



Restoration of Posidonia meadows (*Posidonia oceanica*) in Greece: **A policy proposal for effective implementation**

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Text:

Dimitra Syrou, Nature Policy Associate, The Green Tank
Ioli Christopoulou, Policy Director and Co-Founder, The Green Tank
Dr. Eugenia Apostolaki, Senior Researcher, IO, HCMR
Dr. Vassilios Gerakaris, Postdoctoral Researcher, IO, HCMR
Dr. Maria Salomidi, Senior Researcher, IO, HCMR

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**The Green Tank**

50 Vas. Sofias Ave.

Athens, 11528 Greece

T: +30 210 7233384

W: <https://thegreentank.gr>

E: info@thegreentank.gr

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The INTERREG Euro-MED ARTEMIS project (Accelerating the Restoration of Seagrass Meadows in the Mediterranean area through Innovative ecosystem-service based Solutions) aims to improve restoration techniques for Posidonia meadows (*Posidonia oceanica*), assess the ecosystem services they provide, and develop innovative approaches for integrating these services into both policymaking and investment decisions.



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Summary

The meadows formed by the marine angiosperm *Posidonia oceanica* (Posidonia meadows) constitute a priority habitat and a marine ecosystem of high ecological importance in the Mediterranean. These meadows play a key role in marine biodiversity conservation, coastal protection against erosion, water quality improvement, and carbon sequestration and storage, thereby delivering essential ecosystem services of significant environmental, social, and economic value. Despite the existence of a robust protection framework at international, European, and national level, Posidonia meadows remain subject to significant pressures, primarily resulting from uncontrolled anchoring, coastal development, pollution, eutrophication, aquaculture activities, and climate change.

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The adoption of Regulation (EU) 2024/1991 on Nature Restoration, together with the provisions of Law 5037/2023, establishes a new institutional framework that makes the restoration of degraded ecosystems a legal obligation for all 27 Member States of the European Union. However, in the case of *Posidonia oceanica* meadows, the transition from legal protection to systematic restoration continues to face significant implementation challenges. In particular, important gaps remain with regard to the absence of specialised definitions, a clear allocation of institutional responsibilities, formally established procedures for the spatial designation of restoration areas, technical specifications, monitoring mechanisms, and appropriate administrative instruments for the approval and implementation of restoration projects.

This proposal aims to address the identified gaps and support the effective implementation of Posidonia meadow restoration in Greece through the establishment of a dedicated, coherent, and operational institutional framework. The proposed framework is intended to enable the transition from fragmented or pilot interventions to the systematic implementation of restoration actions at national level. **The proposal has been developed following an analysis of the current institutional framework and an extensive stakeholder consultation process, and draws on specialized scientific knowledge presented in the Report entitled “Restoration of Posidonia Meadows: Scientific Guidance and Implementation Recommendations”¹. This Report serves as a key reference for the implementation of restoration actions,** and relevant parts thereof are included in the Annexes to this proposal.

The proposal covers the full restoration cycle, from the spatial designation of restoration areas to the implementation, monitoring, and adaptive management of interventions. In particular, it puts forward the following recommendations:

- **specifying the responsibilities of the competent authorities involved**, in particular the Ministry of Environment and Energy and the Natural Environment and Climate Change Agency (NECCA), as well as defining the role of implementing bodies;
- introducing a definition of **Priority Restoration Areas (PRAs)** and establishing a procedure for their scientific assessment, prioritization, and designation, both within and outside the National Restoration Plan;
- **establishing specialized technical guidance, based on the scientific protocols** set out in the Report by Gerakaris and colleagues (2026) and the relevant Annexes I and II thereto, with regard to restoration approach selection (passive or active restoration), as well as the design, implementation, and monitoring of restoration actions;
- **preparing and adopting Restoration Action Plans** as the principal

¹ Gerakaris, V., Apostolaki, E. Salomidi, M. (2026). Restoration of Posidonia meadows (*Posidonia oceanica*): Scientific Guidance, Implementation Recommendations, Technical Implementation Guide, and Decision-Making Tools. HCMR, Institute of Oceanography. 67 pages. <https://doi.org/10.5281/zenodo.19401230>

instrument for the design and implementation of restoration interventions; and

- **introducing mechanisms for both monitoring and effectiveness assessment, thereby enabling the adaptive management of restoration interventions.**

In addition, **the proposal sets forth targeted administrative and regulatory arrangements**, aiming to address existing implementation barriers, particularly with regard to the environmental permitting of restoration projects; the authorization of seabed use; the adoption of protection measures within intervention areas; and the strengthening of monitoring, compliance, and enforcement mechanisms.

This policy proposal places particular emphasis on the integration of scientific evidence into the implementation of restoration actions through the adoption of adaptive technical guidance based on the above-mentioned Report, which reflects the current best available knowledge. Given that ecosystem restoration constitutes a new and rapidly evolving field of policy and practice, it is further recommended that the relevant technical guidance be subject to regular revision and updating, thereby ensuring that restoration interventions remain aligned with scientific developments and implementation experience.

The institutionalization of the proposed measures is expected to establish a coherent and operational framework for the restoration of Posidonia meadows. Its implementation will support compliance with emerging European obligations and enable the long-term recovery of a flagship marine habitat of critical importance to Greece's natural capital, while strengthening climate resilience and supporting the sustainable development of the country's coastal and island regions.



Atzikiari Bay, Sitia, Crete

Introduction

Posidonia oceanica meadows are a priority habitat type and one of the most important marine ecosystems in the Mediterranean. They provide a wide range of ecosystem services, including coastal protection against erosion, water filtration, and carbon sequestration and storage. They also perform essential ecological functions, serving as nursery and breeding grounds for numerous marine organisms and fish species, while providing habitat and refuge for a rich diversity of marine life. *Posidonia* meadows are protected under national, European, and international legislation; nevertheless, in both the Mediterranean and Greece, they continue to face significant pressures from unregulated anchoring, aquaculture activities, climate change, and marine pollution. The resulting degradation and die-off of these meadows significantly undermine the ecosystem services they provide.

A legal framework for the ecological restoration of habitats -including *Posidonia* meadows- has been established through the adoption of Regulation (EU) 2024/1991 on Nature Restoration, as well as through the restoration targets and provisions set out in Greek legislation (Law 5037/2023). Nonetheless, the effective implementation of restoration actions is hindered by the absence of specific regulatory provisions; this shortcoming is particularly evident in the case of *Posidonia* meadows, given the complexity of this marine ecosystem and the lack of prior implementation experience.

The first section of this paper presents the ecological importance of *Posidonia* meadows, their current status, the main pressures they face, as well as the existing institutional framework for their protection at international, European, and national level, with particular emphasis on the state of play in Greece. The second section examines the concept of ecological restoration, analyzes the key definitions, and presents the existing legal and policy framework for ecosystem restoration, highlighting the main implementation gaps and institutional challenges related to the restoration of *Posidonia* meadows in Greece. The third section proposes the establishment of a specific institutional framework for the restoration of this particular habitat in Greece, with particular emphasis on definitions, allocation of responsibilities, planning and permitting procedures, technical guidelines, and monitoring and implementation mechanisms. Finally, the fourth section summarizes the main conclusions and assesses the prospects for the implementation of the proposal. It should be noted that the Annexes constitute an integral part of this proposal, as they include the Technical Implementation Guide and the Decision-Making Tools presented in the report entitled “*Restoration of Posidonia Meadows (Posidonia oceanica): Scientific Guidance and Implementation Recommendations*”², which serves as a key reference for the implementation of restoration actions.

Methodology for the development of the proposal

This proposal was developed through a multi-level process combining institutional analysis, participatory consultation, and scientific documentation, within the framework of the ARTEMIS project, under the Interreg Euro-MED program³.

As a first step, **a systematic review of the existing international, European, and national institutional framework** governing the protection, management, and restoration of marine ecosystems was undertaken. Focus was placed on the obligations arising from international conventions, EU legislation, and the relevant Greek legal framework, as well as on recent developments in the field of nature restoration, with special emphasis on the Regulation on

² Gerakaris, V., Apostolaki, E. Salomidi, M. (2026). Restoration of *Posidonia* meadows (*Posidonia oceanica*): Scientific Guidance, Implementation Recommendations, Technical Implementation Guide, and Decision-Making Tools. HCMR, Institute of Oceanography. 67 pages. <https://doi.org/10.5281/zenodo.19401230>

³ ARTEMIS Project. Accelerating the Restoration of Seagrass Meadows in the Mediterranean through Innovative Ecosystem-Service Based Solutions. Interreg Euro-MED Program, 2024–2026, <https://artemis.interreg-euro-med.eu/>

Nature Restoration and Law 5037/2023. Through this institutional mapping process, the key strengths of the existing framework were identified, together with significant gaps relating to implementation, specialization, and coordination, particularly in relation to Posidonia meadows.



In the second stage, **seventeen (17) in-depth semi-structured interviews were carried out** with key stakeholders directly or indirectly involved in the management, conservation, and restoration of Posidonia meadows. Interviewees were scientists and experts in marine ecosystems, as well as representatives of the competent public authorities and services, including the Ministry of Environment and Energy (MEEN), the Natural Environment and Climate Change Agency (NECCA), the Ministry of Culture (Ephorate of Underwater Antiquities), the Land Service, the Coast Guard, the Decentralized Administration, and representatives of the Region of Crete and the Municipality of Sitia.

Subsequently, the interview data were subjected to thematic analysis and organized around three principal axes:

- the ecological status and importance of Posidonia meadows,
- the existing institutional and administrative framework governing conservation and restoration, and
- the potential for the implementation of alternative financial instruments, with particular emphasis on Payments for Ecosystem Services (PES) schemes.

A key finding emerging from this analysis was the absence of a specialized and comprehensive institutional framework for the restoration of Posidonia meadows in Greece. While stakeholders demonstrated a high level of awareness of and engagement with the ecological importance of Posidonia meadows, significant weaknesses were identified in the practical implementation of the existing conservation and restoration framework. In particular, significant weaknesses and gaps were identified with regard to specialised procedures and permitting requirements for restoration projects, the allocation of institutional responsibilities, the absence of technical specifications and standards, the lack of mechanisms for integrating the latest scientific knowledge into restoration practice, and insufficient arrangements for the financing and systematic monitoring of restoration interventions.

At a third stage, the preliminary findings of the institutional analysis and stakeholder interviews served as the basis for a **participatory consultation process involving a broad range of stakeholders**. Within this context, a **working session** entitled “*Restoration of Posidonia Meadows: Institutional Framework, Challenges, and Prospects*” was held in Heraklion, Crete, on March 4, 2025⁴. This meeting included an interactive workshop with

⁴ The Green Tank. (2025). *Laying the foundations for the restoration of Posidonia: workshop with local stakeholders in Crete*. 5 March 2025. Available at: <https://shorturl.at/RiQ0t>

the participation of approximately fifty (50) representatives from public administration, local authorities, the scientific community, and civil society organizations. Several scenarios regarding the establishment of a national framework for the restoration of Posidonia meadows were examined through structured exercises and deliberations within mixed working groups; the discussions encompassed all key stages of the restoration process, including planning, licensing, implementation, and monitoring, as well as funding sources. The conclusions of this participatory process, together with the findings of the interviews and the institutional analysis, informed the formulation of the present proposal. Subsequently, the proposal was subject to targeted consultation with key institutional stakeholders, including the MEEN, the NECCA, and the Institute of Oceanography (IO) of the Hellenic Centre for Marine Research (HCMR), with a view to ensuring its scientific grounding, administrative compatibility, and feasibility of implementation at the national level.

