreting these results.

See the graph below for a visual representation of these results.

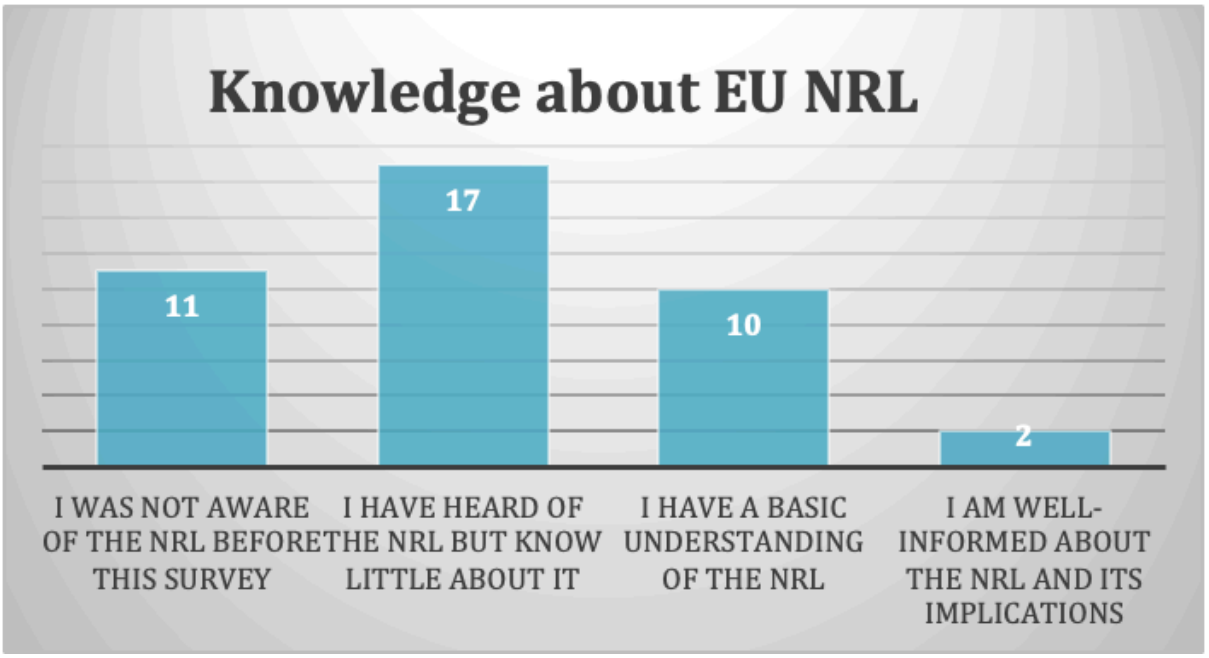


Figure 13. Levels of awareness among MPA managers regarding the NRL and its implications for marine restoration.

Expected impact of the NRL

The responses regarding the expected impact of the NRL on marine and coastal ecosystem restoration efforts highlight a range of perspectives.

- The most frequently mentioned expectation was **increased funding and resources** for restoration projects, indicating that many MPA managers anticipate greater financial support to implement and sustain restoration initiatives.

- Additionally, several respondents expect the NRL to lead to more **ambitious targets for ecosystem restoration**, suggesting a belief that the legislation will drive stronger commitments and higher restoration standards.

- Others emphasize the role of the NRL in **establishing a stronger legal framework** for implementing restoration actions, reinforcing the regulatory mechanisms needed to ensure compliance and

accountability.

- A smaller group of respondents pointed to **enhanced cooperation** between different sectors and stakeholders, reflecting the expectation that the NRL will facilitate better coordination among governments, conservation organizations, and other relevant actors.

Overall, these responses **suggest optimism about the NRL's potential** to strengthen restoration efforts through improved funding, regulatory support, and collaborative engagement.

Restoration Concepts Familiarity

The results for the question **"How familiar are you with the concepts of passive and active restoration in marine and coastal environments?"** indicate varying levels of awareness among MPA managers.

- The majority, **67%, r**eported being familiar with both concepts, suggesting a strong understanding of restoration approaches.

- However, **20%** of respondents were not familiar with these concepts, highlighting a potential knowledge gap that could impact restoration planning and implementation.

- Additionally, **9%** indicated they were only familiar with passive restoration, while 4% reported familiarity only with active restoration.

These results suggest that while most MPA managers have a broad understanding of restoration strategies, some may benefit from **targeted capacity-building efforts** to enhance their knowledge of both passive and active restoration approaches. See the graph below for a visual representation of these findings.

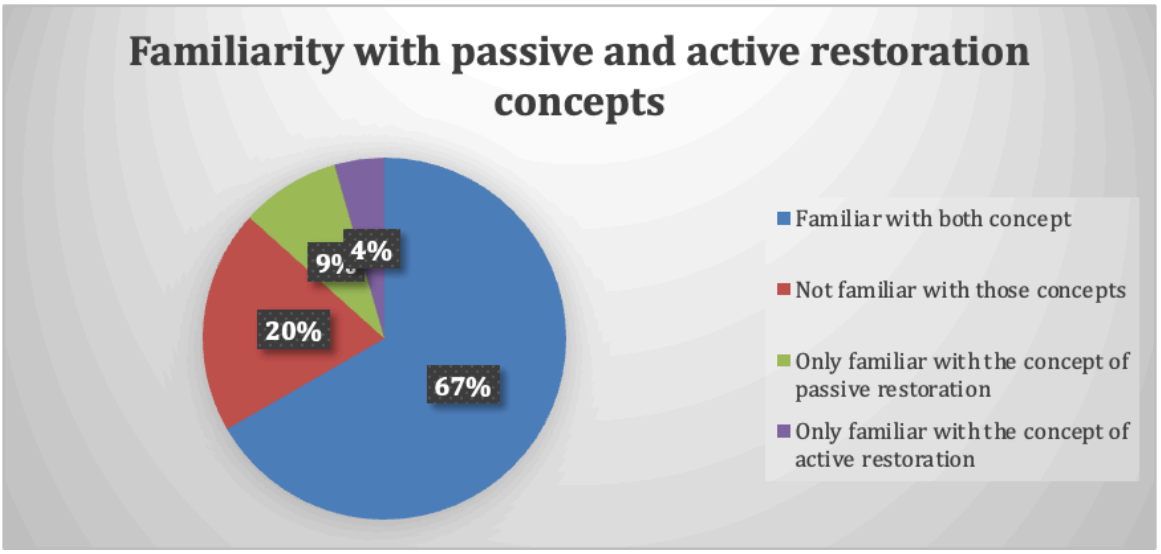


Figure 14. Familiarity of MPA managers with passive and active restoration concepts, indicating a knowledge gap in a minority of respondents.

Training Needs, Priorities and competencies

The results for the question **"Have you received any training related to marine and coastal restoration?**" reveal both a significant gap and a latent demand for training among MPA managers.

- **82%** have not received any training, while only **18%** have.

This highlights the **need for expanded capacity-building opportunities** to improve restoration effectiveness and align efforts with broader conservation objectives. We build on this insight analysing the specific competencies of MPA managers regarding different technical and social aspects of marine restoration.

MPA managers' competency areas

The self-assessment of MPA managers' competencies in various areas of marine and coastal restoration reveals diverse levels of expertise.

- **Ecosystem Restoration Principles and Techniques** show a relatively balanced distribution, with 40% rating themselves at a basic level, 33.3% reporting good competence, 8.9% indicating high competence, and 17.8% reporting no competence at all.

- A similar pattern is observed in **Restoration Project Planning and Implementation**, where 38.6% assessed themselves as having good competence, 31.8% at a basic level, 11.4% at a high level, and 18.1% reporting no competence.

- For **Monitoring and Evaluation of Restoration Efforts**, the highest proportion (45.5%) reported good competence, while 31.8% rated themselves at a basic level, 6.8% at a high level, and 15.9% indicated no competence.

- **Stakeholder Engagement in Restoration Projects** shows a more even distribution, with 39.5% at a basic level, 32.6% at a good level, 16.2% indicating high competence, and 11.6% reporting no competence.

- **Integration of Restoration into MPA Management Plans** sees 40.5% of managers at a basic level, while 35.7% report good competence, 19% high competence, and only 4.8% reporting no competence, suggesting a stronger understanding in this area.

- However, **Policy and Strategic Frameworks for Restoration** appears to be an area requiring more capacity-building, as 54.5% of respondents reported only basic competence, while 18.1% indicated good competence, 15.9% rated themselves as highly competent, and 11.4% reported no competence.

Across all competency areas, MPA managers' self-assessments range from **4.8% to 19%** at the high competence level, while basic competence is the most commonly reported level, ranging from **31.8% to 54.5%.** The proportion of respondents reporting no competence varies from **4.8% to 18.1%,** suggesting that certain topics may require targeted training interventions.

Below, radar charts provide a holistic view of MPA managers' strengths and weaknesses across the different competency areas. These visualizations should be interpreted as representing the entire group, showcasing where competencies are strong and where additional training or capacity-building may be needed to enhance restoration efforts.

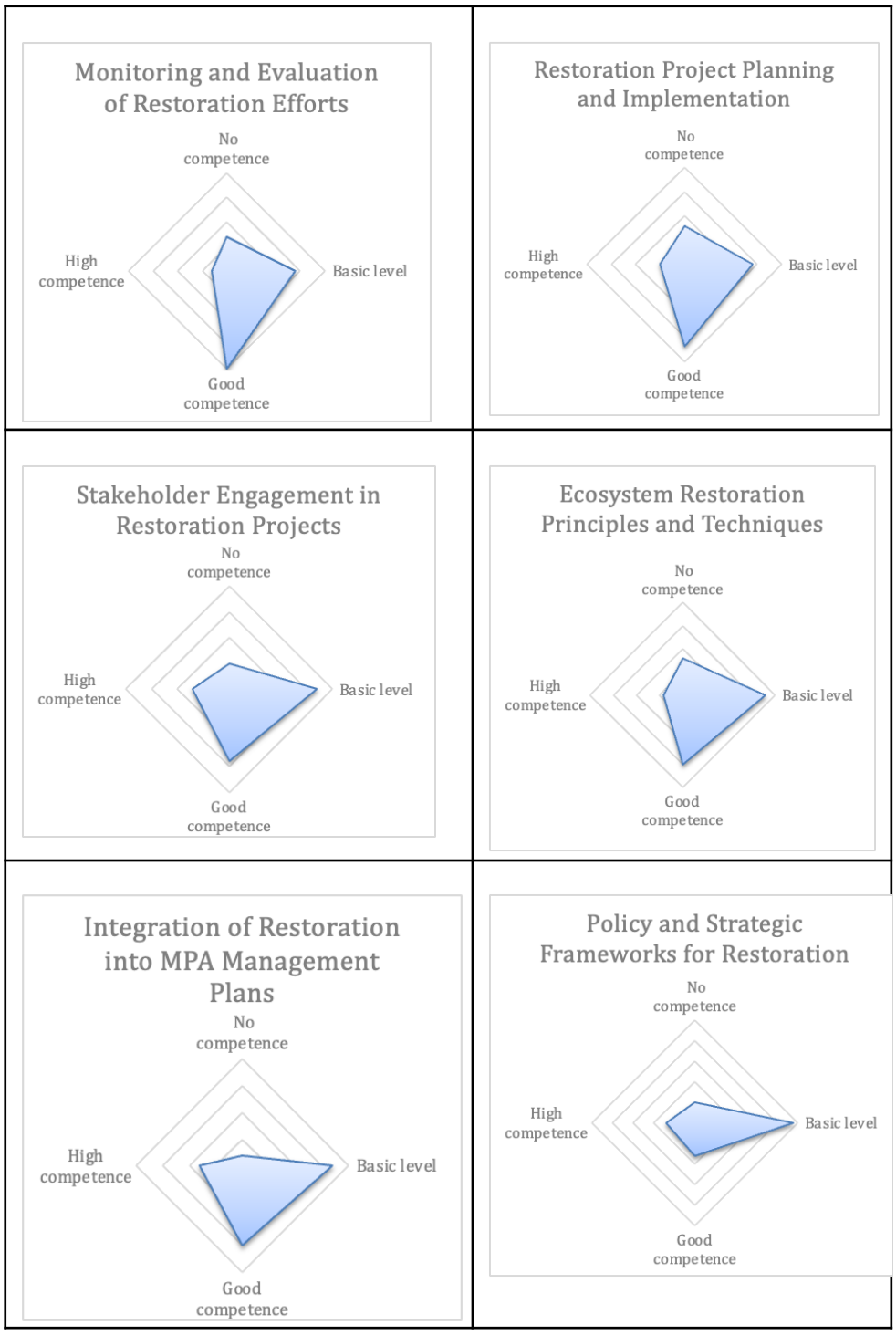


Figure 15. Self-assessed competency levels of MPA managers in key restoration skills, including project planning, monitoring, stakeholder engagement, and policy integration.

MPA managers' perception of training needs

We continue by directly asking MPA managers whether they believe they need training in marine and coastal restoration.

- The responses reveal that **64.4%** answered "Yes", indicating a strong demand for training in this area.

- Meanwhile, **8.9%** responded "No", suggesting that a small portion of managers feel confident in their existing knowledge or do not see a need for further training.

- Lastly, **26.7%** answered "Maybe", reflecting some level of uncertainty, possibly due to varying levels of experience or the perceived relevance of restoration training to their specific roles. These results suggest that a majority of MPA managers recognize a need for additional training, highlighting an opportunity to develop targeted educational programs to support marine and coastal restoration efforts.

Figure 16. Proportion of MPA managers expressing a need for further training in marine and coastal restoration.

MPA managers' training needs

The training needs identified by MPA managers vary across several key areas, with rankings reflecting the relative importance of each topic. The ranking system used in the survey allowed respondents to prioritize training needs by assigning Rank 1 to the most critical area, followed by lower-ranked selections for additional areas of importance. Higher numbers of Rank 1 responses indicate the most pressing training gaps, while Rank 2 and Rank 3 responses highlight secondary priorities.

The highest-ranked priority appears to be "Habitat or Species Restoration," receiving the most Rank 1 responses (13), confirming the demand for technical expertise in restoring degraded marine ecosystems. This is followed by "Planning and Management," with 8 Rank 1 responses, emphasizing the need for structured approaches to designing and implementing restoration projects. Another key priority is "Funding and Financing," which received 4 Rank 1 responses and 9 Rank 2 selections, indicating strong interest in training on securing financial resources and managing sustainable funding mechanisms.

Other significant training areas include "Policy and Governance," "Integration of Restoration into MPA Management," and "Stakeholder Engagement." These topics received fewer Rank 1 responses but were frequently ranked as secondary priorities (Rank 2 and Rank 3), suggesting that while they are important, MPA managers see them as supporting skills rather than immediate needs.

Overall, the results suggest that MPA managers prioritize training in hands-on restoration techniques, project planning, and financial sustainability. While policy, governance, and stakeholder engagement remain relevant, there is a stronger emphasis on acquiring practical, applied knowledge to improve restoration effectiveness and long-term conservation outcomes.

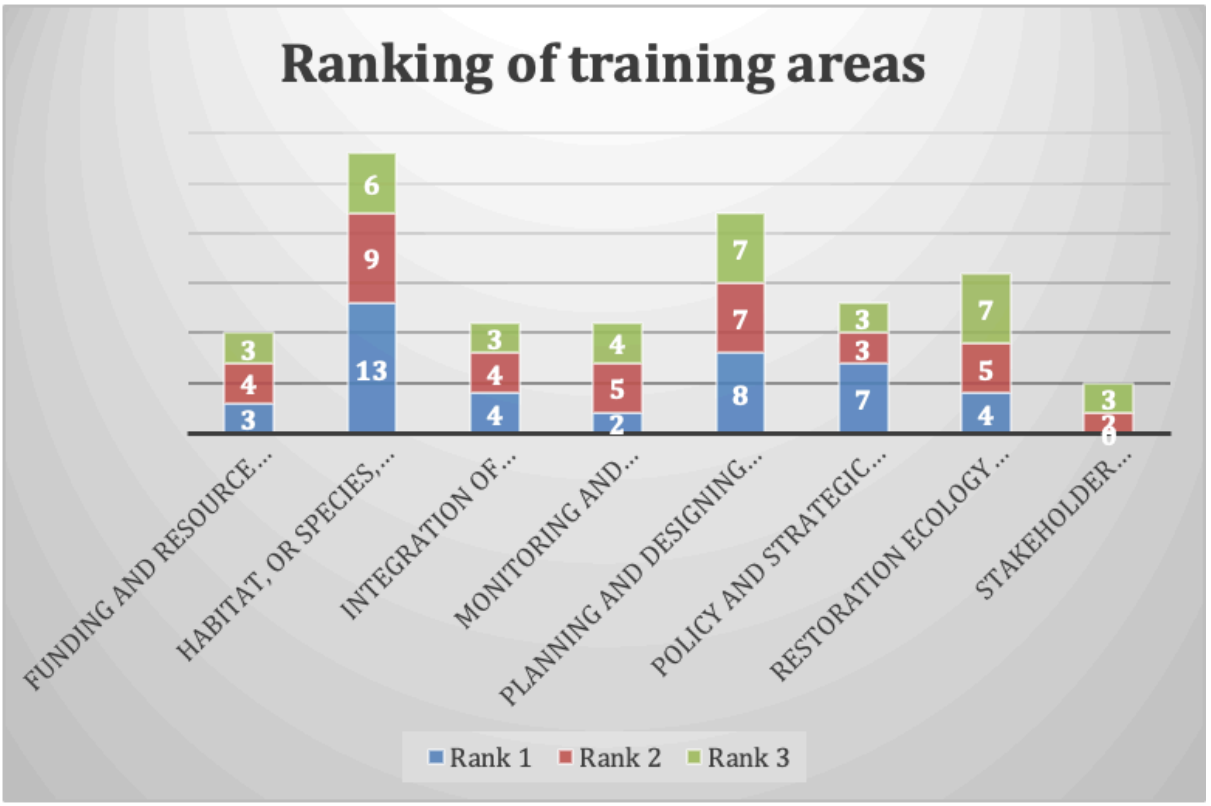


Figure 17. Prioritized training needs of MPA managers, ranking key areas such as habitat restoration, planning, financing, governance, and stakeholder engagement.

3.2. Analysis of Stakeholder Perspectives on Marine and Coastal Restoration: Other stakeholders

Marine and coastal restoration efforts extend beyond MPA managers, relying on a broad network of stakeholders whose expertise and contributions are essential to the success of restoration initiatives. This diverse group includes conservation scientists, policy advisors, governmental agencies, NGOs, research institutions, environmental consultancies, and philanthropy representatives. Their roles range from conducting scientific research and providing evidence-based recommendations to securing funding, influencing policy, and implementing on-the-ground restoration projects.

Understanding the perspectives of these stakeholders is crucial, as their knowledge, resources, and collaborative efforts shape the effectiveness and scalability of marine restoration across the Mediterranean. This section examines their responses to key questions related to their experience in marine restoration, areas of expertise, and direct involvement in restoration

projects. It also explores their focus on specific ecosystems or species, their familiarity with restoration techniques, and the challenges they encounter in their work. Additionally, stakeholders provided insights into policy frameworks, including their awareness of the EU Nature Restoration Law (NRL) and its potential impact on restoration efforts.

By analyzing these responses, we gain a more comprehensive view of the broader restoration landscape, highlighting areas where further support, targeted training, or strengthened collaboration may be needed to enhance restoration outcomes across Mediterranean MPAs.

Experience in Restoration

The survey assessed the level of direct experience stakeholders have in marine and coastal ecosystem restoration. Results indicate that 67% of respondents have actively participated in restoration efforts, while 33% reported no direct experience in this area. While the majority are engaged in hands-on restoration, a considerable portion of stakeholders (representing one-third of respondents) do not have direct involvement in restoration projects. However, their contributions may still be significant, particularly in supporting roles such as policy advocacy, conservation planning, funding allocation, or technical advisory.

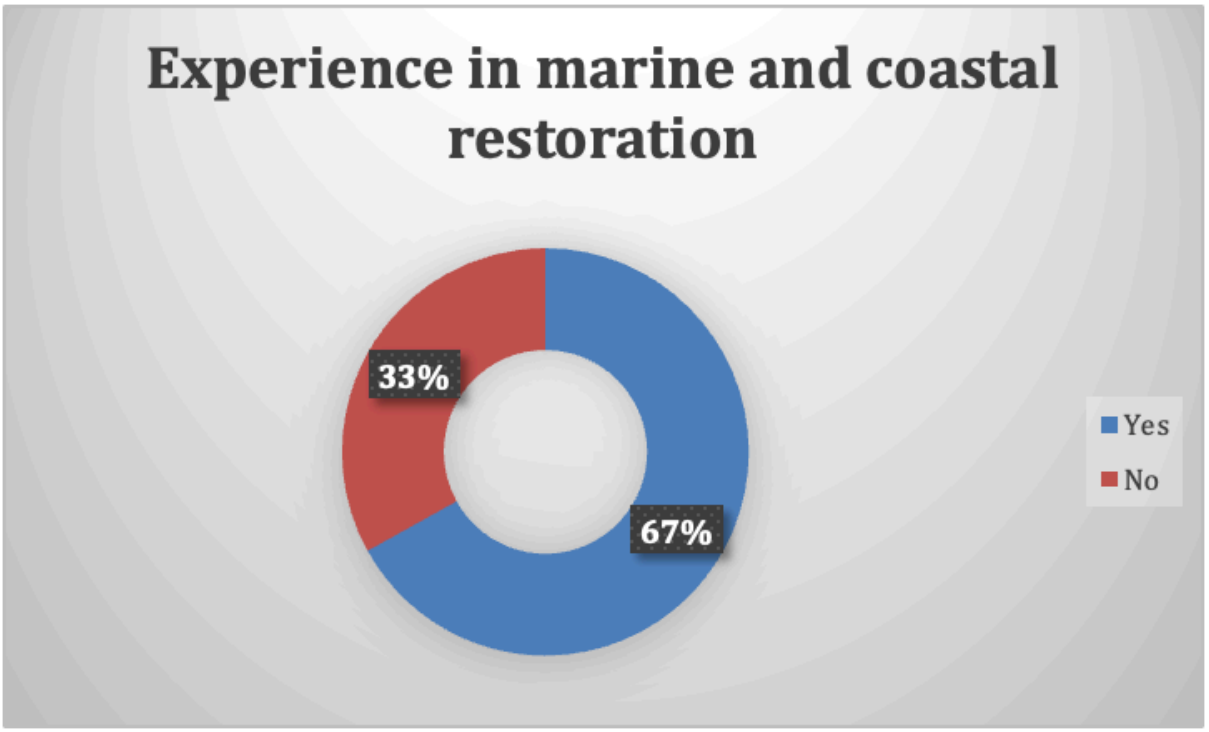


Figure 18. Proportion of stakeholders with direct experience in marine and coastal ecosystem restoration.

Distribution of Experience

To better understand which sectors hold the most expertise in marine restoration, the survey examined the distribution of experience among different stakeholder groups. The findings reveal that universities, scientific research institutions, and their networks represent the largest share, with 43% of respondents affiliated with these entities. This underscores the central role of academia in providing research, data, and technical expertise to support restoration efforts. Private environmental consultancy companies and independent experts account for the second-largest group, making up 22% of experienced stakeholders. Their involvement reflects the growing participation of specialized professionals in implementing and advising on restoration projects. National and local NGOs focused on nature conservation represent 17% of respondents, highlighting their active role in hands-on restoration initiatives. Meanwhile, Mediterranean and international NGOs contribute 8%, indicating their participation in cross-border conservation efforts.

Other key stakeholder groups include intergovernmental organizations (2%), networks of MPA managers and stakeholders (1%), and philanthropy and donor representatives (2%). Additionally, 5% of respondents fall into the "Other" category, covering additional actors engaged in restoration efforts.

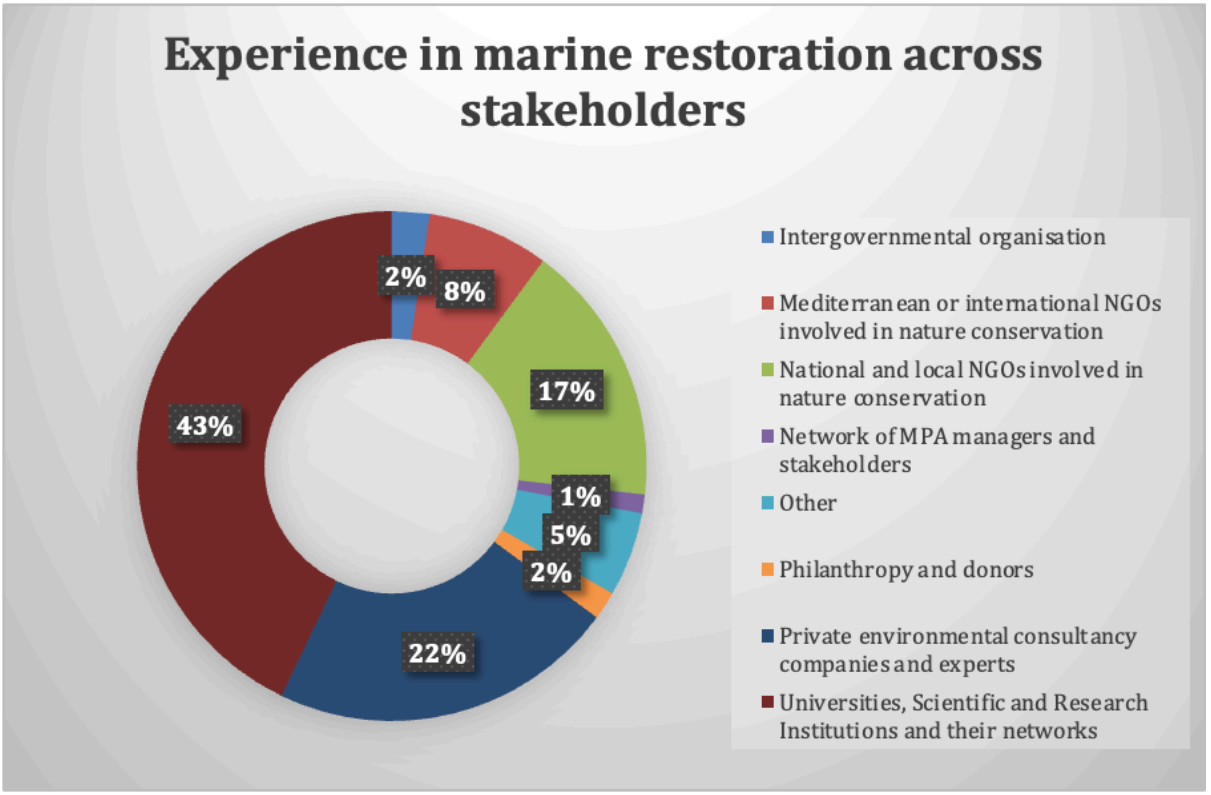


Figure 19. Distribution of expertise across stakeholder groups, indicating the predominant role of universities, consultancies, and NGOs in marine restoration.

Specific expertise areas

The analysis of expertise among stakeholders reveals significant variations in experience across different aspects of marine and coastal restoration. Scientific research and monitoring emerge as the most dominant areas of expertise, with 73.7% of respondents indicating experience in these fields. This reflects the strong scientific foundation supporting restoration efforts, particularly in ecological assessments and long-term monitoring.

Practical restoration implementation also ranks highly, with 59.6% of stakeholders actively engaged in on-the-ground restoration activities. This demonstrates a solid capacity for direct intervention in marine habitats.

However, expertise in law enforcement and compliance, as well as funding and resource provision, is notably lower. Only 13.4% of respondents report experience in enforcement, while just 12.9% have expertise in financial mechanisms for restoration.

Moderate levels of expertise are observed in stakeholder coordination (38.4%), advocacy and public awareness (42.4%), and policy development and implementation (39.5%). While these areas are covered to some extent, there remains potential for capacity-building efforts to enhance collaboration, regulatory integration, and public engagement.

Overall, the findings highlight a strong presence of scientific and practical restoration knowledge but underscore a relative shortage of expertise in enforcement, funding, and policy implementation.

Figure 20. Self-assessed expertise levels among stakeholders in various aspects of marine restoration, including scientific research, policy development, and funding.

Experience in MPA restoration projects

To assess stakeholder involvement in marine and coastal restoration, respondents were asked whether they had participated in restoration projects within Marine Protected Areas (MPAs). The results indicate that 64% (107 out of 167) of stakeholders have been actively engaged in such projects, while 36% (60 out of 167) have not. These findings highlight the significant contribution of stakeholders to restoration efforts within MPAs, reinforcing their essential role in marine conservation and ecosystem recovery.

A geographical analysis of stakeholder-led restoration projects reveals a strong concentration in the Mediterranean region. Restoration efforts are reported in Spain, Italy, Greece, France, Türkiye, Tunisia, Lebanon, Cyprus, Algeria, Morocco, Malta, Jordan, and Egypt. This pattern underscores the Mediterranean's ecological significance, the urgent need for conservation measures, and the extensive involvement of researchers, NGOs, and policymakers in safeguarding marine biodiversity.

While the Mediterranean remains the primary focus, restoration activities extend beyond this region. Projects have also been reported in West Africa, Costa Rica, the Netherlands, Comoros, and more distant locations such as

the Republic of the Marshall Islands, the Philippines, Malaysia, and Peru. This global reach reflects the growing recognition of MPAs as critical sites for marine restoration and highlights the widespread commitment to restoring degraded marine ecosystems across diverse geographical contexts.

Level of experience

We proceed to analyse the level of experience other stakeholders have on active and passive restoration:

- **62%** of respondents have experience in both active and passive restoration, indicating they use a combination of direct interventions and natural recovery methods.
- **23%** have experience only in active restoration, which includes techniques such as habitat transplantation, artificial reef deployment, and species reintroductions.
- **15%** have experience only in passive restoration, focusing on habitat protection, reducing human pressures, and allowing ecosystems to regenerate naturally.

The data shows that most stakeholders apply both approaches, while active restoration alone is more common than passive restoration alone. Please refer to the graph below for a graphical representation of this data.