In addition, a draft version of this policy proposal was presented during the workshop entitled “*Strengthening the Institutional Framework for Posidonia, with a Focus on Anchoring and Restoration*”, held as part of the **1st Greek Seagrass Forum**⁵. Representatives from a range of public authorities participated in the workshop and provided valuable feedback on both the overall approach and the individual proposals, during and following the meeting. Their comments were taken into account in the finalisation of the present proposal.

This proposal focuses on the restoration of Posidonia meadows; nonetheless, several of the recommended instruments and procedures -such as key definitions, planning stages, and monitoring mechanisms- may also contribute to the specification of restoration processes for other marine angiosperm species or related marine habitats.

It should be noted that the findings of the consultation process, together with those of the partners of the Interreg Euro-MED ARTEMIS project, informed the preparation of a policy paper aimed at accelerating the restoration of Posidonia meadows across the Mediterranean⁶. The latter puts forth recommendations -not included in the present document- regarding the need to secure adequate funding for restoration actions, while further exploring alternative instruments for the mobilization of private sector financing.

The **scientific basis** underpinning the formulation of this proposal is provided by the report entitled “*Restoration of Posidonia Meadows (Posidonia oceanica): Scientific Guidance and Implementation Recommendations*” by Gerakaris and colleagues (2026), as well as its accompanying annexes (I. Technical Implementation Guide and II. Decision-Making Tools)⁷. The scientific guidance and recommendations are based on the knowledge and experience acquired through the implementation of national programs under the Habitats Directive (92/43/EEC), the Water Framework Directive (2000/60/EC), and the Marine Strategy Framework Directive (2008/56/EEC), as well as through European research initiatives and pilot restoration projects across the Mediterranean.

In particular, the aforementioned Report provides specialized technical guidance for key stages of restoration, including the selection and prioritization of intervention areas, suitability criteria, methodologies for passive and active restoration, and protocols for monitoring and assessing intervention effectiveness. Within this policy proposal, the Report and its annexes constitute the key reference for defining the technical aspects of restoration and form an integral part thereof, providing the necessary scientific depth and operational guidance for the implementation of the proposed measures. Moreover, selected parts of this Report are reproduced in the Annexes to this proposal, with corresponding references provided in the main text. In this manner, institutional provisions are explicitly linked to scientific tools and methodologies, thereby ensuring that the proposed governance framework is grounded in the latest scientific knowledge and practical experience.

⁵ The workshop was co-organised by the Cyclades Preservation Fund, the Hellenic Centre for Marine Research (HCMR), The Green Tank, WWF Greece and the Greek Island Seagrass Alliance. <https://seagrassalliance.gr/oloklirothike-to-to-greek-seagrass-forum-stin-athina/>

⁶ ARTEMIS Project. (2026). *Policy recommendations (Deliverable D.4.2.1)*. Interreg Euro-MED Program. To be published.

⁷ Gerakaris, V., Apostolaki, E. Salomidi, M. (2026). *Restoration of Posidonia meadows (Posidonia oceanica): Scientific Guidance, Implementation Recommendations, Technical Implementation Guide, and Decision-Making Tools*. HCMR, Institute of Oceanography. 67 pages. <https://doi.org/10.5281/zenodo.19401230>

1 Posidonia meadows

Posidonia oceanica is an endemic marine angiosperm of the Mediterranean and the dominant seagrass species in the region. It forms extensive and long-lived meadows at depths of 1–40 meters, covering approximately 28,000 square kilometers⁸. These meadows constitute one of the most important coastal ecosystems in the Mediterranean, providing a wide range of ecosystem services. As “ecosystem engineers”, they create structurally complex habitats that host a high diversity of organisms and provide shelter, feeding, and spawning grounds for numerous marine and coastal species (e.g. fish, sea turtles, marine mammals, and seabirds). Consequently, Posidonia meadows play a vital role in preserving marine biodiversity⁹.

In addition, Posidonia meadows attenuate current and wave intensity, thereby contributing to coastal protection against erosion, and trap suspended particles, thereby improving water quality¹⁰. Moreover, they constitute important “blue carbon” reservoirs¹¹, thus significantly contributing to climate change mitigation through long-term carbon sequestration and long-term carbon storage.

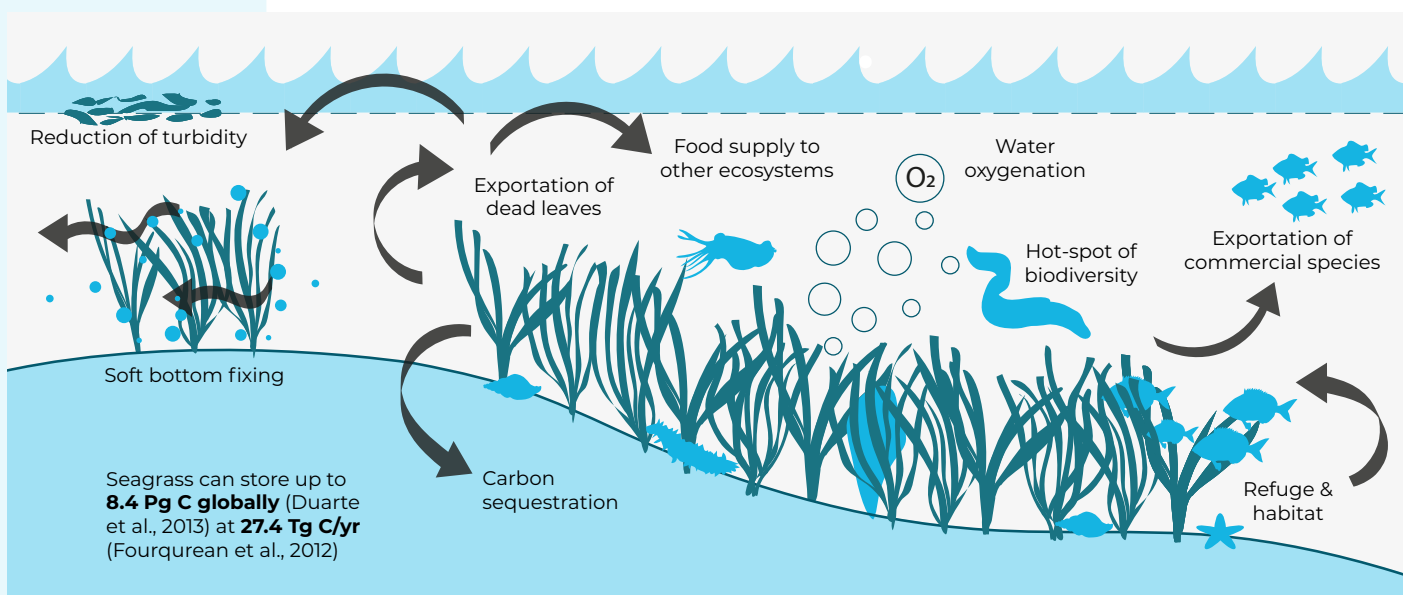


Image 1: Posidonia Meadows Ecosystem Services. Source: Ecoacsa & EY Denkstatt (2025)

⁸ Pergent-Martini, C., Leoni, V., Pasqualini, V., Ardizzone, G., Balestri, E., Bedini, R., et.al. (2021). Descriptors of *Posidonia oceanica* meadows: Use and application. *Marine Environmental Research*, 100, 101–123. <https://doi.org/10.1016/j.meres.2020.100504>

⁹ Duarte, C. M., Apostolaki, E. T., Serrano, O., Steckbauer, A., & Unsworth, R. K. F. (2025). Conserving seagrass ecosystems to meet global biodiversity and climate goals. *Nature Reviews Biodiversity*, 1(3), 150–165. <https://doi.org/10.1038/s44358-025-00028-x>

¹⁰ Gacia, E., Duarte, C. M., & Middelburg, J. J. (2002). Carbon and nutrient deposition in a Mediterranean seagrass (*Posidonia oceanica*) meadow. *Limnology and Oceanography*, 47(1), 23–32. <https://doi.org/10.4319/lo.2002.47.1.0023>

¹¹ Fourqurean, J. W., Duarte, C. M., Kennedy, H., Marbà, N., Holmer, M., Mateo, M. A., ... Serrano, O. (2012). Seagrass ecosystems as a globally significant carbon stock. *Nature Geoscience*, 5(7), 505–509. <https://doi.org/10.1038/ngeo1477>

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These ecological functions also have an important socio-economic dimension, as they directly support fisheries and tourism and are associated with cultural ecosystem services, including recreation and aesthetic value¹².

The ecosystem services provided by *Posidonia* meadows have been extensively documented and are increasingly recognized at both scientific and policy levels. Furthermore, efforts to assess their economic value are ongoing. According to global estimates, seagrass meadows provide ecosystem services with an estimated total value of approximately EUR 5.57 trillion annually.¹ However, valuing the ecosystem services provided by *Posidonia oceanica* meadows, particularly at the local and site-specific levels, remains a significant challenge. Relevant estimates vary considerably in the international literature, reflecting differences in valuation methodologies and in the range of ecosystem services included across studies. In particular, Campagne and colleagues (2015)¹³ estimate the value of *P. oceanica* ecosystem services at 283–513 €/ha/year, focusing primarily on carbon sequestration and storage. By contrast, more comprehensive approaches that consider the full range of ecosystem services (such as coastal protection, biodiversity, and recreation) produce substantially higher values. For instance, Stamatopoulou and colleagues (2020)¹⁴ estimate the average value of Mediterranean seagrass meadows at 8,712 Int\$/ha/year. To this end, relevant methodologies continue to be developed and tested, as was the case under the **ARTEMIS**¹⁵ project. At the same time, efforts to quantify the economic consequences of seagrass loss are also intensifying. For example, recent estimates suggest that the loss of carbon stocks stored in seagrass meadows could result in a social cost of approximately **USD 213 billion** (2020 prices)¹⁶.

The growing recognition of the economic value of the ecosystem services provided by *Posidonia oceanica* meadows has generated considerable interest among private-sector stakeholders in their protection and restoration. This interest is particularly important in addressing the financing gap that characterises nature conservation and restoration more broadly, and *Posidonia oceanica* restoration in particular, given that public funding alone is insufficient to meet the required investment needs.