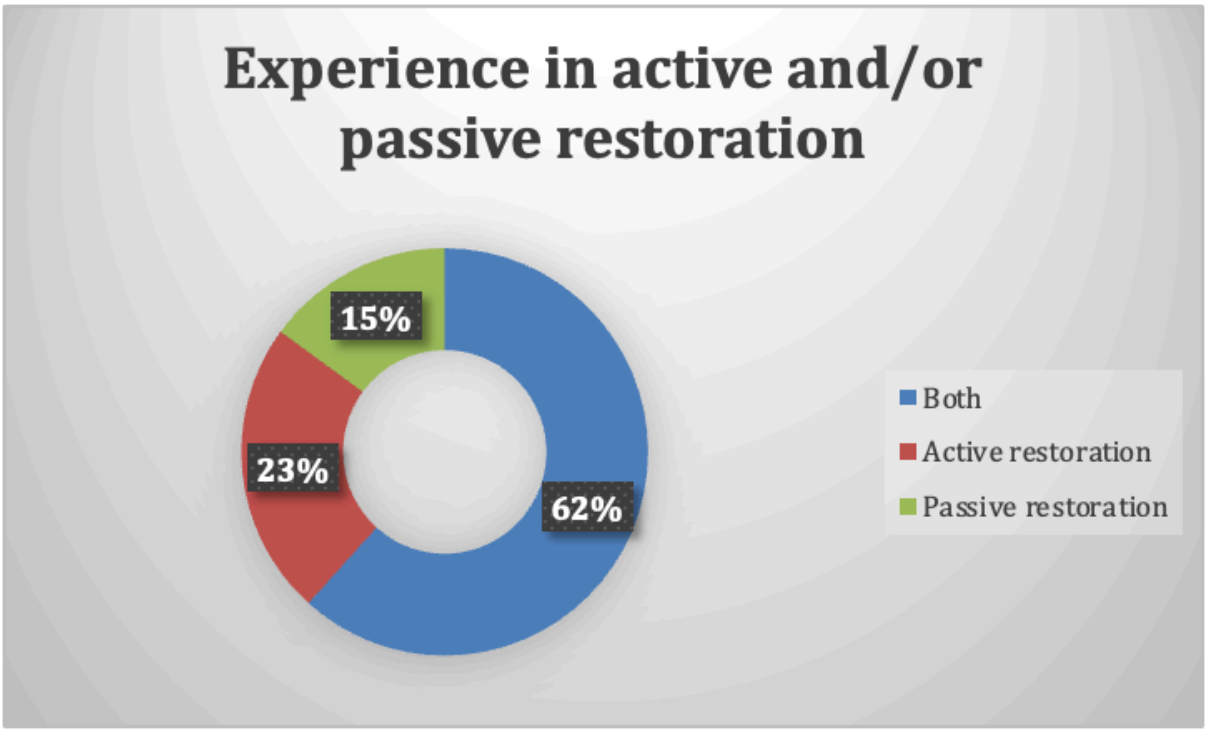


Figure 21. Experience of stakeholders with active and passive restoration approaches, indicating a preference for combined strategies.

Primary targets of restoration

The analysis continues with the question:"**What are the primary targets of restoration activities you have experience with?"** The responses indicate varying levels of focus across different restoration priorities:

- **79%** of respondents (85 out of 107) have experience in habitat restoration, making it the most common focus area, while **21%** (22 respondents) do not engage in this aspect.
- **66%** (71 out of 107) work on species restoration, whereas **34%** (36 respondents) do not focus on restoring individual species.
- **28%** (30 out of 107) have experience restoring ecosystem processes, such as hydrological regimes and water quality, while a significant **72%** (77 respondents) do not engage in this area.
- **46%** (49 out of 107) focus on restoring entire ecosystems, bu**t 54%** (58 respondents) do not take a “whole ecosystem” approach.

The data highlights that habitats and species are the main restoration targets, while ecosystem processes receive the least attention despite their importance in maintaining long-term ecological balance. The focus on

entire ecosystems remains moderate, indicating that many efforts are still directed at restoring specific components rather than full-system recovery.

The graph below visually represents these trends, illustrating the distribution of stakeholder engagement across different restoration targets.

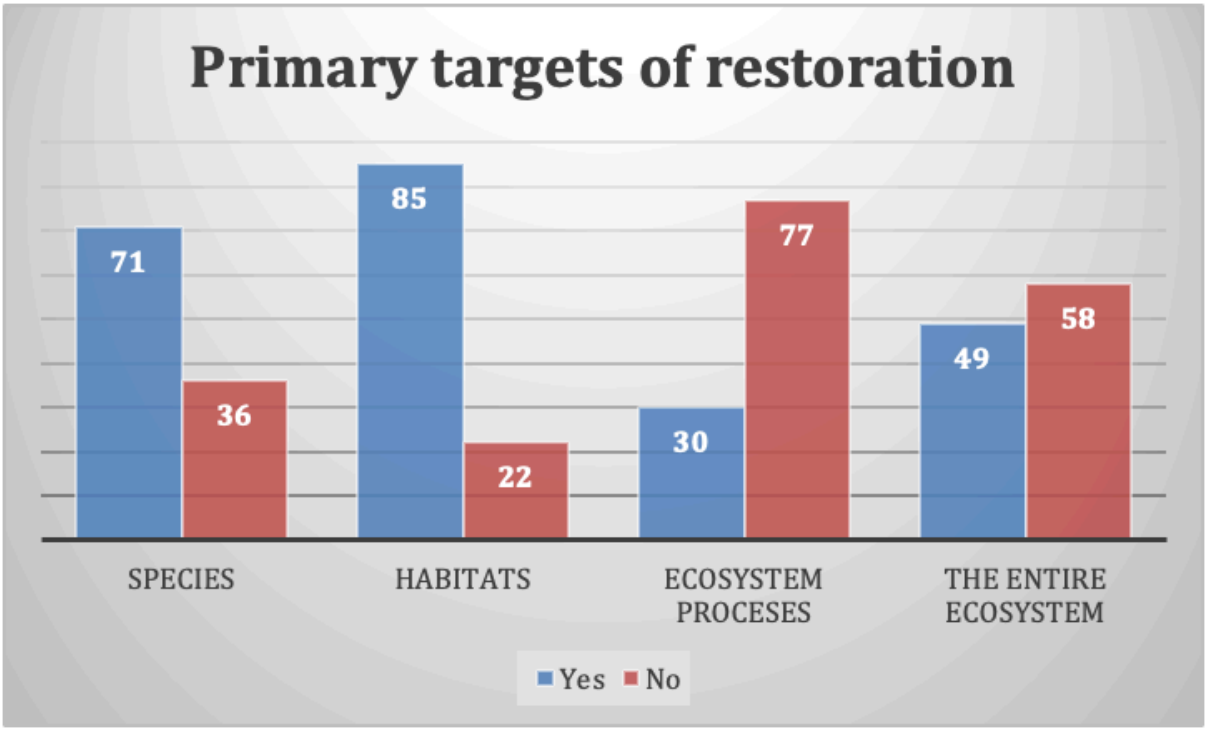


Figure 22. Focus areas of stakeholders in marine restoration, showing dominance of habitat and species restoration over ecosystem process restoration.

Restoration experience ecosystems

The graph below displays the restoration experience of stakeholders across different ecosystems.

It clearly highlights that *Posidonia oceanica* has the highest restoration involvement, with **64.5%** of stakeholders engaged in its restoration, second in importance although significantly behind are coralligenous reefs with **36.4%** of respondents engaged in its restoration. In contrast, ecosystems like deep-sea ecosystems and maerl beds have much lower engagement, at **12.4% and 4.9%** respectively. These results demonstrate varied levels of experience across ecosystems, with certain habitats, like *Posidonia oceanica*, receiving significantly more attention from stakeholders.

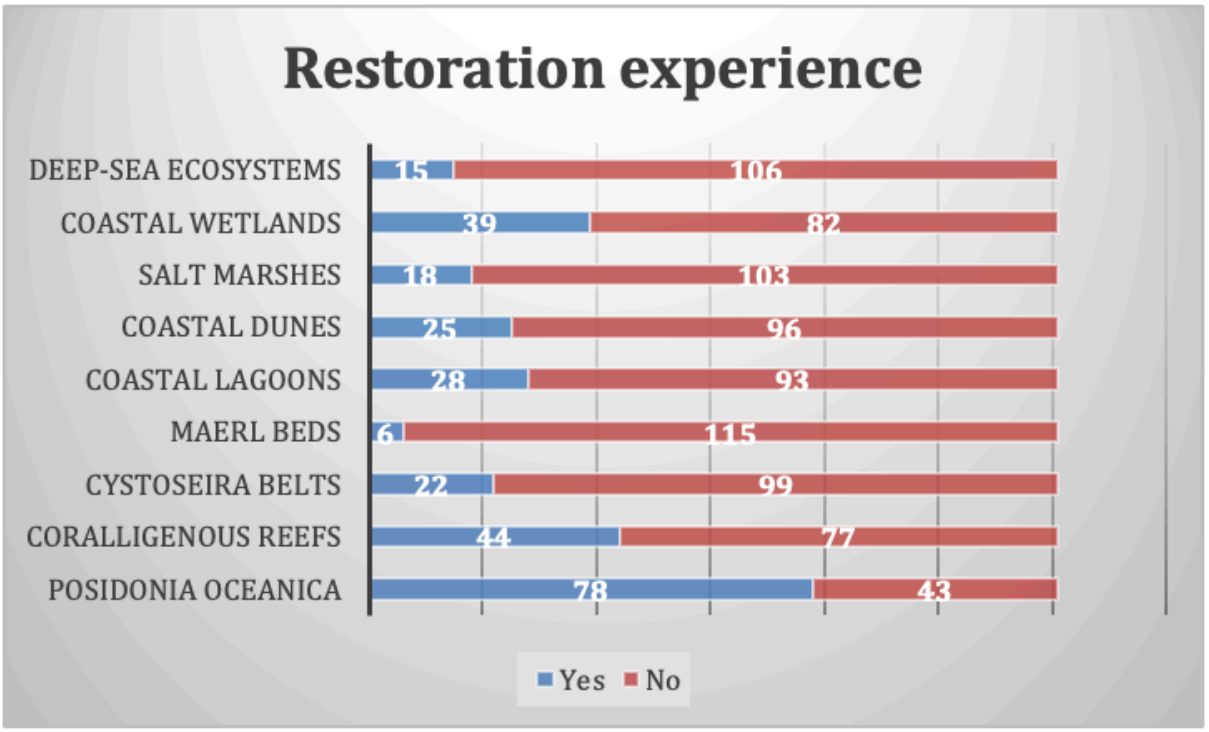


Figure 23. Engagement of stakeholders in the restoration of different ecosystems, with seagrass meadows and coralligenous reefs receiving the most attention.

Restoration experience' success

When evaluating the perceived success of restoration efforts, results indicate varying levels of effectiveness for different ecosystems. In the case of seagrass meadows, such as *Posidonia oceanica*, the majority of respondents (**42%**) reported partial success. However, uncertainty remains a challenge, with **25%** of stakeholders stating that they do not know the outcomes of these restoration efforts. Meanwhile, 17% believe that the restoration led to full recovery, suggesting that while positive results exist, a significant proportion of respondents remain unsure about the actual impact.

For coralligenous reefs, the second most common target of restoration activities, responses present a similarly mixed picture. While **21.6%** of stakeholders reported full recovery, only **16.2%** indicated partial success. A substantial **35.1%** expressed uncertainty about the results, highlighting a widespread lack of clarity regarding the effectiveness of these interventions. Additionally, **21.6%** classified the restoration as minimally successful, while **5.4%** indicated that the efforts had actually worsened conditions.

These findings suggest that despite progress in restoring key marine habitats, many projects still face considerable challenges. The high percentage of respondents unsure about restoration outcomes points to the need for improved long-term monitoring and standardized evaluation frameworks to accurately measure success and inform future restoration strategies.

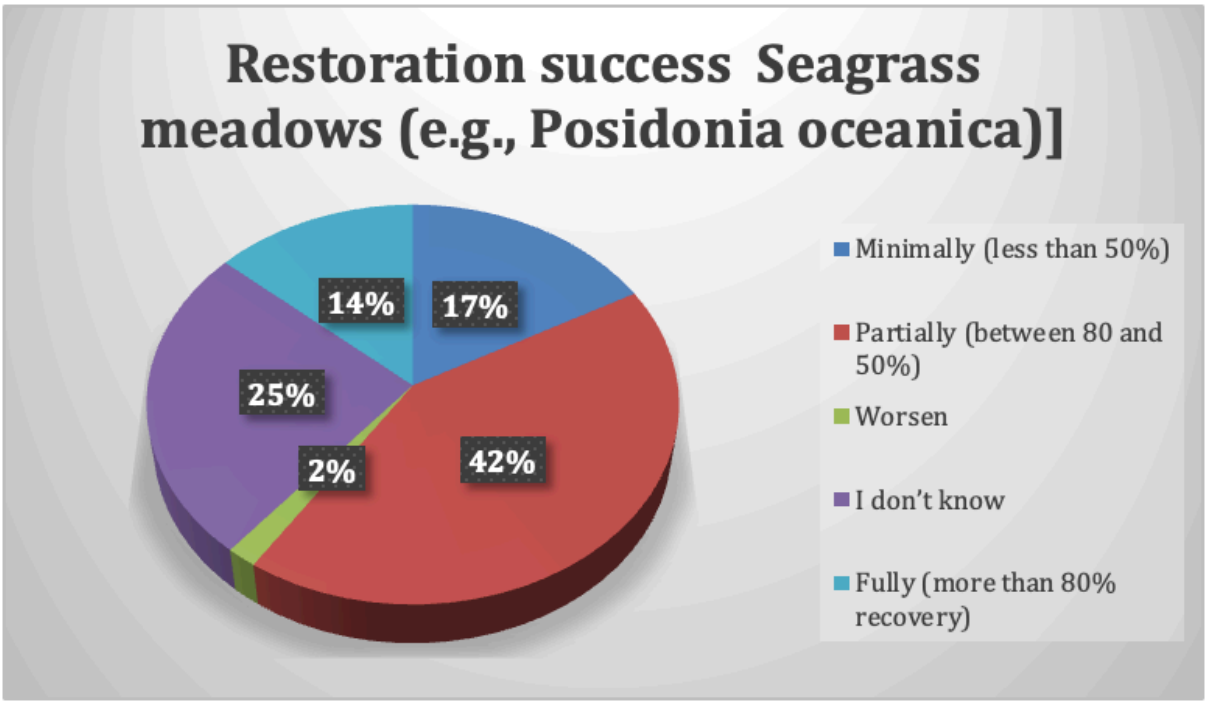


Figure 24. Perceived success of restoration efforts for seagrass meadows and coralligenous reefs, with significant variation in reported outcomes.

Specific restoration experience species

Examining restoration efforts targeting specific species groups, the survey results highlight varying levels of stakeholder involvement. The highest engagement is reported in fish species restoration, such as the Dusky Grouper (*Epinephelus marginatus*), with **42.6%** of respondents actively participating in these initiatives. This suggests that fish populations, often linked to both conservation and fisheries management, receive significant attention in marine restoration efforts.

Marine turtles, including the Loggerhead Turtle (*Caretta caretta*), represent the second most targeted group, with **27.7%** of stakeholders engaged in their restoration. While marine turtle conservation has been

widely promoted, restoration activities specifically addressing their habitats and populations remain less prevalent than those focused on fish.

At the lower end of the spectrum, marine mammals, such as the Mediterranean monk seal (*Monachus monachus*), and shellfish species, including the European flat oyster (*Ostrea edulis*), show the least involvement in restoration efforts, with only **23.8%** of stakeholders working on these species. The comparatively lower engagement in these areas may be due to the complexity of restoring marine mammal populations and the relative novelty of large-scale shellfish reef restoration in the Mediterranean.

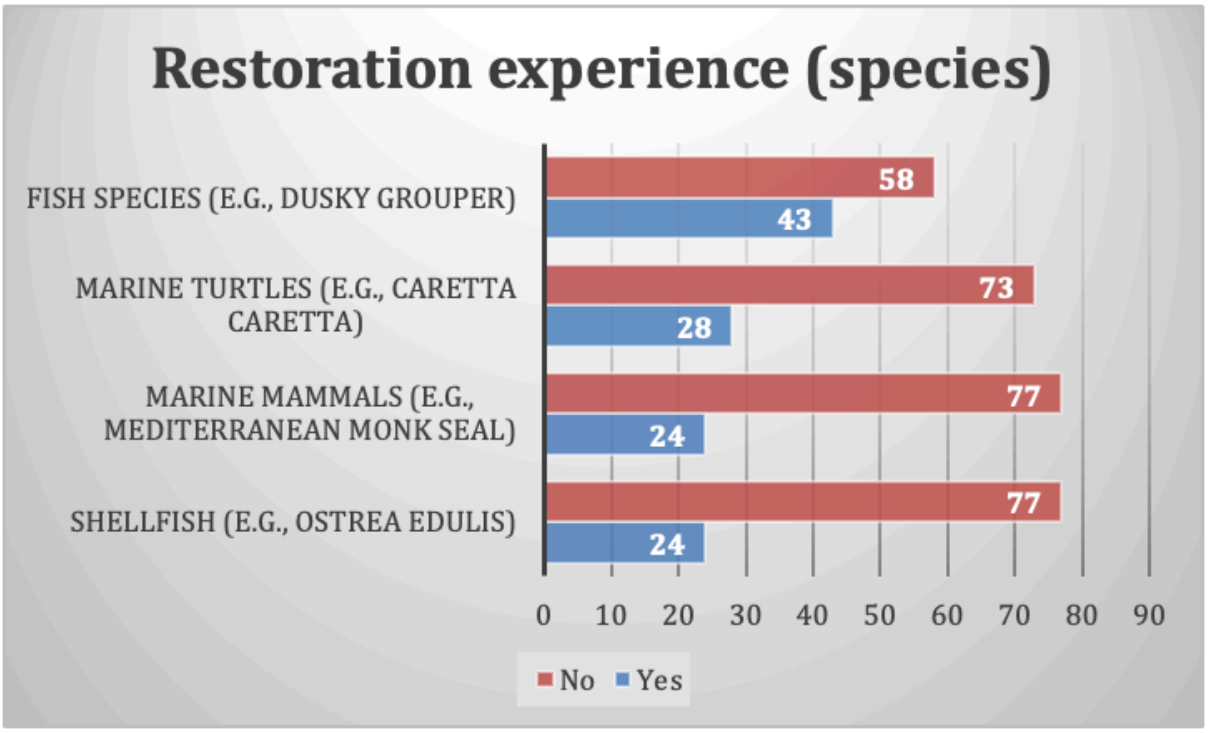


Figure 25. Stakeholder involvement in species-focused restoration, highlighting efforts for fish species, marine turtles, marine mammals, and shellfish.

Success of restoration efforts for fish species

Focusing on the success of restoration efforts for fish species/groups, which has the highest stated focus from other stakeholders, the results reveal a mixed picture.

- **38.2%** of respondents reported partial success (between 50% and 80% recovery), making it the most common outcome.

- **26.5%** expressed uncertainty, stating "I don't know", while **14.7%** noted full recovery (more than 80% recovery).

- An equal percentage, **14.7%**, indicated minimal success (less than 50% recovery), and **5.9%** stated that the restoration efforts have worsened.

These findings suggest some progress in restoring fish species, but with ongoing uncertainty and many projects still falling short of significant recovery.

Success of restoration efforts for marine turtles

In comparison, the restoration efforts for the second most important focus, marine turtles (e.g., *Caretta caretta*), show a relatively positive outcome.

- **40%** of respondents reported partial success, while **24%** achieved full recovery, reflecting more substantial progress in these projects.

- However, **24%** indicated minimal success, and **12%** expressed uncertainty about the results, suggesting that challenges remain in fully restoring these species.

Success of restoration efforts for marine mammals

For marine mammals (e.g., *Mediterranean monk seal*), the restoration efforts show more mixed and less optimistic results.

- **47.4%** reported minimal success, while 31.6% indicated partial success, and 10.5% achieved full recovery.

- A small portion, **5.3%**, expressed uncertainty, and another **5.3%** stated that the restoration efforts had worsened.

These results underscore that while some projects have made headway, marine mammal restoration is facing significant challenges compared to fish species and marine turtles.

Success of restoration efforts for shellfish species

Lastly, shellfish restoration (e.g., *Ostrea edulis*) has shown limited success.

- **5.6%** of respondents reported full recovery, while **27.8%** indicated minimal success, and **22.2%** noted partial success.

- A significant portion, **38.9%**, expressed uncertainty, highlighting the challenges faced in shellfish restoration efforts.

These results add to the broader picture of varying success across species, with fish species and marine turtles showing more positive trends in comparison. Please refer to the table below for the detailed breakdown:

Success Category	Fish species (%)	Marine Turtles (%)	Marine Mammals (%)	Shellfish (%)
Partial success (between 50% and 80%)	38.2	40	31.6	22.2
I don't know	26.5	12	5.3	38.9
Full recovery (more than 80%)	14.7	24	10.5	5.6
Minimal success (less than 50%)	14.7	24	47.4	27.8
Worsen	5.9	0	5.3	0

Table 1. Reported success rates of restoration efforts for different species groups (fish species, marine turtles, marine mammals, and shellfish), based on stakeholder assessments.

Whole ecosystem restoration goals

We proceed then to analyze the responses of other stakeholders who focus specifically on whole ecosystem restoration, to understand their overall goals. The graph below presents the results for this analysis.

- The analysis of the goals for whole ecosystem restoration reveals that **74.7%** of stakeholders focus on restoring ecological functions, with 62 out of 83 respondents engaged in this goal.

- Enhancing biodiversity follows closely, with **71.2%** of stakeholders involved (59 out of 83), while **28.8%** are not.

- Improving resilience sees **67.5%** prioritizing it (56 out of 83), and **32.5%** are not.

- Promoting sustainability has a similar level of involvement, with **71.1%** of stakeholders engaged (59 out of 83), while **28.9%** are not.

These results show that restoring ecological functions and enhancing biodiversity are the most prioritized goals, with promoting sustainability and improving resilience also being important but slightly less emphasized.

Referencing the graph below, we see that restoring ecological functions and enhancing biodiversity are the leading goals for stakeholders involved in whole ecosystem restoration.

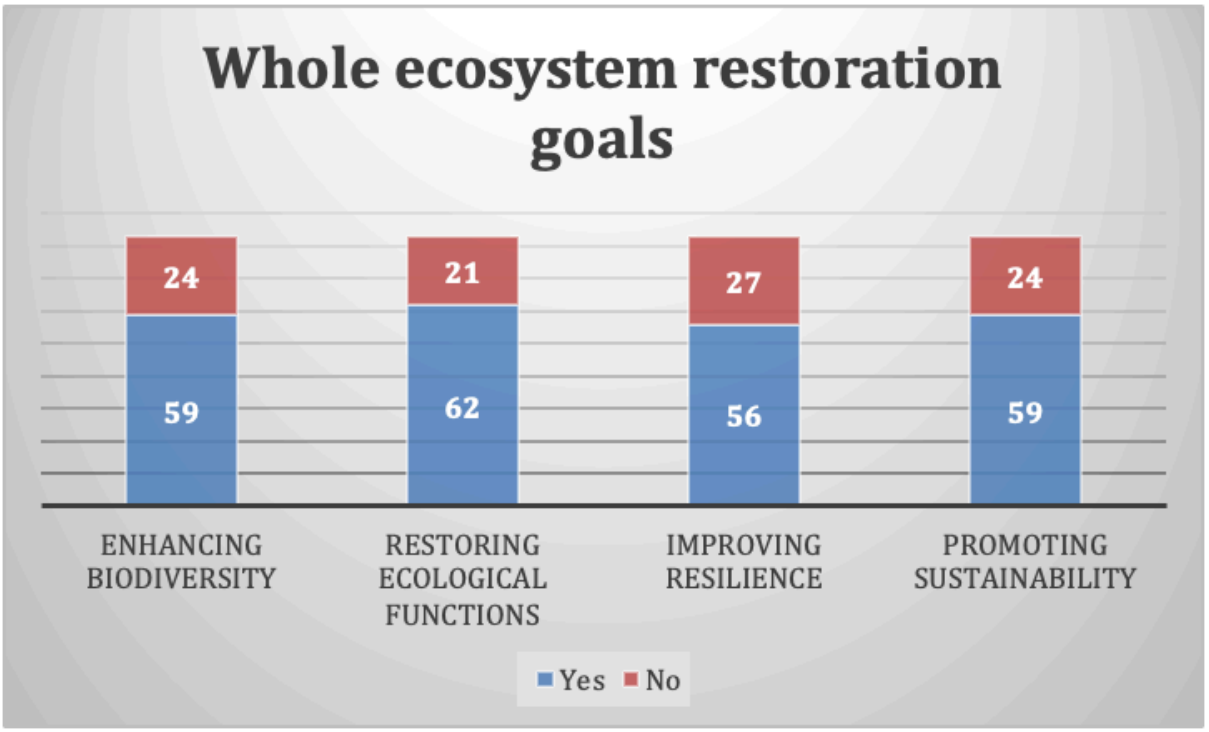


Figure 26. Restoration goals for whole-ecosystem approaches, emphasizing ecological function, biodiversity, resilience, and sustainability.

Types of restoration techniques

We proceeded to analyze the other stakeholders' responses to the question "**What types of restoration techniques do you use?"** focusing on three specific techniques.

- For **Passive Restoration** (e.g., habitat protection, cessation of damaging activities), **69.7%** of stakeholders reported using this technique, while **30.3%** do not.

- Moving on to **Active Restoration** (e.g., transplantation, artificial reef structures), **51.2%** use this approach, and **48.8%** do not. Lastly, Hybrid Approaches (combining passive and active restoration) are used by 41.6% of respondents, with 58.4% not applying this method.

These findings highlight a broad diversity of restoration techniques, with passive restoration being the most widely used, while hybrid and active approaches are somewhat less prevalent.

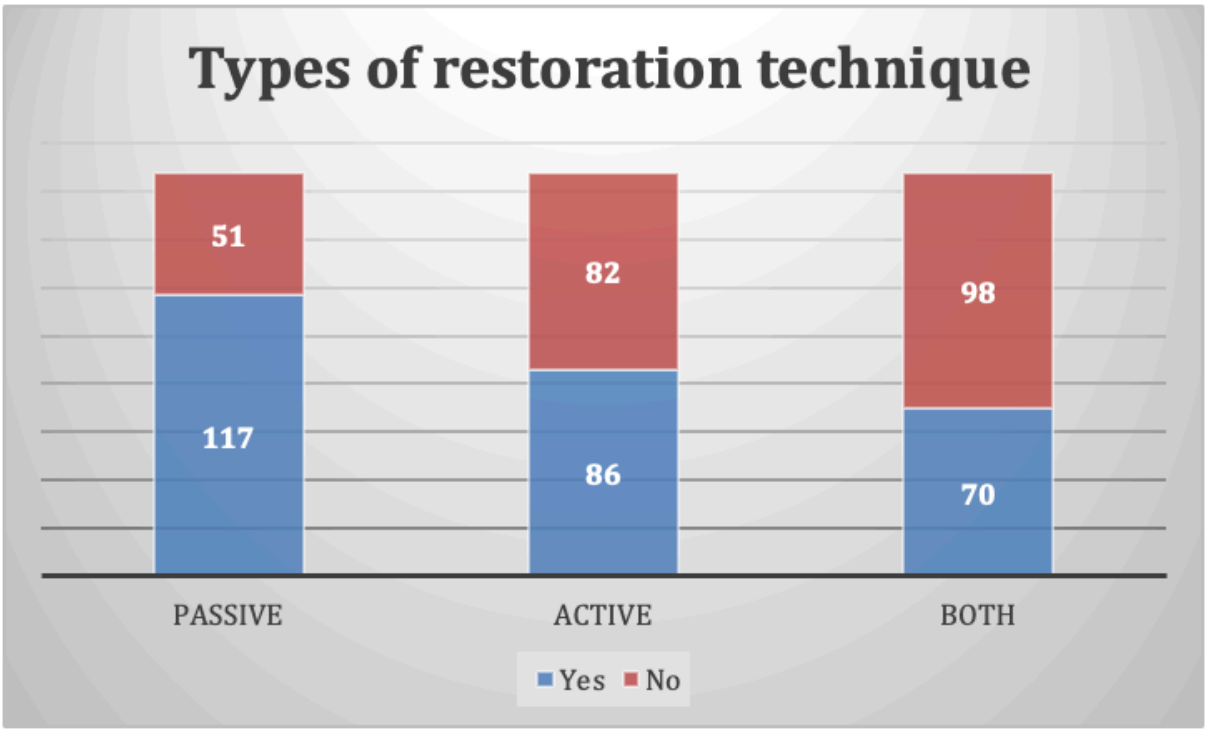


Figure 27. Utilization of different restoration techniques by stakeholders, comparing passive, active, and hybrid methods.

Restoration techniques open responses

Moreover, analysing the open responses of other stakeholders with regards to restoration techniques they reveal a diverse range of approaches used in ecosystem restoration.

- **Key strategies** include waste removal for habitat protection, advanced technologies for real-time monitoring and reporting, and knowledge transfer to enhance collaboration.

- **Specific efforts** also focus on researching impact factors, restoring dune systems, and addressing the socio-cultural value of ecosystems.

- Additionally, **education for users** and involving non-engineer researchers (such as in social and human sciences) emphasize community engagement.

- **Direct interventions** like active restoration on coral reefs and eradication of invasive species (e.g., rats) are also highlighted.

These responses demonstrate a broad, multi-faceted approach to restoration that integrates ecological, social, and technological dimensions.

Monitoring and Evaluation efforts

We proceed then to check what efforts have been placed into monitoring and evaluation (M&E) in restoration projects by other stakeholders.

- According to the responses, **46%** of stakeholders reported that M&E has been implemented, while **18%** stated that it has not been applied.

- Additionally, **24%** indicated that M&E is currently under development, and **12%** responded that they do not know whether such measures are in place.

These findings highlight that while nearly half of the restoration projects incorporate monitoring, a considerable portion still lacks structured evaluation, potentially affecting the ability to assess long-term success.

Referencing the pie chart below, this distribution illustrates the varying degrees of M&E implementation across restoration efforts by other stakeholders.