Beyond being the recipient of donations and philanthropic funding, *Posidonia oceanica* meadows are increasingly attracting interest as an investment opportunity. Businesses and financial institutions are becoming more aware of the economic risks associated with biodiversity loss, while also recognising the benefits of investments whose returns are linked to sustainability performance. As a result, they are increasingly incorporating nature-related investments into their financial portfolios. In this context, the European Commission has proposed the development of **Nature Credits**, an initiative that is currently under development¹⁷. The **ARTEMIS** project is specifically exploring the potential for developing Nature Credits for *Posidonia oceanica*.¹⁸

¹² Foster, N. R., Apostolaki, E. T., DiBenedetto, K., Duarte, C. M., Gregory, D., Inostroza, K., Krause-Jensen, D., Jones, B. L. H., Serrano, E., Zakhama-Sraieb, R., & Serrano, O. (2025). Societal value of seagrass from historical to contemporary perspectives. *Ambio*, 54(8), 1289–1305. <https://doi.org/10.1007/s13280-025-02167-z>

¹³ Campagne, C. S., Salles, J.-M., Boissery, P., & Deter, J. (2015). The seagrass *Posidonia oceanica*: Ecosystem services identification and economic evaluation of goods and benefits. *Marine Pollution Bulletin*, 97(1–2), 391–400. <https://doi.org/10.1016/j.marpolbul.2015.05.061>

¹⁴ Stamatopoulou, A., et al. (2020). Ecosystem services provided by Mediterranean seagrass meadows: A valuation at the regional scale. *Ocean & Coastal Management*, 184, 105050. <https://doi.org/10.1016/j.ocecoaman.2019.105050>

¹⁵ Apostolaki, E. T., Garcia-Escudero, C. A., Gerakaris, V., Skouradakis, G., Dailianis, T., Francesca, F., Cinti, M. F., Congiu, M., Campisi, T., Ulazzi, E., Guala, I., Piazza, L., Marsinyach, E., Estaún, I., Serrano, O., Foster, N., Terrados, J., Castejón, I., Triay, R., Miotti, C., Rismondo, A., & Orescanin, R. (2024). *Deliverable 1.2.1: Pilot Ecosystem Service Baseline. ARTEMIS – Accelerating the Restoration of Mediterranean Seagrass Meadows through Innovative Ecosystem-Service-Based Solutions*.

¹⁶ Krause, J. R., Cameron, C., Arias-Ortiz, A., Cifuentes-Jara, M., Crooks, S., Dahl, M., Friess, D. A., Kennedy, H., Lim, K. E., Lovelock, C. E., Marbà, N., McGlathery, K. J., Oreska, M. P. J., Pidgeon, E., Serrano, O., Vanderklift, M. A., Wong, L.-W., Yaakub, S. M., & Fourqurean, J. W. (2025). Global seagrass carbon stock variability and emissions from seagrass loss. *Nature Communications*, 16(1), 3798. <https://doi.org/10.1038/s41467-025-59204-4>

¹⁷ European Commission. (2025, July 7). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Roadmap towards Nature Credits* (COM(2025) 374 final). https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=comnat%3ACOM_2025_0374_FIN

¹⁸ ARTEMIS. (2025). *Investment Opportunities in Seagrass Restoration*. Interreg. Euro-MED ARTEMIS. <https://artemis.interreg-euro-med.eu/investment-opportunities-in-seagrass-restoration/>

Current Status and Pressures

Despite their significant ecological and socio-economic value, *Posidonia* meadows have undergone widespread degradation and a substantial reduction in their spatial extent over recent decades. This degradation is primarily attributed to multiple anthropogenic pressures, including pollution, coastal development, mechanical disturbance of the seabed (e.g. anchoring, dredging, channel deepening, and bottom-trawl fishing), as well as the impacts of climate change^{19,20,21}. These pressures adversely affect key ecophysiological and biogeochemical processes within *Posidonia* meadows, including primary productivity and their capacity for carbon sequestration and storage. As a result, they compromise the critical role that seagrass meadows play in the provision of ecosystem services, particularly climate change mitigation and biodiversity conservation. According to the most recent assessment under the European Union Habitats Directive (reporting period 2013–2018), the conservation status of *Posidonia* meadows in the Mediterranean is classified as “Unfavourable–Inadequate” (U1), the same classification assigned during the previous reporting period (2007–2013)²².

Institutional Framework for the Protection of *Posidonia* Meadows

Due to its high ecological importance, *Posidonia oceanica* is protected under a multi-level institutional framework comprising international conventions; regional instruments for the Mediterranean; EU legislation on biodiversity conservation; as well as relevant national legislation adopted by individual Mediterranean states. Even though the species is not explicitly referenced in all relevant international instruments, the protection of *Posidonia oceanica* -and the meadows it forms- falls within the scope of broader targets addressing marine ecosystem conservation, biodiversity loss reversal, and “blue carbon” ecosystem enhancement. Table 1 summarizes the key international, regional, and European instruments contributing to the protection of *Posidonia* meadows.

Table 1: Key international, regional, and European instruments for the protection of *Posidonia* meadows

Level	Institutional / Policy instrument	Year	Relevance to <i>Posidonia</i> meadows/ seagrass meadows
International	Convention on Biological Diversity (CBD) ²³	1992	Promotes biodiversity and ecosystem conservation
International	Kunming–Montreal Global Biodiversity Framework ²⁴	2022	Sets global targets regarding Marine Ecosystem Conservation and Spatial Planning
International	Ramsar Convention on Wetlands ²⁵	1971	Covers shallow coastal ecosystems where seagrass meadows occur
International	Bern Convention ²⁶	1979	Promotes the conservation of natural habitats and species of wild flora and fauna

¹⁹ Telesca, L., Belluscio, A., Criscoli, A., Ardizzone, G., Apostolaki, E., Frascchetti, S., Gristina, M., Knittweis, L., Martin, C., Pergent, G., Piazzì, L., Salomidi, M., & Pergent-Martini, C. (2015). Seagrass meadows (*Posidonia oceanica*) distribution and trajectories of change. *Scientific Reports*, 5, 12505. <https://doi.org/10.1038/srep12505>

²⁰ Marbà et al. Marbà, N., Díaz-Almela, E., & Duarte, C. M. (2014). Mediterranean seagrass (*Posidonia oceanica*) loss between 1842 and 2009. *Biological Conservation*, 176, 183–190.

²¹ Litsi-Mizan, V., García-Escudero, C.A., Tsigenopoulos, CS, Tsiaras, K., Gerakaris V., Apostolaki, E.T. (2024) Unravelling the genetic pattern of seagrass (*Posidonia oceanica*) meadows in the Eastern Mediterranean Sea. *Biodiversity and Conservation* 33 (1), 257–280

²² Krause, J. R., Cameron, C., Arias-Ortiz, A., Cifuentes-Jara, M., Crooks, S., Dahl, M., Friess, D. A., Kennedy, H., Lim, K. E., Lovelock, C. E., Marbà, N., McGlathery, K. J., Oreska, M. P. J., Pidgeon, E., Serrano, O., Vanderklift, M. A., Wong, L.-W., Yaakub, S. M., & Fourqurean, J. W. (2025). Global seagrass carbon stock variability and emissions from seagrass loss. *Nature Communications*, 16(1), 3798. <https://doi.org/10.1038/s41467-025-59204-4>

²³ Convention on Biological Diversity. (1992). *Convention on Biological Diversity*. <https://www.cbd.int/convention/>

²⁴ Convention on Biological Diversity. (2022). *Kunming–Montreal Global Biodiversity Framework*. <https://www.cbd.int/gbif/>

²⁵ Convention on Wetlands of International Importance especially as Waterfowl Habitat. (1971, February 2). *Ramsar Convention*. <https://www.ramsar.org/>

²⁶ Council of Europe. (1979). *Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)*. <https://www.coe.int/en/web/bern-convention>

International	Bonn Convention (CMS) ²⁷	1979	Addresses the conservation of migratory species habitats
International	UNFCCC ²⁸	1992	Recognizes the role of natural ecosystems in climate stability
International	Paris Agreement ²⁹	2015	Enhances the protection of natural carbon reservoirs
Regional	Barcelona Convention ³⁰ & SPA/BD Protocol ³¹	1976 / 1995	Identifies Posidonia meadows as priority habitats and designates them as SPAMIs, thereby promoting their conservation
EU	Habitats Directive ³²	1992	Designates Posidonia meadows as Priority habitat 1120*, protected through designation as Special Areas of Conservation (Natura 2000 sites)
EU	Water Framework Directive ³³	2000	Recognizes Posidonia meadows as a biological quality element for the assessment of the ecological status of waters
EU	Marine Strategy Directive ³⁴	2008	Promotes the maintenance of marine ecosystems' favorable environmental status
EU	EU Biodiversity Strategy 2030 ³⁵	2020	Sets targets for the protection of at least 30% of EU marine areas and for strengthening protected areas
EU	Common Fisheries Policy ³⁶ & Mediterranean Fisheries Regulation ³⁷	2006	Prohibits the use of bottom-towed fishing gear in Posidonia meadows

In addition, the protection of Posidonia meadows is further reinforced by general legislative provisions on biodiversity, marine ecosystems, and environmental conservation.

The status of Posidonia meadows in Greece

In Greece, Posidonia meadows cover **an estimated** more than 2,500 square kilometers of seabed and are distributed along approximately 70% of the country's coastline ³⁸.

²⁷ Convention on the Conservation of Migratory Species of Wild Animals. (1979, June 23). *Bonn Convention*. <https://www.cms.int/>

²⁸ United Nations Framework Convention on Climate Change (UNFCCC). (n.d.). *United Nations Framework Convention on Climate Change*. <https://unfccc.int/process-and-meetings/united-nations-framework-convention-on-climate-change>

²⁹ United Nations. (2015, December 12). *Paris Agreement*. <https://unfccc.int/paris-agreement>

³⁰ United Nations Environment Program. (1976, February 16). *Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention)*. <https://www.unep.org/unepmap/who-we-are/barcelona-convention>

³¹ SPA/BD protocol, Available at: https://www.rac-spa.org/sites/default/files/protocole_aspdp/protocol_eng.pdf

³² Council of the European Communities (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive). <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:31992L0043>

³³ European Parliament & Council of the European Union (2000). Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive). <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32000L0060> <https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:32000L0060>

³⁴ European Parliament and Council of the European Union (2008). Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for Community action in the field of marine environmental policy (Marine Strategy Framework Directive). <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32008L0056>

³⁵ European Commission. (2020). EU Biodiversity Strategy for 2030: Bringing nature back into our lives. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, 20 May 2020. <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0380>

³⁶ European Commission. (2023) Common Fisheries Policy (CFP) https://oceans-and-fisheries.ec.europa.eu/policy/common-fisheries-policy-cfp_en

³⁷ Council of the European Union. (2006). Council Regulation (EC) No 1967/2006 of 21 December 2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea. <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:02006R1967-20260110>

³⁸ Panayotidis, P. et al., 2022. Seagrass meadows in the Greek Seas: presence, abundance and spatial distribution. *Botanica Marina*, 65.