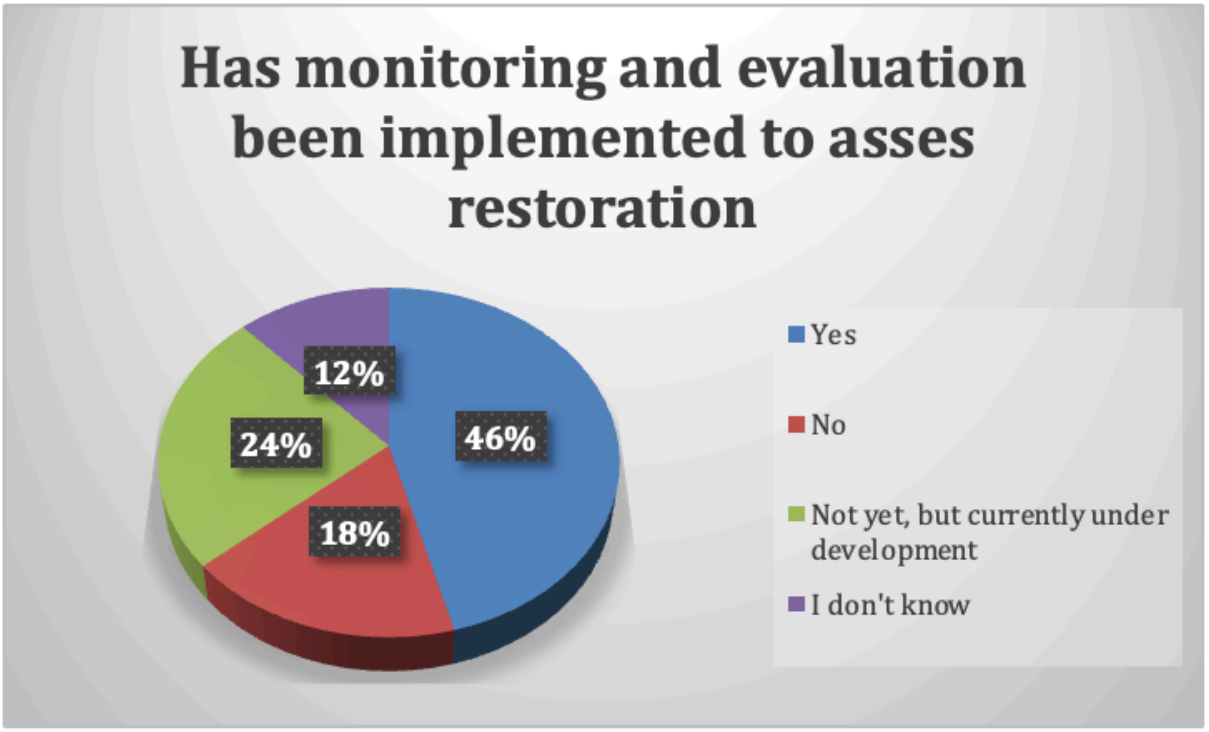


Figure 28. Proportion of stakeholders implementing monitoring and evaluation (M&E) in their restoration projects, with a notable gap in structured assessment.

Other monitoring restoration techniques

When assessing what techniques and practices other stakeholders use to monitor restoration success:

- The responses reveal that **64.4%** of participants use Quadrat and Transect Surveys, while **39.4%** employ Underwater Visual Census.

- Long-term Monitoring Stations are used by **48.3%**, with **51.7%** not employing this practice.

- In contrast, Acoustic Surveys **(16.9%)** and Photogrammetry **(22.9%)** are less common, and Remote Sensing is used by **26.3%**.

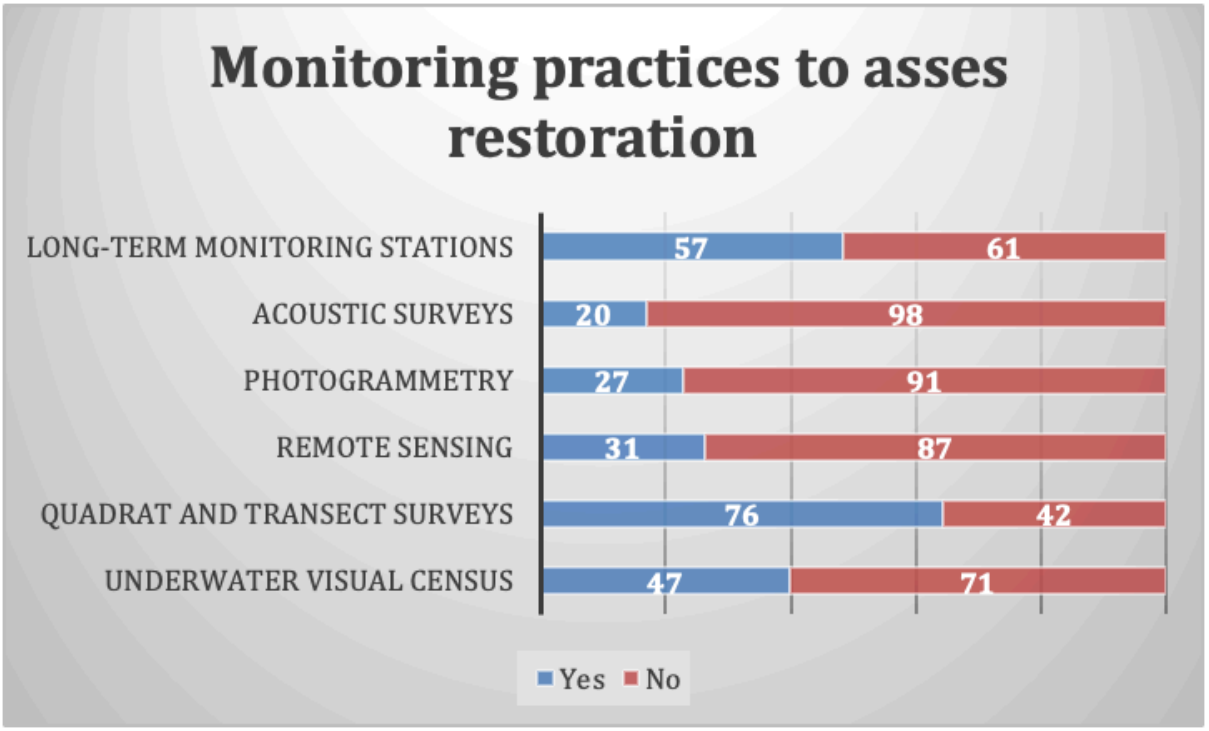


Figure 29. Monitoring techniques employed by stakeholders, including quadrat surveys, underwater census, photogrammetry, and remote sensing.

Success monitoring indicators in marine restoration

We perform a similar analysis to understand which indicators are used by other stakeholders to monitor success in marine restoration.

- Results indicate that species abundance and diversity and habitat cover and extent are the most widely used indicators for monitoring marine restoration success, with a significant **80.5%** of respondents using them.

- Recruitment rates are the least used, with only **22.9%** of respondents incorporating this indicator.

- Biomass and size distribution **(43.2%)**, water quality parameters **(28%**), and associated biodiversity **(53.4%)** fall in between, with varying emphasis placed on these aspects depending on the stakeholders involved in monitoring and restoration efforts.

Refer to the graph below for a visual representation of the results.

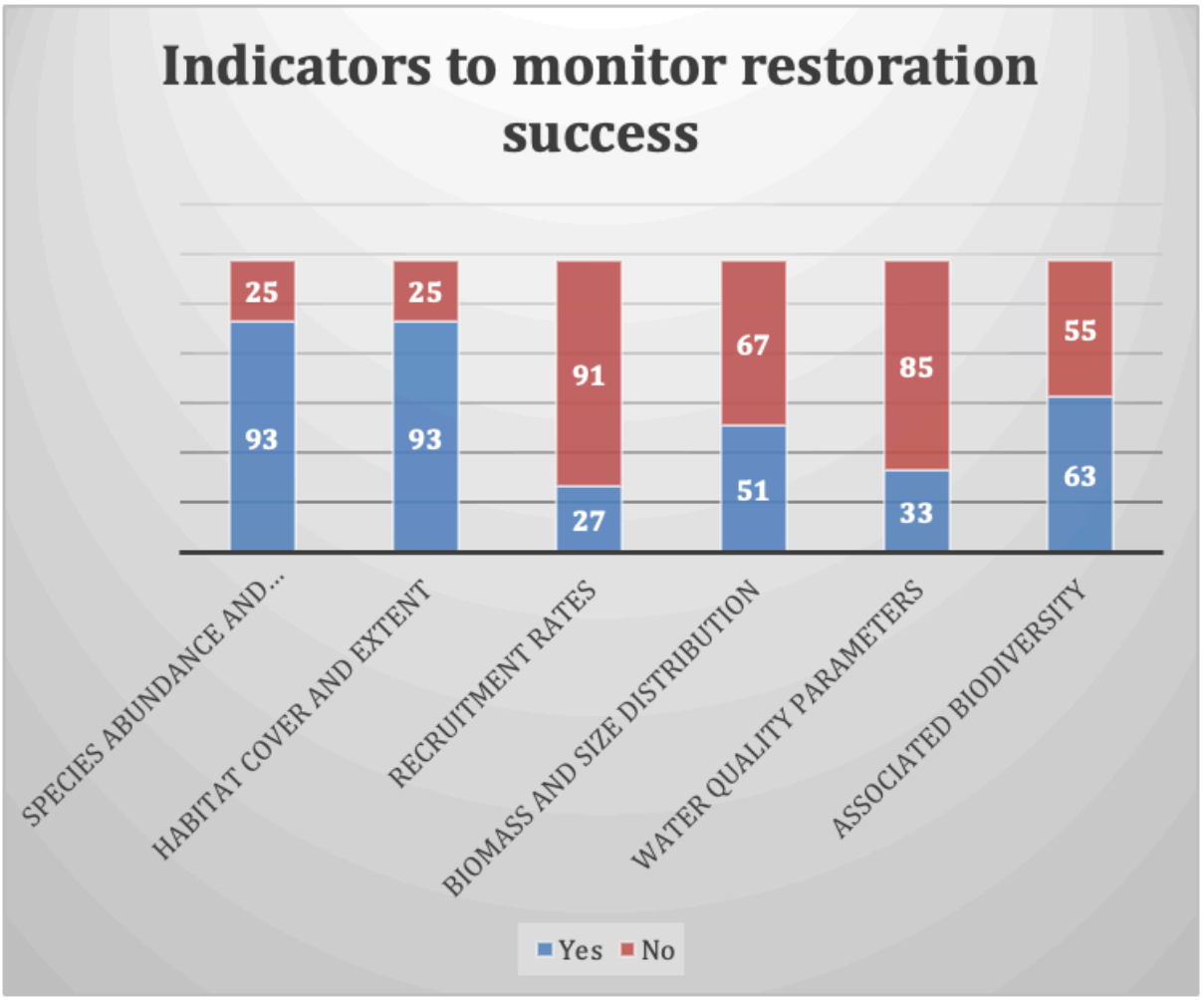


Figure 30. Indicators used by stakeholders to assess restoration success, with habitat cover and species diversity ranking as the most commonly monitored metrics.

Monitoring Protocols in marine restoration

Stakeholders involved in marine restoration employ a variety of monitoring protocols tailored to different restoration targets and activities. Traditional ecological methods, such as scuba transects, remain a widely used approach for conducting underwater surveys, allowing for direct assessment of benthic habitats and species diversity. Similarly, ROV (remotely operated vehicle) transects are commonly used for assessing deep-sea benthic communities, offering a technological alternative to traditional dive-based monitoring. App-LogBooks are also utilized to facilitate data tracking and long-term monitoring efforts.

Many stakeholders integrate remote sensing technologies and Internet of Things (IoT) applications to enhance data collection, particularly in tracking marine bioindicators. These methods are often combined with in-situ

techniques to improve the accuracy and efficiency of monitoring efforts. Other widely implemented monitoring approaches focus on specific ecological components, such as tracking sea turtle nests, monitoring stranding events, and assessing plastic pollution through direct observation and tagging techniques.

For biodiversity monitoring, stakeholders employ taxonomical studies, metabarcoding techniques, and satellite-based tools such as Landsat images for remote sensing. Additionally, the effectiveness of Marine Protected Areas (MPAs) is evaluated using specialized management effectiveness assessment tools, which incorporate ecological and socio-economic indicators.

Several monitoring efforts focus on water quality parameters, species abundance, diversity assessments, and habitat coverage using Geographic Information System (GIS) mapping and environmental sensors. In some regions, monitoring protocols for seagrass meadows are still under development, with stakeholders applying long-term demographic studies and photo-quadrat analysis to assess their recovery. More specialized approaches, such as genetic analysis and socio-cultural value chain diagnostics, are also being integrated to evaluate ecosystem services and stakeholder engagement in restoration efforts.

The survey further examined how stakeholders use monitoring data to inform and adjust their restoration strategies. The results show a high level of adaptability, with **84.4%** of respondents confirming that they actively use monitoring data to refine their restoration approaches, while **7.8%** reported not doing so, and another **7.8%** (6 out of 77 respondents) were unsure. These findings highlight the importance of robust monitoring frameworks in ensuring that marine restoration efforts are data-driven and responsive to changing ecological conditions.

Main challenges faced in restoration efforts

We proceed to analyse the ranking of the main challenges faced by other stakeholders when engaging in marine restoration. The graph illustrates the main challenges to ecosystem restoration as reported by stakeholders, highlighting the most significant obstacles in four ranks.

The highest-ranked challenge, **lack of funding**, received the most responses for Rank 1, followed by **Stakeholder conflicts, regulatory barriers, and lack of baseline data**. These three challenges stand out as the most pressing issues. **Limited scientific knowledge** and insufficient

staff, lack of equipment or resources were also key challenges, with significant responses across all ranks. **Limited technical expertise,** and other factors were ranked lower, indicating that while they remain concerns, they are less critical compared to funding, stakeholder conflicts, and regulatory issues.

These results emphasize the primary need for adequate financial resources, engagement and comprehensive policy understanding to address ecosystem restoration effectively.

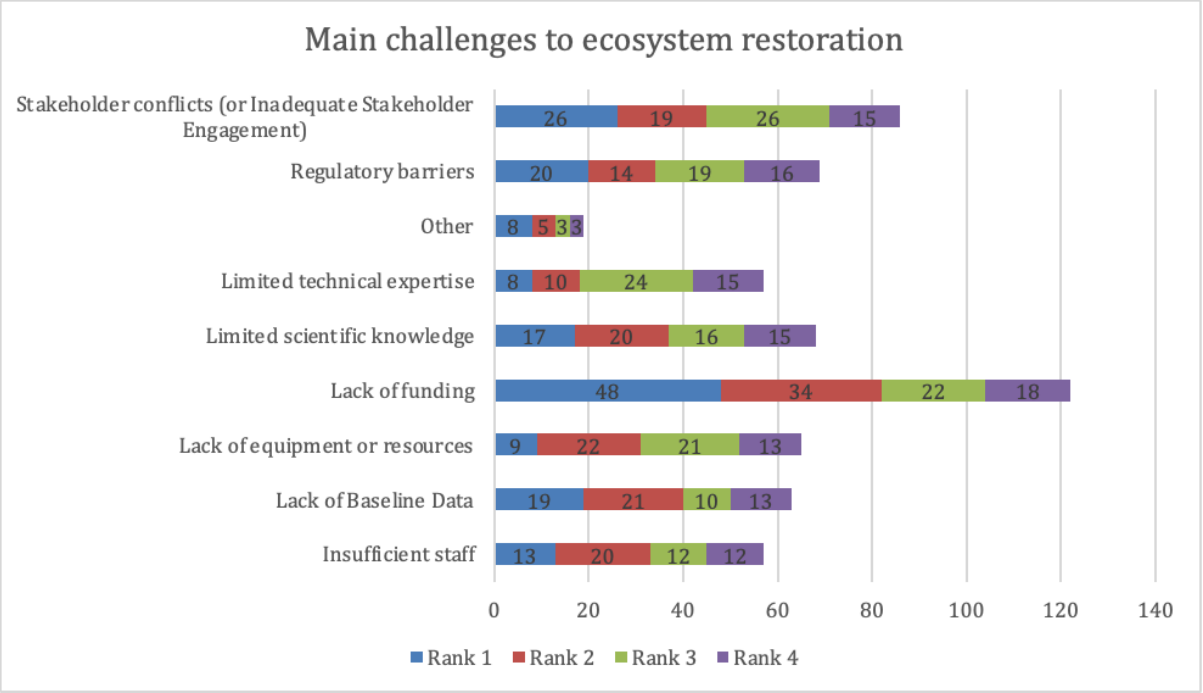


Figure 31. Ranking of key challenges faced by stakeholders in marine restoration, with funding, stakeholder conflicts, and regulatory barriers as primary obstacles.