According to the habitat conservation status assessment under the **EU Habitats Directive (92/43/EEC)**, habitat type **1120*** (*Posidonia oceanica* meadows) in Greece is classified as **“Unfavourable–Inadequate” (U1)**³⁹. This overall U1 assessment is primarily attributed to future conservation prospects and to existing pressures affecting the habitat’s extent, spatial continuity, and connectivity at the local scale. Consequently, the U1 classification does not reflect widespread functional degradation of *Posidonia* meadows but rather localized pressures that may compromise the habitat’s long-term conservation.

In contrast, the “Structure and Functions” parameter is assessed as “Favourable” (FV), indicating that, in terms of ecological functioning, the existing *Posidonia* meadows maintain their structural integrity and key functional processes. However, this picture is not uniform across all areas. At the local scale, signs of degradation of the seagrass community and declines in the abundance of associated species have been recorded, reflecting spatially localized pressures without altering the overall assessment of the “Structure and Functions” parameter as Favourable (FV).

According to monitoring and assessment data compiled under the Marine Strategy Framework Directive⁴⁰ (2018–2023), the total extent of *Posidonia* meadows in Greece has not declined by more than 2% relative to the estimated natural reference area. In addition, Greece’s monitored benthic ecosystems are assessed as being in “Good Environmental Status” (GES). Nevertheless, significant spatial variations and localized pressures persist, particularly as a result of eutrophication and unregulated anchoring.

At the same time, implementation data under the Water Framework Directive (2000/60/EC)⁴¹, combined with targeted research activities, confirm the spatial variability in the ecological condition of *Posidonia oceanica* meadows. Localised deviations from Good Ecological Status are observed primarily in semi-enclosed bays and estuarine areas affected by eutrophication, agricultural runoff and aquaculture activities.

Posidonia oceanica is used as a key **biological quality element** under both the ****Water Framework Directive (2000/60/EC)****¹ and the **Marine Strategy Framework Directive**,² yet the existing mapping and monitoring datasets remain fragmented and are often limited to specific geographic areas or individual research projects. Monitoring coverage is restricted both in terms of the number of monitoring stations and the areas surveyed, meaning that there is no comprehensive and representative picture of the ecological condition of *Posidonia oceanica* meadows along the Greek coastline, while many potential meadows remain effectively “blind spots”.

To date, no national conservation target has been established for *Posidonia oceanica* meadows, as is the case for most marine habitat types, under the relevant Ministerial Decision of 2021.⁴² Although scientific knowledge of *Posidonia oceanica* meadows has expanded considerably in recent years, significant gaps remain regarding their current condition and systematic monitoring.⁴³ It is noteworthy that, in the Ministerial Decision establishing site-specific conservation objectives,⁴ for a significant number of Natura 2000 sites and parameters relating to habitat type **1120***, target values and/or specific conservation objectives are recorded as **“insufficient data”**, highlighting the existing scientific, technical and management gaps in the assessment, monitoring and implementation of conservation

³⁹ National Surveillance Reports under Article 17 of Directive 92/43/EEC (Period 2007-2012bis, 2013-2018 & 2019-2024). <https://nature-art17.eionet.europa.eu/article17/> and <https://www.eionet.europa.eu/etcs/etc-be/activities/reporting/article-17>

⁴⁰ Reizopoulou, S., Smith C., Papadopoulou K., Drakopoulou P., Gerakaris V., et al. (2025). Assessment of the Environmental Status of Greece's Marine Sub-Areas for the Period 2018-2023. Descriptor D6: Seafloor Integrity. HCMR & INALE, June 2025. https://ypen.gov.gr/wp-content/uploads/2025/09/MSFD_D6_Assessment_2018-2023.pdf

⁴¹ National Database and River Basin Management Plans: Approved River Basin Management Plans – 2nd Revision.

⁴² Ministerial Decision ΥΠΕΝ/ΔΔΦΠΒ/30339/982/31.3.2021, *Establishing National Conservation Objectives for Natural Habitat Types and Species of Union Interest* (Government Gazette, Series II, No. 1375).

⁴³ Gerakaris, V., Apostolaki, E., & Salomidou, M. (2026). *Restoration of Posidonia oceanica Meadows: Scientific Guidance, Implementation Recommendations, Technical Implementation Manual and Decision-Support Tools*. Hellenic Centre for Marine Research (HCMR), Institute of Oceanography, p. 67. <https://doi.org/10.5281/zenodo.19401230>

and restoration measures⁴⁴. This Decision is expected to be updated following the completion of the assessment of data collected during the **2019–2024 reporting period**.

The need for up-to-date knowledge on the condition and extent of marine habitats has become even more pressing in the context of the EU Nature Restoration Regulation, which requires Member States to have reliable and comparable data on the condition of the habitat types falling within its scope.

The principal pressures and threats affecting *Posidonia oceanica* meadows are associated with **the intensity and spatial interaction** of human activities and uses in the marine and coastal environment, particularly where these are not planned or implemented in accordance with **the ecosystem-based approach** and the principles of adaptive management. These pressures include uncontrolled anchoring, coastal development, pollution and eutrophication, aquaculture, subsea engineering works and, more generally, **any disturbance affecting the integrity of the seabed and the composition of the water column**. Climate change also constitutes a significant **pressure on** *Posidonia oceanica* meadows. In this regard, the initiative of the **Ministry of Tourism** to establish an **Eastern Mediterranean Marine and Coastal Tourism Observatory**⁴⁵, with the aim of strengthening the monitoring of marine and coastal tourism activities and supporting policies for sustainable development and the protection of marine ecosystems, may contribute to **more systematic** collection of data on pressures arising from **this sector**.

Indeed, implementation data reported under the Water Framework Directive⁴⁶, together with targeted research initiatives, confirm the spatial differentiation of *Posidonia* meadows' ecological status. Deviations from Good Ecological Status are observed primarily in semi-enclosed bays and estuarine areas affected by eutrophication, agricultural runoff, and aquaculture activities.

Unregulated anchoring, coastal construction and development, pollution and eutrophication, aquaculture activities, and seabed disturbances are identified as the main pressures affecting *Posidonia* meadows.

Even though scientific knowledge regarding *Posidonia* meadows has expanded considerably in recent years, significant gaps persist in relation to the monitoring and assessment of their actual status⁴⁷. *Posidonia* is used as a key biological quality element under both the Water Framework Directive and the Marine Strategy Framework Directive. Nonetheless, to date, mapping and data collection efforts remain fragmented and are often confined to specific areas or individual research projects. Consequently, data collection and monitoring sites remain limited, resulting in the absence of a complete and representative overview of the Greek coastline as a whole. In addition, several potential *Posidonia* meadows remain effectively unrecorded, constituting “blind spots”. The need to ensure systematic information on the status and extent of marine habitats has become increasingly urgent in the context of the Regulation on Nature Restoration, which requires Member States to provide reliable data on the status of habitats falling within its scope.

At national level, pursuant to Article 28 par. 1 of the Constitution, international conventions -as referred to above and duly ratified by Greece- prevail over any contrary provision of domestic law. Furthermore, Article 24 of the Constitution explicitly enshrines the protection of the natural environment as a fundamental obligation of the State.

⁴⁴ Ministerial Decision ΥΠΕΝ/ΔΔΦΠΒ/24776/985/7.3.2023, *Establishing Conservation Objectives for the Natural Habitat Types Listed in Annex I and the Species Listed in Annex II to Directive 92/43/EEC in Special Areas of Conservation and Sites of Community Importance of the Natura 2000 National Ecological Network* (Government Gazette, Series II, No. 1807).

⁴⁵ Ministry of Tourism. (2024). *Launch Event of the Eastern Mediterranean Coastal and Maritime Tourism Observatory*. Press Release, 7 October 2024. <https://mintour.gov.gr/ekdilosi-gia-tin-enarxi-leitoyrghias-toy-paratiritirioy-paraktioy-kai-thalassioy-toyrmoy-stin-anatoliki-mesogeio/>

⁴⁶ National Database and River Basin Management Plans: Approved River Basin Management Plans – 2nd Revision – River Basin Management Plans

⁴⁷ Gerakaris, V., Apostolaki, E. Salomidi, M. (2026). Restoration of *Posidonia* meadows (*Posidonia oceanica*): Scientific Guidance, Implementation Recommendations, Technical Implementation Guide, and Decision-Making Tools. HCMR, Institute of Oceanography. 67 pages. <https://doi.org/10.5281/zenodo.19401230>

Greece has transposed and implemented the relevant EU environmental legislation, particularly in the fields of biodiversity conservation, water management, protected areas and marine spatial planning, thereby establishing a robust legal framework for the protection of *Posidonia oceanica* and providing the basis for its implementation. *Posidonia oceanica* meadows have been designated as Special Areas of Conservation (SACs) within the Natura 2000 network, particularly following the expansion of the network in 2007. In addition, they are protected by regulatory provisions aimed at preventing degradation resulting from pollution, development projects and other potentially harmful activities.

In addition, Greece has adopted national legislation containing provisions relating to ecosystem conservation. Law 3937/2011⁴⁸ on biodiversity conservation establishes protection measures for species and habitats; in particular, Article 9 (par. 1(d)) prohibits the siting of aquaculture facilities over *Posidonia* meadows within Natura 2000 sites.

In parallel, in the context of the implementation of the Mediterranean Regulation (Regulation (EC) No 1967/2006), national seabed mapping has been carried out and fisheries restricted areas have been established to limit the use of towed fishing gear, with the aim of protecting vulnerable benthic habitats, including *Posidonia oceanica* meadows⁴⁹. Top of Form Bottom of Form

Alongside these legislative developments, Greece has, in recent years, undertaken important policy commitments at high-level international fora; these commitments serve as strategic instruments guiding national marine policy. In particular, during the 2024 Our Ocean Conference⁵⁰ held in Athens, Greece announced a series of commitments concerning, inter alia, the strengthening of marine biodiversity conservation; the expansion and effective management of marine protected areas; the reduction of pressures arising from anthropogenic activities; and the promotion of restoration and blue carbon initiatives in the Mediterranean. A flagship commitment is the designation of two new National Marine Parks in the Ionian Sea and the Southern Aegean Sea. According to the approved Special Environmental Studies underpinning their protection framework, these parks will encompass extensive *Posidonia oceanica* meadows, under a special management regime.

In terms of legal principles and binding commitments, the existing institutional framework for the protection of *Posidonia oceanica* meadows is particularly robust. Their protection is founded on a multi-layered system of international, European and national legal instruments. Nevertheless, despite this strong legal framework, significant gaps remain, primarily with regard to the implementation and further specification of the relevant policies. International and national assessments indicate that marine protected areas cover approximately 18% of Greece's territorial waters. However, a substantial proportion of these areas remain effectively "paper parks", as more than 90% of Greece's protected marine waters lack adequate management, surveillance and substantive regulation of human activities.^{51,52} Although the Natura 2000 network and the two National Marine Parks currently under designation provide an important institutional basis for the protection of *Posidonia oceanica* meadows, the absence of approved Presidential Decrees establishing protection zones and conditions, together with the lack of operational Management Plans, means that the protection of these meadows remains, to a large extent, theoretical.