Other stakeholders' knowledge of EU NRL

We now proceed to analyze the knowledge of other stakeholders regarding the question, **"How would you rate your knowledge of the EU Nature Restoration Law (NRL) and its implications for marine and coastal ecosystem restoration?"**

- As shown in the graph below, **36%** of respondents indicated that they have heard of the NRL but know little about it, while **32%** stated

that they have a basic understanding of the NRL.

- A smaller proportion, **17%,** reported being well-informed about the NRL and its implications.

- Lastly, **15%** of respondents were not aware of the NRL prior to this survey.

These results suggest that a significant portion of stakeholders have only limited knowledge about the NRL, with a smaller percentage having a deeper understanding of its implications for ecosystem restoration.

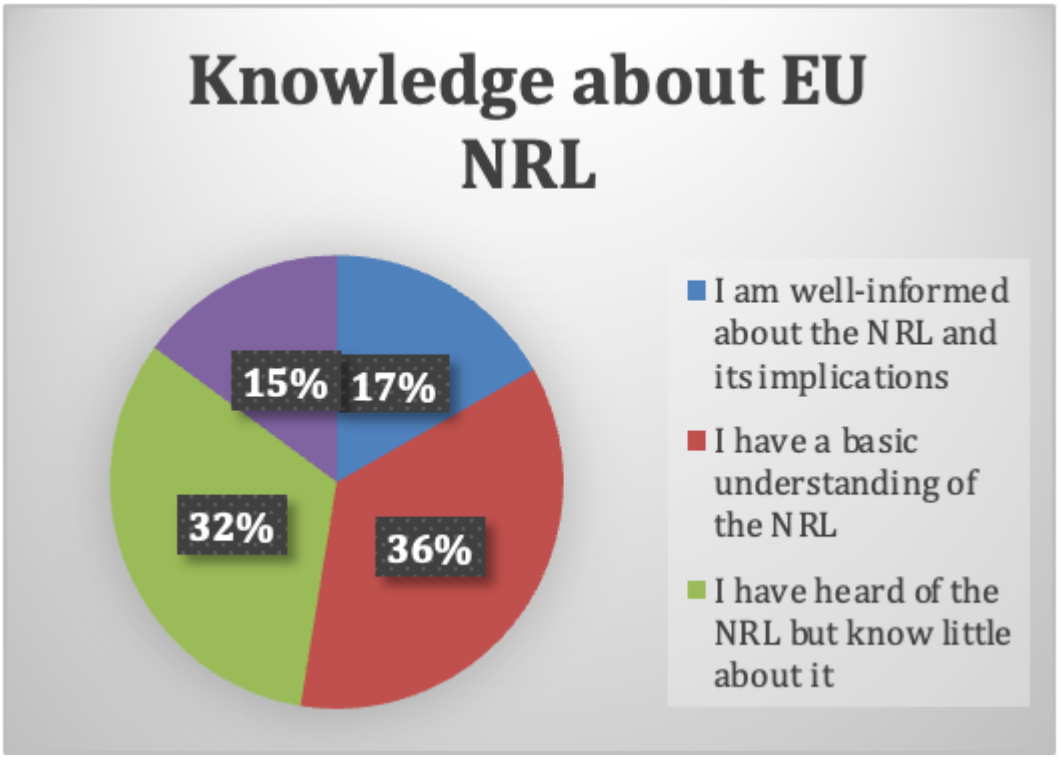


Figure 32. Levels of knowledge among stakeholders regarding the EU Nature Restoration Law (NRL) and its implications for restoration efforts.

We proceed to conduct a differentiated analysis of other stakeholders, looking at both EU and non-EU respondents, given that we presume there might be systematic differences between these two groups. We note that 215 responses do not reveal their base country, as they are from international NGOs, universities, research institutions, or private entities, which most likely work internationally. Therefore, we focus on 30 valid

responses from stakeholders affiliated with governmental ministries, agencies, or similar institutions responsible for MPAs who reveal their base country and also answer this question.

Among the 18 EU respondents, 11% (2 respondents) are well-informed about the NRL and its implications, 50% (9 respondents) have a basic understanding, and 39% (7 respondents) have heard of the NRL but know little about it. On the other hand, among the 12 Non-EU respondents, 25% (3 respondents) are well-informed about the NRL, 17% (2 respondents) have a basic understanding, and 33% (4 respondents) have heard of the NRL but know little about it. Additionally, 17% (2 respondents) from the Non-EU group were not aware of the NRL before this survey, and 8% (1 respondent) marked the question as non-applicable.

Therefore, while there are notable differences between the two groups, caution must be exercised in interpreting the results for Non-EU stakeholders due to the smaller sample size and potential issues with representativity. Interestingly, it is somewhat surprising that the EU group has a higher proportion of respondents who have heard of the NRL but know little about it, while Non-EU respondents appear to have a greater proportion who are well-informed about the NRL. This contrast may suggest differences in the level of awareness or engagement with the NRL, but further investigation with a larger sample size would be needed to confirm this trend.

Other stakeholders' knowledge of passive and active restoration

We then proceed to analyze other stakeholders' knowledge of passive and active restoration in the context of marine and coastal environments.

- The great majority of respondents, approximately **88%,** confirm that they are familiar with both concepts, indicating that these approaches are widespread across the restoration community.

- The remaining responses collectively account for just **12%.**

Please refer to the pie chart below.

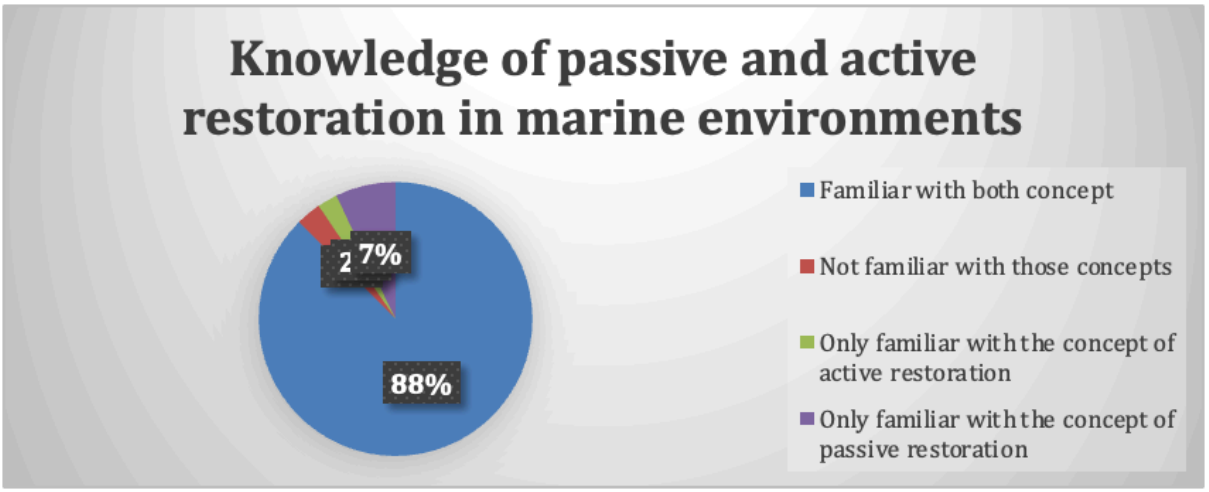


Figure 33. Familiarity of stakeholders with passive and active restoration approaches, demonstrating a strong overall understanding.

Other stakeholders' competences

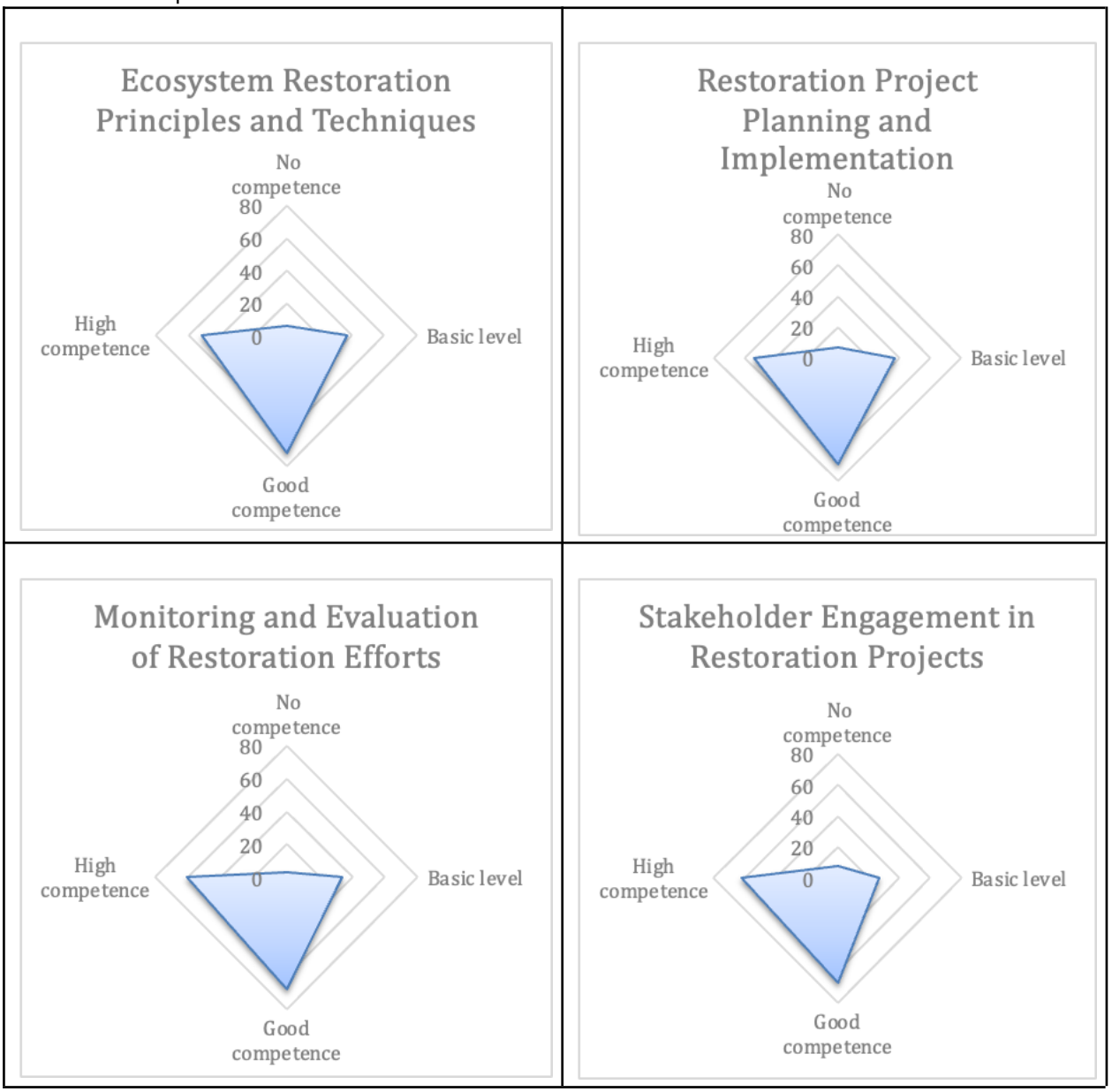
We then proceed to analyse other stakeholders' self-assessed competences across key aspects and topics of marine restoration using radar charts.

Based on the analysis of the self-assessment of other stakeholders' competencies in various areas of marine and coastal restoration, the distribution of skills shows notable similarities across the sample.

In Ecosystem Restoration Principles and Techniques, **43%** report good competence and **31%** indicate high competence, suggesting a solid understanding of these concepts. Restoration Project Planning and Implementation shows a similar pattern, with **41**% having good competence and **32%** reporting high competence, highlighting strong planning and implementation capabilities among stakeholders. For Monitoring and Evaluation of Restoration Efforts, the highest proportion **(40%)** reported good competence, while **36%** indicated high competence, and this area also recorded the lowest levels of no competence across all assessed skillsets. Stakeholder Engagement in Restoration Projects is another area where **40%** of respondents reported good competence, while **37%** indicated high competence, with a smaller portion (**16%**) at the basic competence level. The Integration of Restoration into MPA Management Plans shows a stronger understanding, with **37%** at the basic level, 30% reporting high competence, and 23% indicating good competence. Finally, Policy and Strategic Frameworks for Restoration appears to be the area requiring the most attention, as **32%** of respondents reported only basic

competence, **35%** indicated good competence, **23%** reported high competence, and **6.5%** reported no competence, the highest in the survey.

Overall, stakeholders show a solid understanding of key restoration concepts, but the area of Policy and Strategic Frameworks for Restoration may require more targeted capacity-building. Please refer to the radar charts below for a visual overview of these self-assessments across the various competencies.



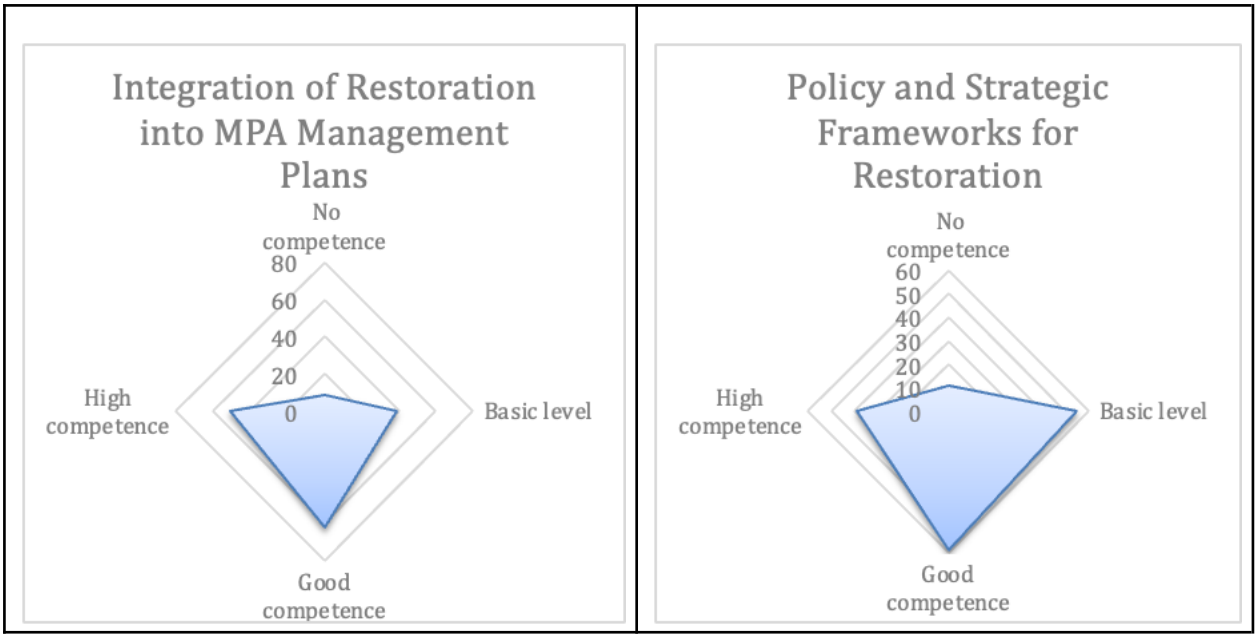


Figure 34. Self-assessed competencies of stakeholders in key restoration-related skills, visualized through radar charts.