The implementation gap becomes particularly evident in relation to activities known to cause immediate or cumulative degradation of seagrass meadows, such as anchoring,

⁴⁸ Law 3937/2011. Biodiversity conservation and other provisions (GG A 60).

⁴⁹ MD 167378/2007: Designation of marine areas where *Posidonia oceanica* occurs, in which fishing with towed gears is prohibited (GG D 241); MD 2442/51879/28.4.2016 Designation of marine areas, outside the Natura 2000 Network, with vegetation consisting in particular of *Posidonia oceanica*, in which fishing with specific gears is prohibited (GG D 118); MD 2886/142447/2019 Designation of marine areas with vegetation consisting in particular of *Posidonia oceanica*, in which fishing with specific gears, other than those specified in MD 167378/14.5.2007 of the Ministry of Rural Development and Food (GG D 241), is prohibited (GG D 105).

⁵⁰ Our Ocean Conference 2024. (2024). Greece's Commitments. https://www.ourocean2024.gov.gr/wp-content/uploads/2024/04/A5_OOC-9_PROPOSED-COMMITMENTS_12.4.pdf

⁵¹ Lialios, G. (2025, April 11). *Marine Protected Areas: Protection Only "on Paper"*. Kathimerini. <https://www.kathimerini.gr/visual/infographics/563558212/thalassies-perioches-prostasia-mono-sta-chartia/>

⁵² Boudouresque C. F., Bernard G., Bonhomme P., Charbonnel E., Diviacco G., Meinesz A., Pergent G., Pergent-Martini C., Ruitton S., Tunesi L., (2012). *Protection and conservation of Posidonia oceanica meadows*. RAMOGE and RAC/SPA publisher, Tunis: 1-202.

fishing with towed gear, aquaculture siting, and coastal urban development⁵³. For instance, a relevant report by WWF Greece⁵⁴ highlights that, despite the existence of important European and national conservation provisions, their implementation remains limited and often fragmented, particularly with regard to pressures such as anchoring and other activities causing physical damage to *Posidonia* meadows. Furthermore, other analyses^{55,56} underline the need to revise the regulatory provisions governing the siting of aquaculture facilities and establish scientifically based minimum safety distances, in order to mitigate impacts on this important habitat.

From conservation to restoration

Despite the existence of the above institutional framework, both the degradation and loss of marine habitats persist in many areas of the Mediterranean, including Greece. In recent years, this finding has driven a significant shift in environmental policy: alongside conservation, growing emphasis is now placed on ecosystem restoration. In this context, new policy and legislative instruments -most notably the Regulation on Nature Restoration- promote systematic actions for the restoration of degraded habitats, including seagrass meadows.

The following section examines the concept of ecological restoration and presents the relevant institutional framework emerging at international, European, and national levels.

⁵³ Boudouresque C. F., Bernard G., Bonhomme P., Charbonnel E., Diviacco G., Meinesz A., Pergent G., Pergent-Martini C., Ruitton S., Tunesi L., (2012). *Protection and conservation of Posidonia oceanica meadows*. RAMOGE and RAC/SPA publisher, Tunis: 1-202.

⁵⁴ WWF Greece. (2025). *Protection of Posidonia meadows in Greece: Report and legislative proposal*. Athens: WWF Greece.

⁵⁵ Holmer, M., Argyrou, M., Dalsgaard, T., Danovaro, R., Diaz-Almela, E., Duarte, C. M., Frederiksen, M., Grau, A., Karakassis, I., Marbà, N., Mirto, S., Pérez, M., Pusceddu, A., & Tsapakis, M. (2008). Effects of fish farm waste on *Posidonia oceanica* meadows: Synthesis and provision of monitoring and management tools. *Marine Pollution Bulletin*, 56(9), 1618–1629. <https://doi.org/10.1016/j.marpolbul.2008.05.020>

⁵⁶ Athinaïou, I., Pyloridou, K., Piselli, M., & Naasan Aga-Spyridopoulou, R. (2024). *Assessing the health status of Posidonia meadows in the Inner Ionian Sea: Report I – Posidonia meadows adjacent to aquaculture facilities in Kalamos*. iSea, Greece, https://isea.com.gr/wp-content/uploads/2025/02/ENG-FINAL_Assessing-the-health-status-of-Posidonia-meadows-adjacent-to-Kalamos-island-aquaculture-facilities.pdf

2

Ecological restoration of ecosystems

Ecological restoration has emerged in recent decades as a key priority of global environmental policy, in response to the accelerating degradation of terrestrial and marine ecosystems and the alarming rate of biodiversity loss. The period 2021–2030 has been designated by the United Nations as the “UN Decade on Ecosystem Restoration”⁵⁷, constituting a global call to action for the restoration of degraded ecosystems.

The restoration of marine ecosystems, and Posidonia meadows in particular, is vital for biodiversity conservation, as well as for climate action, given their role as blue carbon reservoirs.

This chapter introduces the concept of ecological restoration, presents key definitions, and outlines major developments in the institutional framework established at international, European, and national levels to promote ecological restoration; particular emphasis is placed on initiatives relating to the restoration of Posidonia meadows.

Definitions

Ecological restoration is defined as “the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed”⁵⁸. This is not a new concept or practice; nonetheless, it has evolved significantly and is increasingly applied through diverse approaches in support of broader environmental policy objectives⁵⁹, as the “restoration of degraded ecosystems across the globe is one of the most urgent tasks facing our generation”⁶⁰. Ecological restoration constitutes a complex and demanding process that requires the integration of scientific knowledge, suitable technical methodologies, and long-term monitoring mechanisms, together with an effective institutional and implementation framework.

Ecological restoration is implemented through passive and active approaches:

- **Passive ecological restoration** refers to the natural recovery of degraded ecosystems through the removal or effective reduction of the main anthropogenic pressures, thereby allowing natural ecological processes to drive ecological succession and ecosystem regeneration without active intervention (such as planting or technical interventions to the substrate)⁶¹. Passive restoration differs from conservation in that it is applied to ecosystems that have already been degraded and aims to facilitate their natural recovery, whereas conservation focuses on preventing or mitigating ecosystem degradation. Conservation and passive restoration are complementary approaches, whose combined

⁵⁷ United Nations Decade on Ecosystem Restoration. <https://www.decadeonrestoration.org/>

⁵⁸ Society for Ecological Restoration International Science & Policy Working Group. (2004). *The SER international primer on ecological restoration*. Society for Ecological Restoration International. https://www.ser.org/resource/resmgr/custompages/publications/ser_publications/ser_primer.pdf

⁵⁹ Baker, S., Eckerberg, K., & Zachrisson, A. (2014). Political ecology and ecological restoration. *Restoration Ecology*, 22(6), 707–715. <https://orca.cardiff.ac.uk/id/eprint/63215/1/Baker%202014.pdf>

⁶⁰ zu Ermgassen, S. O. S. E., & Löfqvist, S. (2024). Financing ecosystem restoration. *Current Biology*, 34(9), R412–R417. DOI: [10.1016/j.cub.2024.02.031](https://doi.org/10.1016/j.cub.2024.02.031)

⁶¹ ARTEMIS. (2025). Pilot restoration reports and roadmap (Deliverable D1.3.1). Interreg Euro-MED Program.

application enhances the natural recovery of ecosystems.

In recent years, however, the two concepts have often been used interchangeably⁶².

- **Active ecological restoration** refers to the process of assisting the recovery of ecosystems that have been degraded, damaged, or destroyed through targeted human interventions, such as the planting of seeds or shoots, invasive species removal, or substrate enhancement through fertilization or irrigation⁶³. In this context, active restoration measures seek to accelerate ecological recovery where natural regeneration processes are insufficient or where ecosystem degradation is particularly extensive⁶⁴.

“
Passive
restoration is the
first and essential
step in enabling
the natural
recovery of an
ecosystem.
”

These approaches are complementary rather than competing alternatives. Passive restoration often constitutes the first and necessary step to facilitate the natural recovery of an ecosystem; subsequently, active restoration serves to complement natural processes through targeted interventions, where natural regeneration is overly slow or unfeasible. In all cases, **the removal of the pressures responsible for ecosystem degradation constitutes a prerequisite for the success of any restoration intervention**³⁰.

The above definitions equally apply to the **ecological restoration of the Posidonia meadows**.

Passive restoration, through the removal of anthropogenic pressures such as anchoring, coastal construction, pollution, or harmful fishing practices, allows natural ecological processes to drive the gradual recovery of Posidonia meadows. In several cases, this approach can be more effective and cost-efficient than active restoration interventions, particularly where ecosystem processes remain functionally intact⁶⁵.

However, where degradation is extensive or natural regeneration processes are insufficient, the implementation of active restoration measures becomes necessary. These interventions aim at accelerating ecosystem recovery and include transplanting shoots, planting seeds, and enhancing the substrate⁶⁶.

Despite the significant progress achieved in recent years, active restoration of Posidonia meadows continues to face important challenges. Environmental factors such as substrate type, water temperature, salinity, and light availability, **and particularly extreme events (e.g. storms)**, critically influence **the growth of transplanted plants**⁶⁷. At the same time, seed-based restoration **is constrained by the limited and unpredictable availability of seeds**, as well as the highly demanding conditions required for seed germination and seedling survival⁶⁸.

⁶² For example, the Habitats Directive defines conservation in Article 1 as “a series of measures required to maintain or restore the natural habitats and the populations of species of wild fauna and flora at a favourable conservation status...”¹ Similarly, Article 3 of the EU Nature Restoration Regulation defines restoration as “the process of actively or passively assisting the recovery of an ecosystem in order to improve its structure and functions, with the aim of conserving or enhancing biodiversity and ecosystem resilience, through improving the condition of a habitat type to good condition, re-establishing a sufficient area of a habitat type to reach its favourable reference area, and improving the quality and quantity of a species’ habitat...”.

⁶³ Atkinson, J., & Bonser, S. P. (2020). “Active” and “passive” ecological restoration strategies in meta-analysis. *Restoration Ecology*, 28(6), 1311–1320. <https://doi.org/10.1111/rec.13229>

⁶⁴ ARTEMIS. (2025). Pilot restoration reports and roadmap (Deliverable D1.3.1). Interreg Euro-MED Program.

⁶⁵ Crouzeilles, R., Ferreira, M. S., Chazdon, R. L., Lindenmayer, D. B., Sansevero, J. B. B., Monteiro, L., Iribarrem, A., Latawiec, A. E., & Strassburg, B. B. N. (2017). Ecological restoration success is higher for natural regeneration than for active restoration in tropical forests. *Science Advances*, 3(11), e1701345. <https://doi.org/10.1126/sciadv.1701345>

⁶⁶ Pergent-Martini, C., André, S., Castejon, I., Deter, J., Frau, F., Gerakaris, V., Mancini, G., Molenaar, H., Montefalcone, M., Oprendi, A., Pergent, C., Poursanidis, D., Royo, L., Terrados, J., Tomasello, A., Ventura, D., & Villers, F. (2024). *Guidelines for the active restoration of Posidonia oceanica*. ResearchGate. <https://doi.org/10.13140/RG.2.2.26679.84644>

⁶⁷ Piazza, L., Acunto, S., Frau, F., Atzori, F., Cinti, M. F., Leone, L., & Ceccherelli, G. (2021). Environmental engineering techniques to restore degraded *Posidonia oceanica* meadows. *Water*, 13(5), 661. <https://doi.org/10.3390/w13050661>

⁶⁸ Balestri, E., & Lardicci, C. (2012). Nursery-propagated plants from seed: A novel tool to improve the effectiveness and sustainability of seagrass restoration. *Journal of Applied Ecology*, 49(6), 1426–1435. <https://doi.org/10.1111/j.1365-2664.2012.02197.x>

The success of active restoration actions therefore depends to a large extent on the careful selection of suitable restoration sites, the suitability of the environmental conditions and, above all, on the prior removal of the pressures that caused meadow degradation. Consequently, active restoration is generally implemented as a complement to passive restoration and within an integrated ecosystem management framework.

The importance of preventing degradation and implementing passive restoration measures at an early stage is further underscored by the high cost of active seagrass restoration. According to recent estimates, the average cost of active seagrass restoration ranges between EUR 516,000 and EUR 942,000 per hectare, while in some cases costs of up to EUR 2.5 million per hectare have been reported⁶⁹. By contrast, the cost of passive restoration measures is substantially lower (**EUR 38.10–57.80 per hectare**), making them **not only ecologically effective but also more cost-effective**. For this reason, active restoration is generally implemented **as a complement to passive restoration measures** within a **comprehensive ecosystem management framework**.

International, European, and national framework

The restoration of ecosystems -and in particular marine ecosystems of high ecological value, such as Posidonia meadows- has emerged in recent years as a central pillar of international and European environmental policy. In contrast to biodiversity conservation, which is underpinned by a long-established legal framework, ecosystem restoration represents a comparatively recent field of institutional and regulatory development.

International level

At global level, the institutional basis for ecosystem restoration is primarily provided by the Convention on Biological Diversity. Article 8 establishes the obligation of Parties to “rehabilitate and restore degraded ecosystems and promote the recovery of threatened species”⁷⁰. Even though this provision does not specify habitat types or set quantified targets, it does introduce ecosystem restoration as an obligation of the State.

This direction is substantially reinforced by the adoption of the **Kunming–Montreal Global Biodiversity Framework (2022)**, which introduces a quantitative and time-bound target: Target 2 provides for the restoration of at least 30% of degraded terrestrial, coastal, and marine ecosystems by 2030⁷¹. Moreover, Target 8 explicitly links ecosystem restoration with climate change mitigation and adaptation through nature-based solutions, including blue carbon ecosystems such as Posidonia meadows⁷².

The institutional foundation for ecosystem conservation and restoration is further strengthened by a number of international and regional conventions. These include the Ramsar Convention⁷³ and the relevant resolutions of the Conference of its Contracting

⁶⁹ ARTEMIS (2025), *Investment Opportunities in Seagrass Restoration*, a. 11 <https://artemis.interreg-euro-med.eu/investment-opportunities-in-seagrass-restoration/>

⁷⁰ United Nations. (1992). *Convention on Biological Diversity*, Article 8: In-situ Conservation. <https://www.cbd.int/convention/articles/?a=cbd-08>

⁷¹ Convention on Biological Diversity. (2022). *Kunming–Montreal Global Biodiversity Framework*. Adopted at the 15th Conference of the Parties (COP15), Montreal. Target 2 – Restore 30% of degraded ecosystems by 2030. <https://www.cbd.int/gbf/>

⁷² Convention on Biological Diversity. (2022). *Kunming–Montreal Global Biodiversity Framework*. Adopted at COP15 (Decision 15/4). Target 8 – Climate change mitigation, adaptation and nature-based solutions. <https://www.cbd.int/gbf/>

⁷³ Ramsar Convention Secretariat. (1971). *Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)*. <https://www.ramsar.org>

Parties⁷⁴, the Bern Convention⁷⁵, and the Barcelona Convention (through the SPA/BD⁷⁶ and ICZM Protocols⁷⁷), all of which contain provisions aimed at preventing further ecosystem degradation and promoting conservation and restoration measures.

Table 2: International and European policy initiatives for ecosystem restoration

Initiative / Framework	Year	Key provisions for ecosystem restoration
United Nations Decade on Ecosystem Restoration ⁷⁸	2021–2030	Constitutes a global initiative to strengthen actions for the restoration of degraded ecosystems
Kunming–Montreal Global Biodiversity Framework (CBD) ⁷⁹	2022	Establishes target to restore at least 30% of degraded ecosystems by 2030 (Target 2) ⁸⁰
EU Biodiversity Strategy for 2030 ⁸¹	2020	Establishes ecosystem restoration as a key priority of European biodiversity policy
Regulation (EU) 2024/1991 on Nature Restoration ⁸²	2024	Establishes legally binding ecosystem restoration targets: restoration measures must be implemented in 20% of ecosystems by 2030
European Ocean Pact ⁸³	2025	Provides a comprehensive framework for the sustainable management and restoration of EU marine ecosystems, with particular emphasis on marine resilience and biodiversity conservation

European level

At European level, ecosystem restoration has emerged as a central pillar of EU environmental policy, and of the European Green Deal in particular⁸⁴. The foundations for the development of a binding regulatory framework on ecosystem restoration are laid through the 8th Environment Action Program⁸⁵ and the EU Biodiversity Strategy for 2030; the latter constitutes the first EU strategic instrument to explicitly prioritize the establishment of a comprehensive framework for biodiversity restoration. In addition, the **European Ocean**

⁷⁴ In the context of the Ramsar Convention, Resolution XIII.14 (2018) (see <https://www.ramsar.org/document/resolution-xiii14-promoting-conservation-restoration-sustainable-management-coastal-blue>) promotes the restoration of coastal blue carbon ecosystems; COP15 resolutions (2025) and the Strategic Plan 2025–2034 further strengthen alignment with the Kunming–Montreal Global Biodiversity Framework and support ecosystem restoration actions, including marine angiosperm meadows. See: Strategic Plan 2025–2034 - COP15 Resolution 23.3 https://www.ramsar.org/sites/default/files/2025-04/COP15_23_3_DR_SP5_e.pdf

⁷⁵ Council of Europe. (1979). *Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)*. <https://eur-lex.europa.eu/EL/lex-content/summary/bern-convention.html>

⁷⁶ UNEP/MAP. (1995). *Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol)*. <https://www.unep.org/unepmap/who-we-are/contracting-parties/specially-protected-areas-protocol-spa-and-biodiversity-protocol>

⁷⁷ UNEP/MAP. (2008). *Protocol on Integrated Coastal Zone Management in the Mediterranean (ICZM Protocol)* <https://www.unep.org/unepmap/who-we-are/contracting-parties/iczm-protocol>

⁷⁸ <https://www.decadeonrestoration.org/>

⁷⁹ Convention on Biological Diversity. (2022). *Kunming–Montreal Global Biodiversity Framework*. <https://www.cbd.int/gbf/>

⁸⁰ Convention on Biological Diversity (CBD). (2022). *Target 2: Restore 30% of all degraded ecosystems*. <https://www.cbd.int/gbf/targets/2>

⁸¹ European Commission (2020), EU Biodiversity Strategy for 2030: Bringing nature back into our lives, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0380>

⁸² European Parliament and Council (2024). Regulation (EU) 2024/1991 of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202401991

⁸³ European Commission (2025) Communication from the Commission to the European Parliament, the Council, the European and Social Committee and the Committee of the Regions: The European Ocean Pact. COM(2025) 281 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52025DC0281>

⁸⁴ European Commission (2019) Communication from the Commission to the European Parliament, the European Council, the Council, the European Social Committee and the Committee of the Regions: The European Green Deal. COM(2019) 640 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019DC0640>

⁸⁵ Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030. <https://eur-lex.europa.eu/legal-content/EL/TXT/HTML/?uri=CELEX:32022D0591>

Pact (2025) further strengthens the integration of ecosystem restoration into maritime spatial planning, blue carbon financing mechanisms, and marine resilience policies.

The adoption of the **Regulation on Nature Restoration** constitutes the most significant institutional development in the field of ecosystem restoration. Adopted in the context of the implementation of the EU Biodiversity Strategy for 2030, the Regulation establishes binding, quantitative, and time-bound restoration targets for all Member States. Its overarching objective is the implementation of restoration measures in at least 20% of the EU's terrestrial and marine areas by 2030.

The Regulation on Nature Restoration explicitly covers marine ecosystems (Article 5) and includes Posidonia meadows among the habitat types falling within its scope of application. Pursuant to Article 5, Member States are required to implement restoration measures in:

- at least 30% of marine ecosystem areas assessed as being in unfavorable status by 2030;
- 60% by 2040; and
- 90% by 2050.

The same Article also provides for the restoration of habitats in areas where they have been lost. In addition, Member States are required to incorporate the relevant restoration measures into the National Restoration Plans prepared pursuant to the Regulation (Article 14 par. 1).

This Regulation complements the existing EU legislative framework for the protection of Posidonia meadows. In particular, the Habitats Directive provides for the conservation or restoration of protected habitat types at favorable conservation status, while the Water Framework Directive⁸⁶ and the Marine Strategy Framework Directive⁸⁷ link the achievement of good ecological status of waters and good environmental status of marine ecosystems with the implementation of conservation, improvement, and restoration measures.

National level

At national level, ecosystem restoration has been recognized as a strategic policy priority through the adoption of the National Biodiversity Strategy and the related Action Plan of 2014; nonetheless, implementation progress has been limited⁸⁸.

More recently, Greece adopted binding national targets with regard nature conservation and restoration: Law 5037/2023⁸⁹ -inter alia- provides for the conservation of 30% of terrestrial and marine areas and the restoration of 30% of degraded ecosystems by 2030. Greece was the first EU Member State to establish such targets, even prior to the adoption of the Regulation on Nature Restoration. The Annex to the Law also includes habitat types associated with seagrass meadows.

Despite this important institutional basis, ecosystem restoration remains a relatively new policy area, with implementation actions primarily carried out through research projects

⁸⁶ European Parliament and Council of the European Union. (2024). Regulation (EU) 2024/1991 of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202401991

⁸⁷ European Parliament and Council of the European Union. (2008). Directive 2008/56/EC of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32008L0056>

⁸⁸ The Green Tank (2026) Draft of the Revised Biodiversity Strategy and Action Plan, Annex 1: Assessment of the implementation of the 1st National Biodiversity Strategy (to be published)

⁸⁹ Law 5037/2023. Renaming of the Regulatory Authority for Energy to the Regulatory Authority for Energy, Waste, and Water and other provisions for the protection of the environment (GG A 78).

and small-scale pilot initiatives⁹⁰.