Finally, we look at the engagement of stakeholders in providing training related to marine and coastal restoration.

Out of other stakeholders, **40.1%** confirmed having provided such training, while the majority, **59.9%** reported not having done so.

This indicates that although a noteworthy portion of stakeholders are actively involved in training activities, there is a substantial need for further capacity-building to enable more stakeholders to deliver effective training on marine and coastal restoration.

4. Discussion

This study provides valuable insights into the current state of marine and coastal restoration efforts in Mediterranean MPAs, highlighting key **competency gaps, training needs, and challenges** faced by MPA managers and stakeholders. Comparing the **survey findings with the literature review**, we identify areas requiring further **capacity building, financial support, policy integration, and improved monitoring** to enhance **restoration effectiveness**.

4.1. Competency Gaps and Training Needs

The survey results revealed significant gaps in training and competency levels among MPA managers, with 82% reporting no prior training in marine and coastal restoration. This finding is consistent with the literature, which identifies limited technical expertise and access to training programs as major barriers to restoration implementation in Mediterranean MPAs (*RestCoast Literature Review*). Despite this gap, some managers demonstrated basic knowledge of restoration principles, with 40% rating themselves at a basic level in ecosystem restoration techniques and 38.6% reporting good competence in restoration project planning.

However, self-assessments in policy frameworks and strategic planning for restoration were notably weaker, with 54.5% reporting only basic competence and 11.4% having no competence at all. This aligns with existing research that underscores how regulatory complexity and a lack of clear policy guidance hinder effective restoration planning (*RestCoast Literature Review*). Furthermore, while 67% of MPA managers were familiar with both passive and active restoration techniques, 20% lacked familiarity with these concepts altogether. This highlights the need for structured capacity-building programs that not only provide theoretical knowledge but also practical, hands-on training in implementing restoration strategies. The literature also stresses the importance of incorporating real-world case studies and field-based learning to improve knowledge transfer and ensure that MPA managers are equipped with actionable skills (*RestCoast Literature Review*).

Another critical gap identified in the survey relates to awareness of key regulatory frameworks such as the **EU Nature Restoration Law (NRL)**. **Among EU-based MPA managers,** only **7% described themselves as well-informed,** while **40% had heard of it but knew little about its details.** In contrast, **17% of EU respondents and 43% of non-EU respondents were entirely unaware of the NRL before the survey**. Given that effective restoration requires alignment with existing policy frameworks, this knowledge gap presents a significant challenge. Integrating a dedicated module on regulatory frameworks, including the NRL, into future training programs would help MPA managers **navigate legal requirements, access funding opportunities, and enhance policy-driven restoration strategies**.

Addressing these competency gaps through structured training programs, combined with practical exposure to restoration techniques and policy

frameworks, will be crucial to ensuring that restoration initiatives are both scientifically sound and policy-aligned.

4.2. Challenges and Barriers to Restoration Implementation

When examining the barriers preventing restoration implementation, MPA managers overwhelmingly cited a lack of financial resources and insufficient knowledge as the most critical constraints. These findings align with existing research, which consistently identifies inadequate funding, technical limitations, and weak institutional support as major challenges for MPA restoration in the Mediterranean (RestCoast Literature Review).

A key finding from the survey indicates that demand for restoration exists, but implementation is impeded by resource and knowledge limitations.

Of the 10 managers who stated that no restoration activities are currently implemented, 7 identified a lack of resources as the main limiting factor, while 5 mentioned a lack of knowledge. In contrast, only one manager indicated that there was no need for restoration activities. This suggests that the absence of restoration is not due to a lack of interest or necessity but rather to barriers in capacity and expertise.

This finding aligns with the literature, which highlights financial and knowledge constraints as the two most significant barriers to scaling up restoration efforts in MPAs (RestCoast Literature Review). Studies emphasize that even when restoration needs are identified, insufficient expertise and funding often delay or prevent action. These results reinforce the importance of addressing competency gaps and increasing financial support to expand restoration efforts.

A comparative analysis with other stakeholders reveals that MPA managers and external restoration stakeholders face similar barriers but with different priorities. As indicated in the survey responses, the key challenges for MPA managers include lack of funding, insufficient staff, and lack of baseline data. Other stakeholders, such as NGOs, scientists, and policymakers, also cite funding constraints but place greater emphasis on policy and governance barriers, regulatory constraints, and stakeholder conflicts.

These differences suggest that MPA managers experience operational and resource-driven challenges, whereas external stakeholders are more

affected by bureaucratic hurdles and coordination difficulties. The literature confirms that policy fragmentation, lack of legal clarity, and intergovernmental barriers often limit the effectiveness of large-scale restoration initiatives (RestCoast Literature Review, p. 22). Addressing these issues will require a multi-faceted approach that improves both on-the-ground capacity and governance structures.

4.3. Restoration Targets and Success Rates

The survey findings indicate that habitat restoration is the primary focus of MPA managers, with 77% prioritizing habitat restoration, followed by species restoration (65%). In contrast, restoring ecosystem functions (26%) and whole ecosystems (34%) received significantly less attention. This mirrors trends observed in the literature, where seagrass meadows, particularly *Posidonia oceanica*, have been the dominant focus of Mediterranean restoration efforts (RestCoast Literature Review). However, the literature warns that restoration projects should aim for an ecosystem-based approach, incorporating habitat connectivity and ecological function restoration rather than focusing only on single species or habitats.

When assessing which ecosystems receive the most restoration efforts, 79% of MPA managers reported focusing on *Posidonia oceanica*, followed by coralligenous reefs (54%) and *Cystoseira* belts (25%). The literature confirms this trend, noting that seagrass and coralligenous reef restoration projects are the most widespread due to their critical role in marine biodiversity and carbon sequestration. However, deep-sea ecosystems remain severely underrepresented, a finding confirmed by this study, where no restoration projects were reported for deep-sea habitats.

While restoration initiatives are expanding across the Mediterranean, their success remains limited and highly variable. Survey responses indicate that a majority of respondents rated restoration efforts for key species as minimally successful. For fish species, 45% of respondents reported minimal success (**below 50%**), while only **27%** considered restoration fully successful (**above 80%**). Similarly, for marine turtles, **40%** of respondents assessed restoration efforts as minimally successful, with only **20%** reporting full success. These findings emphasize that while restoration is increasingly implemented, its ecological impact is often uncertain or constrained by challenges such as inadequate site selection, suboptimal techniques, and insufficient post-restoration monitoring.

The literature corroborates these findings, highlighting that many restoration projects lack long-term ecological monitoring frameworks, making it difficult to assess their true impact . Without standardized indicators and extended observation periods, restoration success remains difficult to quantify. Moreover, restoration projects in Mediterranean MPAs often focus on habitat-based interventions rather than ecosystem-wide approaches, which could explain the limited ecological gains observed in species recovery. Addressing these limitations will require stronger institutional support, expanded use of scientific monitoring tools, and improved restoration methodologies to achieve more consistent and lasting outcomes.

These findings suggest that increased investment in post-restoration monitoring and standardizing success indicators are necessary to assess and improve the effectiveness of these efforts. Expanding the use of remote sensing, photogrammetry, and long-term monitoring stations could provide better tracking of restoration outcomes. However, traditional in-situ methods like quadrat and transect surveys remain underutilized and should be incorporated to improve data accuracy and adaptive management.

5. Implications and Future Directions

The findings from this study emphasize critical areas requiring immediate attention to enhance the effectiveness of marine and coastal restoration in Mediterranean MPAs. While the survey responses provide direct insights into the challenges faced by MPA managers, the literature review offers validated strategies to address these barriers. Integrating these two perspectives ensures that the recommendations are both evidence-based and actionable.

One of the most urgent needs identified is capacity building and training, as 82% of MPA managers reported never hav**ing received formal training in marine and coastal restoration. Survey results indicate that "Habitat or Species Restoration" is the most critical training need, receiving the highest number of Rank 1 responses (13), highlighting the strong demand for technical expertise in restoring degraded marine ecosystems. "Planning and Management" follows closely, with 8 Rank 1 responses, emphasizing the necessity of structured approaches to designing and implementing restoration projects.** The priority areas requiring training also include policy frameworks, monitoring techniques, and stakeholder engagement, which are essential for improving restoration outcomes. The literature review supports these findings, emphasizing that field-based learning, case studies, and hands-on workshops are critical for bridging the gap between theoretical knowledge and practical application. Developing structured training programs, such as online courses, peer-to-peer exchanges, and regional knowledge-sharing initiatives, would significantly enhance the competencies of MPA managers and restoration practitioners.

Another major limitation in restoration efforts is the lack of financial and institutional support, which prevents MPAs from implementing or scaling up restoration projects. The survey results identify funding constraints as a leading challenge, and the literature review reinforces this by highlighting the need for sustainable financial mechanisms. Establishing long-term funding through grants, public-private partnerships, and national conservation budgets is essential to provide continuous financial support for restoration initiatives. Additionally, stronger institutional backing is necessary to integrate MPA restoration into national conservation strategies, ensuring that these efforts receive legal and financial support. Promoting collaborative funding approaches among governments, NGOs, and private-sector stakeholders could further enhance the financial security of restoration projects.

Policy integration and coordination also remain significant challenges, as many MPAs conduct restoration activities without clear alignment with national or regional strategies. This lack of coherence reduces the scalability and impact of restoration efforts. The literature review underscores the importance of cross-border collaboration among Mediterranean countries, particularly for transboundary ecosystems that require coordinated management approaches. Strengthening policy integration at the national and regional levels would enhance the legal framework for restoration, facilitating access to funding, technical expertise, and capacity-building resources. Aligning MPA restoration efforts with broader conservation policies would also enable a more systematic approach to scaling up successful initiatives.

A critical weakness in current restoration efforts is the lack of standardized monitoring and evaluation frameworks, leading to uncertainty about the success and ecological impact of restoration activities. Many MPA managers reported being unsure whether their projects had achieved long-term ecological benefits. The literature review highlights the need for standardized indicators and monitoring protocols to ensure consistency in data collection and assessment. Incorporating advanced tools such as remote sensing, ecological modeling, and citizen science initiatives could improve the reliability of monitoring programs. Strengthening long-term monitoring frameworks would allow MPA managers to refine their restoration strategies and allocate resources more effectively.

Lastly, adopting a holistic, ecosystem-based approach is essential for ensuring the sustainability of restoration efforts. The survey results indicate that habitat restoration, particularly of seagrass meadows (Posidonia oceanica) and coralligenous reefs, remains the dominant focus, while broader ecological functions and connectivity receive less attention. The literature review advocates for integrated restoration strategies that move beyond single-species or single-habitat approaches. Incorporating biodiversity conservation, ecosystem connectivity, and climate resilience into restoration planning would significantly improve the long-term success of projects. Ecosystem-based management approaches should be prioritized to ensure that restoration contributes to broader ecological stability and resilience within Mediterranean MPAs.

5.1. Summary of Key Recommendations

The table below summarizes the key recommendations by integrating findings from both the survey and the literature review.

Priority Area	Key Actions	Supporting Evidence
Capacity Building and Training	Develop structured training programs focusing on **habitat and species restoration, planning and management, and financial**	**Survey results (Figure 17) indicate that "Habitat or Species Restoration" received the most Rank 1 responses (13),**

	sustainability, alongside policy frameworks, monitoring techniques, and stakeholder engagement. Utilize field-based learning and case studies to enhance practical application.	**confirming the demand for technical expertise. "Planning and Management" ranked second with 8 Rank 1 responses, while "Funding and Financing" also emerged as a critical area.** The literature review supports the need for structured, hands-on training to bridge the gap between theory and practice.
Financial and Institutional Support	Establish targeted funding mechanisms (e.g., grants, public-private partnerships) and integrate MPAs into national conservation funding schemes.	Survey identifies funding as a major barrier; literature review emphasizes the role of institutional backing and financial incentives.
Policy Integration and Coordination	Align MPA restoration activities with national and regional policies, enhance cross-border collaboration, and develop legal frameworks.	Survey shows many MPAs lack policy integration; literature review highlights the importance of coordinated management approaches.
Monitoring and Evaluation Strategies	Develop standardized indicators, monitoring protocols, and long-term assessment frameworks to improve restoration success tracking.	Survey reveals uncertainty about restoration effectiveness; literature review calls for structured monitoring approaches.

Holistic, Ecosystem-Based Approaches	Move beyond single-species and single-habitat restoration by incorporating biodiversity, ecosystem connectivity, and climate resilience.	Survey shows a strong focus on habitat restoration; literature review supports integrated ecosystem recovery strategies.

Table 2. Summary of key recommendations integrating findings from both the survey and the literature review.

5.2. Final Considerations

By addressing these key challenges, restoration efforts in Mediterranean MPAs can become more **effective, sustainable, and scalable**.

Achieving these improvements will require **coordinated action** from multiple stakeholders, including governments, conservation organizations, researchers, and local communities. Strengthening institutional capacity, securing long-term financial resources, aligning restoration policies, improving monitoring frameworks, and adopting ecosystem-based approaches will ensure that restoration efforts contribute meaningfully to long-term marine conservation goals.

The findings from this study reinforce that **while restoration efforts are underway in Mediterranean MPAs, major barriers, particularly in funding, knowledge, stakeholder engagement, and policy coordination, continue to hinder their effectiveness**. The literature supports these findings, indicating that enhancing capacity building, integrating restoration within national frameworks, and adopting ecosystem-based approaches are critical steps to improving restoration outcomes.

6. Best Practices and Case Studies in Mediterranean MPA Restoration

Restoration efforts in Mediterranean MPAs employ a range of approaches, including **active restoration**, such as habitat transplantation, and **passive restoration**, which focuses on conservation regulations and natural ecosystem recovery. To understand which strategies have been effective, this section presents **selected case studies** that highlight best practices in marine restoration across the region.

These examples are drawn from both the literature review and survey responses, providing a **comprehensive overview of real-world restoration applications**. The literature review offers **scientific and documented experiences**, while the survey responses provide **firsthand insights from MPA managers actively implementing restoration projects**.

6.1. Regional Case Studies

The following table summarizes key **restoration projects across the Mediterranean**, detailing **their primary restoration targets, applied strategies, and recorded outcomes**. These projects provide **valuable lessons on integrating restoration techniques with monitoring, policy frameworks, and stakeholder engagement**.

Project & Location	Restoration Target	Key Strategies	Outcomes	Source
Cabrera Archipelago National Park (Spain)	*Posidonia oceanica* Seagrass Meadows	Mooring regulations, long-term monitoring	Reduced anchoring impact, increased seagrass coverage	Literature Review
LIFE Blue Natura Project (Andalusia, Spain)	*Posidonia oceanica* Seagrass Meadows	Site selection using a multi-criteria approach	Improved restoration success through targeted interventions	Literature Review

Medes Islands Marine Reserve (Spain)	Gorgonian coral restoration	Artificial reef experiments, diving restrictions	Improved coral recruitment, enhanced reef complexity	Literature Review
Calanques National Park (France)	*Corallium rubrum* (Red Coral)	Artificial reef structures, transplantation	Increased coral survival and growth rates	Literature Review
Port-Cros National Park (France)	*Posidonia oceanica* Seagrass Meadows	Public awareness campaigns, anchoring management	Higher seagrass survival, reduced physical damage	Literature Review
Scandola Nature Reserve (France)	Fish populations & benthic communities	No-take zones, ecological monitoring	Increased fish biomass and species diversity	Literature Review
Portofino MPA (Italy)	Coralligenous habitats	Regulation of recreational activities, monitoring programs	Reduced human impact, stable habitat conditions	Literature Review
Tavolara-Punta Coda Cavallo MPA (Italy)	Coral restoration	Citizen science initiatives, strict protection measures	Greater community involvement, improved coral resilience	Literature Review
National Marine Park of Alonissos (Greece)	*Monachus monachus* (Monk Seal) Habitat	Access restrictions, habitat protection	Increased seal sightings and breeding success	Literature Review
Zakynthos National Marine Park (Greece)	*Caretta caretta* (Loggerhead Turtle)	Beach restoration, tourism	Improved nesting success,	Literature Review

		regulations, public awareness	reduced human disturbance	
Rhodes Islands (Greece)	Oyster reefs	Substrate addition, spat seeding	Higher recruitment rates, improved water filtration	Literature Review
Galite Archipelago (Tunisia)	Seabird colonies	Predator control, restricted human access	Stabilized populations of seabirds	Literature Review
Galite Archipelago (Tunisia)	*Patella ferruginea* (Endangered Limpet)	Active translocation	Increased population stability, reduced risk of extinction	Literature Review
Platamuni MPA (Montenegro)	Benthic habitats	Trawling restrictions, mooring regulations	Enhanced habitat recovery, reduced seabed degradation	Survey Responses
Gökova Bay MPA (Türkiye)	*Posidonia oceanica* Seagrass Meadows	No-take zones, fisheries management	Improved seagrass density, greater fish biomass	Survey Responses
Karaburun-Sazan National Marine Park (Albania)	*Epinephelus marginatus* (Dusky Grouper)	Artificial reefs, fishing bans	Recovery of fish populations, enhanced biodiversity	Survey Responses

Table 3. Key restoration projects across the Mediterranean, detailing restoration targets, applied strategies, and recorded outcomes.

These case studies demonstrate the importance of **site-specific restoration strategies**, integrating scientific research, regulatory frameworks, and community participation to ensure long-term success. The projects reinforce the **need for sustainable funding, adaptive management, and ecosystem-based approaches** to maximize

restoration impact.

6.2. General Recommendations for Best Practices

To strengthen future restoration efforts in Mediterranean MPAs, key best practice recommendations have been identified based on survey responses and literature review insights.

These recommendations emphasize the need for **policy integration, scientific data standardization, stakeholder involvement, and long-term financial sustainability**.

Focus Area	Recommendations	Supporting Evidence
Integration of Science & Policy	Ensure restoration activities align with national and regional strategies	Survey results show lack of policy integration; literature review emphasizes the need for cross-border cooperation
Monitoring & Data Standardization	Develop long-term ecological monitoring frameworks and standardized indicators	Lack of reliable data in survey results; literature highlights importance of data-driven adaptive management
Stakeholder Engagement	Increase collaboration between governments, NGOs, and the private sector	Case studies show strong outcomes from community-driven initiatives
Ecosystem-Based Approaches	Move beyond single-species restoration to broader ecosystem resilience	Literature supports connectivity-based restoration for long-term impact
Financial & Institutional Support	Establish sustainable funding mechanisms, including public-private partnerships	Funding identified as a major barrier in survey responses

Table 4. Best practice recommendations for Mediterranean MPA restoration, emphasizing policy integration, scientific data standardization, stakeholder involvement, and financial sustainability.

By applying these best practices, Mediterranean MPAs **can enhance the effectiveness and sustainability** of their restoration efforts, **ensuring long-term ecological resilience**.

7. Recommendations for Future Capacity Building

Ensuring the long-term sustainability of marine and coastal restoration in Mediterranean MPAs requires a structured capacity-building strategy that strengthens technical knowledge, policy implementation, and financial sustainability.

The following recommendations provide **actionable steps** to enhance restoration capacity.

Capacity Area	Recommendation	Description
Technical Training & Skill Development	Implement structured training programs on monitoring techniques, restoration methodologies, and policy frameworks	Survey reveals 82% of managers lack formal restoration training
Financial Mechanisms & Funding Access	Promote funding diversification, including grants, subsidies, and public-private partnerships	Survey and literature highlight financial constraints as a key barrier
Institutional Strengthening	Align MPAs with national conservation strategies for legal and administrative support	Literature review underscores the need for policy integration
Stakeholder & Community Involvement	Facilitate participatory approaches, including citizen science initiatives	Best practices show greater success when local stakeholders are involved

Adaptive Management & Long-Term Planning	Develop monitoring frameworks with standardized indicators and adaptive restoration strategies	Survey responses highlight the need for more reliable ecological data

Table 5. Strategic recommendations for enhancing restoration capacity across Mediterranean MPAs.

ANNEXES

Here is the complete set of **Annexes**, formatted in a structured manner with **tables and detailed redactions** to ensure consistency with the main report.

Annex 1: Structured Survey Questionnaire

This annex presents the **full structured survey questionnaire** used to collect data from MPA managers, restoration practitioners, and other stakeholders. The survey was designed to assess their restoration experience, challenges, competencies, policy integration, and training needs.

Question	Response Options
What type of organization do you represent?	MPA Management Authority, Government Agency, NGO, Research Institution, Environmental Consultancy, Private Sector, Other (Specify)
Which country and specific MPA do you work in?	Open-ended response
Do you have direct experience in marine and coastal restoration?	Yes / No
Are you involved in restoration projects inside a Marine Protected Area (MPA)?	Yes / No

Section 1: General Information

Section 2: Restoration Practices and Targets

Question	Response Options
What type of restoration is being implemented in your MPA?	Passive Restoration, Active Restoration, Hybrid Approaches, No restoration currently implemented
What are the main targets of restoration activities in your MPA?	Seagrass meadows (*Posidonia oceanica*), Coralligenous reefs, *Cystoseira* forests, Deep-sea ecosystems, Oyster and shellfish reefs, Other benthic habitats, Specific marine species (Specify)
Are your restoration activities linked to a national restoration plan?	Yes / No / Not sure
What are the key challenges preventing restoration in your MPA?	Rank from most to least critical: Lack of funding, Insufficient staff, Lack of baseline data, Limited equipment and technical expertise, Stakeholder conflicts, Regulatory barriers

Section 3: Monitoring and Evaluation

Question	Response Options
Does your restoration project include a monitoring and evaluation component?	Yes / No / In development

Which monitoring techniques are used?	Quadrat and transect surveys, Underwater visual census, Photogrammetry, Acoustic surveys, Remote sensing, Long-term monitoring stations
Which indicators are used to assess restoration success?	Species abundance and diversity, Habitat cover and extent, Biomass and size distribution, Water quality parameters, Recruitment rates

Section 4: Training and Capacity Building

Question	Response Options
Have you received training on marine and coastal restoration?	Yes / No
What are your self-assessed competency levels in the following areas?	Rate from 1 (No competence) to 5 (High competence) in: Ecosystem restoration principles and techniques, Restoration project planning and implementation, Monitoring and evaluation of restoration efforts, Stakeholder engagement in restoration projects, Policy and strategic frameworks for restoration
Would you be interested in receiving further training on marine restoration?	Yes / No / Maybe

Which topics should be prioritized in future training programs?	Habitat or species restoration, Restoration project planning and management, Policy and governance frameworks, Stakeholder engagement, Funding and financing mechanisms

Table A1. Structured survey questionnaire used to collect data from MPA managers, restoration practitioners, and other stakeholders.

Annex 2: Summary of Key Survey Findings

This annex presents the **main findings from the survey**, structured according to relevant themes.

1. Respondent Profile

Category	Findings
Experience in restoration	67% have direct experience in marine and coastal restoration
Work within MPAs	64% work on restoration projects inside MPAs
Geographic distribution	The majority of respondents work in Spain, France, Italy, Greece, Tunisia, Türkiye, Montenegro, and Albania

2. Restoration Implementation in MPAs

Category	Findings

MPAs with a management plan	83% of MPA managers have a management plan, but only 35% fully implement it
MPAs implementing restoration	62% of MPA managers conduct restoration activities
Most restored habitats	*Posidonia oceanica* (79%), Coralligenous reefs (54%), *Cystoseira* forests (25%)

3. Challenges and Barriers

Ranked Barrier	Severity
Lack of funding	Most critical
Insufficient staff	High
Lack of baseline data	High
Lack of equipment or expertise	Moderate
Stakeholder conflicts	Moderate
Regulatory barriers	Lower priority but present

4. Monitoring and Evaluation

Category	Findings
Projects with monitoring	46% have structured M&E components, while 18% lack any monitoring strategy
Common techniques used	Quadrat and transect surveys (64.4%), Underwater visual census (39.4%), Long-term monitoring stations (48.3%)

5. Training Needs

Category	Findings
Formal training received	82% of MPA managers have never received training
Interest in training	64.4% want training, 26.7% are uncertain
Priority topics	Restoration techniques, Monitoring and evaluation, Stakeholder engagement

Table A2. Summary of key survey findings, structured according to relevant themes.

Annex 3: Case Studies of Successful Restoration Initiatives in Mediterranean MPAs

This annex presents detailed case studies of **successful restoration initiatives** in Mediterranean Marine Protected Areas (MPAs), highlighting **key restoration strategies, ecological challenges addressed, and**

outcomes. These case studies are based on **survey responses and findings from the literature review**.

1. Cabrera Archipelago National Park (Spain)

Restoration Target	*Posidonia oceanica* Seagrass Meadows
Challenges Addressed	Damage from recreational anchoring, habitat fragmentation, and climate change effects.
Key Strategies	Introduction of environmentally friendly mooring buoys, **anchoring regulations**, and **long-term ecological monitoring** to track recovery trends.
Outcomes	Reduced direct human impact on seagrass meadows, with a measurable increase in **seagrass coverage and shoot density** in monitored areas over five years.

2. LIFE Blue Natura Project (Andalusia, Spain)

Restoration Target	*Posidonia oceanica* Seagrass Meadows
Challenges Addressed	Limited knowledge on blue carbon potential, lack of standardized restoration methodologies.
Key Strategies	Selection of **priority restoration sites** using a **multi-criteria approach**, integration of **blue carbon valuation** into conservation financing.

Outcomes	Increased restoration **success rates** through targeted site selection, strengthened financial justification for **seagrass conservation** via carbon offset mechanisms.

3. Medes Islands Marine Reserve (Spain)

Restoration Target	**Gorgonian coral populations**
Challenges Addressed	Coral degradation due to **diving pressure**, rising sea temperatures.
Key Strategies	Use of **artificial reef structures**, transplantation of damaged corals, and **seasonal diving restrictions**.
Outcomes	Enhanced coral **recruitment and growth**, with artificial reefs contributing to **higher species richness and reef complexity**.

4. Calanques National Park (France)

Restoration Target	***Corallium rubrum* (Red Coral)**
Challenges Addressed	Overharvesting for jewelry trade, slow natural recruitment.
Key Strategies	**Coral transplantation**, establishment of **no-take zones**, public awareness campaigns to reduce illegal harvesting.

Outcomes	Increased **survival and settlement rates** of transplanted coral, reduction in **illegal coral extraction** due to public engagement.

5. Port-Cros National Park (France)

Restoration Target	***Posidonia oceanica* Seagrass Meadows**
Challenges Addressed	Boat anchoring damage, coastal infrastructure expansion.
Key Strategies	**Zoning measures** to protect seagrass beds, **public awareness campaigns** on sustainable boating practices.
Outcomes	**Higher survival rates** of seagrass meadows, decline in **physical damage** from anchoring.

6. Scandola Nature Reserve (France)

Restoration Target	**Fish populations & benthic communities**
Challenges Addressed	Overfishing, habitat degradation.
Key Strategies	Implementation of **no-take zones**, enforcement of **fisheries management policies**, **long-term monitoring** of fish stocks.

Outcomes	Increase in **fish biomass and species diversity**, with spillover effects benefiting adjacent areas.

7. Portofino MPA (Italy)

Restoration Target	**Coralligenous habitats**
Challenges Addressed	Destructive fishing practices, recreational diving pressure.
Key Strategies	**Regulation of recreational activities**, enforcement of **protected zones**, ecological monitoring.
Outcomes	Reduction in **human impact**, stabilization of **coralligenous reef conditions**.

8. National Marine Park of Alonissos (Greece)

Restoration Target	***Monachus monachus* (Mediterranean Monk Seal) Habitat**
Challenges Addressed	Habitat destruction, human disturbance.
Key Strategies	**Access restrictions** in critical seal breeding areas, **habitat conservation programs**.
Outcomes	Increase in **monk seal sightings**, **higher breeding success rates**.

9. Zakynthos National Marine Park (Greece)

Restoration Target	*Caretta caretta* (Loggerhead Turtle) Nesting Sites
Challenges Addressed	Tourism-related habitat destruction, light pollution, beach erosion.
Key Strategies	**Beach restoration**, **tourism regulations**, **public awareness campaigns**.
Outcomes	**Improved nesting success**, reduced human disturbance.

10. Gökova Bay MPA (Türkiye)

Restoration Target	*Posidonia oceanica* Seagrass Meadows
Challenges Addressed	Unregulated fishing, loss of marine vegetation.
Key Strategies	Establishment of **no-take zones**, integration of **fisheries management**.
Outcomes	**Increased seagrass density**, **greater fish biomass**, improved ecological balance.

Table A3. Case studies of successful restoration initiatives in Mediterranean MPAs, highlighting key restoration strategies, ecological challenges addressed, and outcomes.

Annex 4: List of Survey Respondents and Stakeholders

The following organizations, institutions, and agencies **participated in the survey** or provided insights through **consultation and collaboration**.

Stakeholder Category	Institution/Organization Name	Country
MPA Management Authorities	Cabrera Archipelago National Park	Spain
	Medes Islands Marine Reserve	Spain
	Calanques National Park	France
	Port-Cros National Park	France
	Scandola Nature Reserve	France
	Portofino MPA	Italy
	Tavolara-Punta Coda Cavallo MPA	Italy
	National Marine Park of Alonissos	Greece
	Zakynthos National Marine Park	Greece
	Gökova Bay MPA	Türkiye

Government Agencies	French Marine Protected Areas Agency	France
	Hellenic Ministry of Environment	Greece
NGOs & Conservation Organizations	WWF Mediterranean	Multiple
	MedPAN (Mediterranean MPA Network)	Multiple
	BlueSeeds	France
	MARISTANIS Project	Italy
Research Institutions	Institut de Ciències del Mar (ICM-CSIC)	Spain
	STARESO Research Station	France
	University of Algarve	Portugal
	Hellenic Centre for Marine Research (HCMR)	Greece
Environmental Consultancies	ECOMERS Lab	France

	MERCES Project Partners	Multiple

Table A4. List of survey respondents and stakeholders, including MPA management authorities, government agencies, NGOs, conservation organizations, research institutions, and environmental consultancies.