However, in view of the preparation and implementation of the **National Restoration Plan (NRP)** required under the **EU Nature Restoration Regulation (Regulation (EU) 2024/1991)**, as well as the growing interest in nature-related investments, the conditions are now emerging for the implementation of restoration actions of greater scope and scale⁹¹. The NRP, in accordance with the **provisions and guidance of the European Commission**⁹², is expected to define the national restoration objectives, priorities and areas where restoration measures will be implemented. It does not, however, necessarily specify the competent authorities and public services, the entities involved and the framework for cooperation among them, the administrative procedures, the technical specifications, or the implementation mechanisms required for the effective delivery of restoration actions on the ground. Without such detailed provisions and dedicated institutional arrangements for the restoration of *Posidonia oceanica* meadows, significant administrative and scientific uncertainties may arise during the implementation of the NRP, leading to delays, fragmented implementation, difficulties in scaling up restoration interventions, or even an inability to achieve the restoration targets arising from EU law. The development of a coherent and dedicated national implementation framework is therefore a necessary precondition for the effective operationalisation and implementation of the NRP's provisions in the marine environment.

This gap has already been partially addressed at the institutional level through the recent introduction of paragraph 7 of Article 19 of Law 1650/1986, which now expressly provides that, within protected zones, **“projects and interventions considered necessary for the protection or restoration of the natural environment” may be implemented**. At the same time, the amendment provides for the temporary or permanent restriction or prohibition of activities where necessary to safeguard the integrity of protected areas and support their restoration, in accordance with **Article 175 of Law 5037/2023**⁹³. This development is particularly significant, as it establishes an explicit legal basis for the implementation of ecological restoration actions and strengthens the link between protection and restoration in protected areas and Natura 2000 sites. Nevertheless, despite this important institutional development, the specialised administrative procedures, technical specifications and operational mechanisms required for the practical implementation of restoration actions in marine ecosystems, including *Posidonia oceanica* meadows, remain lacking.

The transition from pilot actions towards the integration of restoration into the environmental policy toolkit and its successful implementation requires further specification of the institutional framework. Such clarification is of particular importance in the case of already degraded *Posidonia* meadows and requires the identification of existing gaps, restoration needs, and suitable intervention areas, drawing on the expertise of competent authorities and relevant stakeholders. In addition, planning, implementation, and monitoring procedures for restoration actions should be established in accordance with technical guidelines grounded in the most recent scientific evidence.

⁹⁰ Aubert, G., Costa Domingo, G., Christopoulou, I., Underwood, E. & Baroni, L. & (2022), *The Socio-Economic Benefits of Nature Restoration in Greece: Showcasing the potential benefits of upscaling nature restoration in Greece to meet the targets of the proposed EU Nature Restoration Law*. Policy brief by the Institute for European Environmental Policy. <https://thegreentank.gr/en/2022/07/05/proposed-eu-nature-restoration-regulation-benefits-greece-en/>

⁹¹ Aubert, G., Costa Domingo, G., Christopoulou, I., Underwood, E. & Baroni, L. & (2022), *The Socio-Economic Benefits of Nature Restoration in Greece: Showcasing the potential benefits of upscaling nature restoration in Greece to meet the targets of the proposed EU Nature Restoration Law*. Policy brief by the Institute for European Environmental Policy. <https://thegreentank.gr/en/2022/07/05/proposed-eu-nature-restoration-regulation-benefits-greece-en/>

⁹² Commission Implementing Regulation (EU) 2025/912 of 19 May 2025 laying down rules for the application of Regulation (EU) 2024/1991 of the European Parliament and of the Council as regards a uniform format for the National Restoration Plan.

⁹³ Article 96 of Law 5299/2026, *Modernisation of the legislative framework for the use and production of energy from renewable sources – Transposition of Directive (EU) 2023/2413, Directive (EU) 2024/1405 and partial transposition of Directive (EU) 2024/1788 – Provisions on the energy market – Urban planning provisions – Environmental and forest protection provisions – Provisions on the organisation and adequate staffing of the Ministry of Environment and Energy and its supervised bodies, and other provisions* (Government Gazette, Series I, No. 67).

Implementation gaps and institutional challenges with regard to the restoration of *Posidonia* meadows in Greece

While the institutional framework has established clear quantitative restoration targets, the translation of these commitments into concrete implementation processes and operational instruments remains limited. In Greece, in particular, a dedicated regulatory framework has yet to be established to govern:

- permitting procedures for restoration projects;
- national technical standards and implementation specifications;
- mechanisms for the systematic monitoring and assessment of interventions; and
- the provision of stable and long-term financing for restoration actions.

In particular, the allocation of responsibilities for restoration remains general and fragmented. Although **Law 5037/2023** recognizes the role of the Ministry of Environment and Energy in establishing restoration measures within Natura 2000 sites, it does not provide a clear administrative framework for the implementation of restoration projects in areas outside the Natura 2000 network, nor does it define the responsibilities of the competent authorities for the planning, implementation and monitoring of such actions. The recent amendments to the institutional framework referred to above still do not address this gap, as they apply exclusively to protected areas.

At the same time, there are no formally established procedures for the designation of restoration areas, the submission and evaluation of Restoration Action Plans, or the integration of restoration measures into existing marine management instruments. Furthermore, although specialized guidelines and technical protocols for the active restoration of *Posidonia oceanica* meadows⁹⁴ have been developed at both the Mediterranean and European levels, these have not yet been translated into binding national technical standards.

Against this background, it is necessary to complement the existing institutional framework with dedicated provisions for the restoration of *Posidonia oceanica* meadows, clarifying existing legal obligations and establishing clear procedures for the planning, permitting, implementation and monitoring of restoration actions. As presented in detail in the following section, the present proposal seeks to contribute to the development of the institutional framework required for the effective implementation of *Posidonia oceanica* meadow restoration in Greece.

Furthermore, given the ecological significance of *Posidonia oceanica* meadows as a priority habitat type (1120*) and the need for the coordinated implementation of protection, restoration, monitoring and management measures at the national level, the Ministry of Environment and Energy could consider preparing a **National Action Plan for *Posidonia oceanica* and other marine angiosperms**, in accordance with the institutional framework governing Action Plans for species and habitat types⁹⁵. The framework proposed in this report could serve as the technical and scientific basis for the preparation of such a National Action Plan, particularly with regard to the methodology for identifying and prioritising restoration areas, the criteria for selecting restoration measures, monitoring protocols, institutional governance arrangements, and integration with the Management Plans for protected areas and Marine Spatial Planning.⁴

⁹⁴ Pergent-Martini C., André S., Castejon I., Deter J., Frau F., Gerakaris V., Mancini G., Molenaar H., Montefalcone M., Oprandi A., et al. 2024. *Guidelines for Posidonia oceanica restoration*. Report Cooperation agreement Mediterranean Posidonia Network (MPN), French Biodiversity Agency (OFB) & University of Corsica Pasquale Paoli (UCPP) N°OFB-22-1310: 29 p.

⁹⁵ Ministerial Decision ΥΠΕΝ/ΔΔΦΠΒ/104707/2518/2020, *Establishing the Specifications and Content of Action Plans for Species and Habitat Types* (Government Gazette B' 4924).

“Despite the strong legal recognition of ecosystem restoration, dedicated administrative procedures, technical standards and operational mechanisms for implementing restoration actions in *Posidonia* seagrass meadows remain lacking.”

3 Policy proposal

Building on the analysis of the existing institutional framework and the identification of the main implementation gaps presented in the previous section, this section sets out a series of complementary measures which, taken together, constitute a comprehensive proposal for the development of a dedicated institutional framework for the organisation and implementation of *Posidonia oceanica* meadow restoration in Greece. The proposed framework complements the existing restoration-related definitions and specifies the main stages of the planning and implementation of restoration projects. In addition, it ensures a clear allocation of responsibilities among stakeholders and incorporates scientifically grounded planning, implementation, and monitoring procedures.

The proposal covers all key stages of the restoration process:

- Spatial planning; identification and designation of restoration sites
- Institutional allocation of responsibilities
- Technical guidance and scientific protocols
- Implementation and monitoring of restoration projects
- Surveillance, compliance and enforcement mechanisms, and specific administrative arrangements for implementation

Each component of the proposal is addressed through the examination of the existing institutional framework, the identification of relevant implementation gaps, and the formulation of corresponding recommendations. Implementation timelines and procedural deadlines should be specified for each of the stages outlined below, in order to ensure the completeness of the proposed framework.

Key definitions and concepts

Article 1 of Law 5037/2023 includes the following general definition of restoration: “restoration: the process of actively or passively assisting the recovery of an ecosystem towards achieving good ecological status; of a habitat type, towards the highest possible level of favourable condition that can be attained; and of the reference area of a species’ habitat, with sufficient quality, extent and species populations at satisfactory levels, as a means of maintaining or enhancing biodiversity and ecosystem resilience.” While the Law distinguishes between passive and active ecological restoration, in line with established scientific principles, it does not provide definitions of the measures falling under either active or passive restoration to guide restoration planning, decision-making and implementation.

Therefore, for the purposes of this proposal, and in order to ensure **clarity and the uniform application of the provisions** relating to the restoration of *Posidonia* meadows, **the introduction of the following specific definitions** is considered necessary:

- **Passive ecological restoration:** the process of removing, eliminating or reducing the anthropogenic pressures identified as the primary drivers of meadow degradation or loss, thereby allowing the ecosystem to recover naturally through its intrinsic processes of regeneration and ecological succession, without direct technical interventions, such as the

transplantation of plant material.

- **Active ecological restoration:** the process of assisting the recovery of a degraded or destroyed ecosystem through direct technical and ecological interventions aimed at accelerating or initiating ecological recovery. In the case of *Posidonia oceanica* meadows, such interventions include the collection and transplantation of shoots, the application of anchoring and stabilisation techniques, and, where appropriate, the use of seeds or seedlings produced through controlled cultivation.

The above definitions concern ecosystem restoration within the context of the Regulation on Nature Restoration and Law 5037/2023; they are explicitly distinguished from remediation measures arising from the implementation of Directive 2004/35/EC on Environmental Liability⁹⁶.

In the context of the Environmental Liability Directive, environmental damage is defined as “a measurable adverse change in a natural resource or measurable impairment of a natural resource service which may occur directly or indirectly” (Article 2). In this context, remediation is linked to the “polluter pays” principle and aims at restoring the natural resource to its baseline condition prior to the occurrence of the damage, under the responsibility of the liable operator.

By contrast, restoration under the Regulation on Nature Restoration does not presuppose the existence of a specific liable operator, nor is it linked to the concepts of environmental damage or environmental liability. This Regulation promotes preventive and coordinated restoration, establishing binding obligations for Member States to systematically and actively restore degraded ecosystems within the framework of biodiversity conservation and climate neutrality policies, through the achievement of specific targets and timelines.

This conceptual distinction is particularly important: restoration actions relating to *Posidonia* meadows under the proposed framework are explicitly distinct from environmental compensation or remediation measures arising from environmental damage. Instead, these actions form part of a stand-alone, proactive, and preventive framework for ecological restoration.

Similarly, the restoration actions provided for under the present framework do not constitute compensatory measures within the meaning of Article 6(4) of the Habitats Directive (92/43/EEC), nor do they replace the appropriate assessment procedure required under Article 6(3) of that Directive. Rather, these constitute standalone interventions for the systematic restoration of degraded ecosystems. They are not linked to the compensation of impacts arising from specific projects or activities but form part of the strategic planning for the restoration of degraded ecosystems within the framework of implementing international commitments, the EU Nature Restoration Regulation, and Law 5037/2023.

Proposal:

For the purposes of ensuring the coherent implementation of the proposed framework, and, consequently, of restoration actions relating to *Posidonia* meadows, **it is recommended that the aforementioned specific definitions of “passive” and “active” restoration be added to Article 173 (Definitions) of Law 5037/2023.**

⁹⁶ European Parliament and Council. (2004). Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage. Official Journal of the European Union, L 143, 30.4.2004, pp. 56–75. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004L0035>

Provision for the implementation of restoration measures outside the Natura 2000 network

Article 175 of Law 5037/2023, entitled “*Restoration of terrestrial, coastal, freshwater, and marine ecosystems within Natura 2000 areas*”, designates the Ministry of Environment and Energy as the main competent authority for the establishment of restoration measures. However, the wording of the provision indicates that the current institutional framework primarily focuses on the restoration of ecosystems located within the Natura 2000 network.

This approach creates **a clear institutional gap with regard to the restoration of Posidonia meadows located outside Natura 2000 protected areas**, despite the fact that Posidonia meadows constitute a priority habitat of particularly high ecological value requiring restoration irrespective of the protection status of the area concerned. It should also be noted that, while Article 4 of the Regulation on Nature Restoration -concerning terrestrial, coastal, and freshwater ecosystems- prioritizes restoration measures *within* Natura 2000 areas by 2030, Article 5 concerning the restoration of marine ecosystems, does not establish such a distinction with regard to the Natura 2000 network. Consequently, the existing gap in national legislation may obscure the distribution of competences among stakeholders and lead to fragmented implementation, ultimately undermining the achievement of the binding targets established under the Regulation on Nature Restoration.

Proposal:

The current framework under Article 175 of Law 5037/2023 does not explicitly provide for restoration measures outside the Natura 2000 network, thereby creating an institutional gap with regard to the competence of stakeholders and the implementation of restoration actions. In order to address this gap, it is recommended that **a new Article (175A) be introduced into Law 5037/2023**, to:

- ensure the existence of a coherent and unified policy framework for the restoration of Posidonia meadows nationwide, irrespective of the protection status of the area concerned; and
- explicitly provide that the Ministry of Environment and Energy is competent for the establishment of restoration measures relating to Posidonia meadows both within and outside protected areas and Natura 2000 sites.

Role and responsibilities of the Natural Environment and Climate Change Agency (NECCA)

The Natural Environment and Climate Change Agency (NECCA) constitutes the principal implementing authority for national policy on biodiversity conservation and protected area management in Greece. Consequently, this Agency plays a central role in both the planning and implementation of biodiversity conservation and ecosystem restoration actions. This role is expected to be further strengthened in the context of the implementation of the latest institutional obligations arising from the Regulation on Nature Restoration and Law 5037/2023.

Nevertheless, as defined under its founding law (Law 4685/2020), the role of NECCA does not explicitly include competences relating to ecosystem restoration. **The absence of an explicit reference to biodiversity restoration creates ambiguity regarding the scope of NECCA's responsibilities** and may hinder the effective implementation of restoration measures, particularly in ecosystems such as Posidonia meadows, which are highly complex from both a scientific and operational perspective.

Proposal:

With a view to ensuring the **institutional role of NECCA in the restoration** of Posidonia meadows, it is recommended that:

“
A clear institutional framework provides the foundation for the effective restoration of *Posidonia* seagrass meadows.
”

1) Article 27 par. 4 of Law 4685/2020 **be amended** to specify the role of NECCA and explicitly provide that: “NECCA aims to implement the policy formulated by the Ministry of Environment and Energy regarding the management of protected areas in Greece, the conservation and **restoration** of biodiversity, as well as the promotion and implementation of sustainable development actions and climate change mitigation”.

2) a new paragraph be **added** to Article 27 par. 5 of Law 4685/2020, defining the competences of NECCA, explicitly assigning to NECCA the following responsibilities:

- the approval and implementation of *in situ* restoration actions; and
- the monitoring, scientific documentation, and supervision of these actions, both within the Natura 2000 network and in other areas where Posidonia meadow restoration projects are being implemented, given that Posidonia meadows constitute a priority habitat, irrespective of whether they are located within or outside Natura 2000 areas.

Provision regarding restoration implementing bodies

Law 5037/2023 provides that the establishment of restoration measures falls under the competence of the Ministry of Environment and Energy. Nonetheless, it does not explicitly specify the entities that may undertake the implementation of restoration actions in the field. While this regulatory gap does not concern the planning or legislative adoption of restoration measures, it significantly affects the stage of implementation.

The absence of a clear provision regarding implementing bodies creates institutional ambiguity, hinders the effective utilization of available administrative, scientific, and technical expertise, and may lead to delays or fragmented implementation of restoration initiatives. This challenge is particularly pronounced in the case of Posidonia meadows, where restoration interventions require specialized scientific knowledge, operational capacity, and, in several cases, coordinated cooperation among multiple stakeholders.

Proposal:

It is recommended that **a new paragraph be introduced in Article 175 of Law 5037/2023, to provide that ecosystem restoration actions, and particularly those concerning Posidonia meadows, may -under specific conditions- be implemented by entities other than the central competent authorities.**

In particular, it is recommended that **this provision establishes that restoration actions may be implemented, indicatively, by:**

- **public authorities;**
- **local and regional authorities;**
- **legal entities governed by public law;**
- **legal entities governed by private law;**
- **academic and research institutions;**
- **civil society organisations (CSOs) and public-benefit organisations.**

The designation of implementing bodies shall be subject to prior approval by the competent authority and contingent upon the fulfilment of clearly defined criteria relating to scientific expertise, technical capacity, and adherence to approved technical guidelines and monitoring protocols, as outlined below. This approach aims to ensure both the effective implementation of restoration measures and the leveraging of available expertise, while

preventing institutional gaps between planning and implementation.

Technical guidelines for the restoration of *Posidonia oceanica*

Although ecosystem restoration constitutes a relatively recent field of environmental policy, significant scientific and operational experience has been generated in recent years through the implementation of research projects and pilot restoration actions aimed at informing larger-scale restoration interventions. Nonetheless, these developments have yet to be integrated into the relevant institutional framework; consequently, formal and standardized guidelines for *Posidonia* meadows restoration remain absent. In particular, **the existing framework lacks provisions defining the approved methodologies, technical specifications, and requirements for the design, implementation, and monitoring of restoration actions.** More specifically, there is currently no clear definition of the accepted methodologies, technical specifications, or the requirements governing the design, implementation and monitoring of restoration actions.

This regulatory gap poses significant risks of inconsistency and fragmentation in the implementation of restoration initiatives. In a scientifically complex and rapidly evolving field such as the restoration of *Posidonia* meadows, the absence of harmonized technical standards may lead to ineffective or even harmful interventions. This challenge is further accentuated by the limited national experience in the implementation of restoration measures within this habitat, particularly compared to other ecosystems, such as forests. Furthermore, the absence of formally established scientific and technical standards, particularly for active restoration actions, may lead to the implementation of inappropriate or insufficiently evidence-based restoration practices. This creates a risk not only of reducing the effectiveness of restoration interventions, but also of causing additional pressures or damage to the very ecosystems they are intended to restore. This need is particularly critical in ecologically sensitive environments such as *Posidonia oceanica* meadows, where even small-scale interventions may have significant and long-lasting ecological impacts.

Furthermore, as scientific knowledge **evolves continuously**, it is essential to establish governance mechanisms that enable the regular revision and updating of technical guidance, ensuring it remains aligned with the **best available scientific evidence**.

Proposal:

It is recommended that:

- 1) a **Special Provision be introduced in Article 175 of Law 5037/2023**, stipulating that **the restoration of *Posidonia* meadows shall be implemented exclusively within designated Priority Restoration Areas** (as defined below) and **governed by an approved Restoration Action Plan** (as defined below). Furthermore, these actions shall be **implemented in accordance with specific scientific and technical guidance** issued by the competent authority -namely the Ministry of Environment and Energy- on the basis of the most recent scientific advancements.
- 2) the **Ministry of Environment and Energy issues a dedicated Circular** to specify the implementation framework for the relevant legislation. This Circular shall formally adopt the Report entitled "*Restoration of *Posidonia* Meadows (*Posidonia oceanica*): Scientific Guidance, Implementation Recommendations, Technical Implementation Guide, and Decision-Making Tools*"⁹⁷ as the primary technical reference. This Report consolidates and systematizes existing scientific knowledge while providing operational guidance for the implementation of restoration actions. In particular:

⁹⁷ Gerakaris, V., Apostolaki, E. Salomidi, M. (2026). Restoration of *Posidonia* meadows (*Posidonia oceanica*): Scientific Guidance, Implementation Recommendations, Technical Implementation Guide, and Decision-Making Tools. HCMR, Institute of Oceanography. 67 pages. <https://doi.org/10.5281/zenodo.19401230>

- **The Technical Implementation** Guide, presented in **Annex I**, establishes the technical specifications and guidelines governing the design, implementation, and monitoring of restoration actions; and
- **The Decision-Making Tools**, presented in **Annex II**, provide robust methodologies, including criteria for the selection and prioritization of intervention sites, the strategic preference between passive and active restoration approaches, and associated decision-making flowcharts.

The technical guidance governing the implementation of restoration actions addresses in particular:

- the distinction between, and selection of, passive and active restoration approaches, in accordance with the decision-support tools set out in **Annex II**;
- the methodology for the assessment, prioritization and selection of intervention areas, pursuant to the criteria and procedures set out in **Annexes I and II**;
- minimum implementation requirements, feasibility assessment, and criteria for scaling-up restoration interventions, in accordance with **Annex II**;
- the technical specifications applicable to restoration actions, as per **Annex I**; and
- protocols for the monitoring, assessment, and adaptive management of interventions, in accordance with **Annexes I and II**.
- The Report is considered a living document, subject to periodic review and updating to reflect the latest scientific evidence and practical experience gained from pilot and operational projects. Its scientific foundation integrates both national experience and findings from European and international research programs.

- 3) The aforementioned Circular shall further stipulate that **these guidelines may be revised and updated** upon the recommendation of qualified experts, **based on the latest scientific evidence and implementation data**, without requiring a legislative amendment on each occasion. This provision aims to ensure the institutional integration of robust, specialized technical guidance, enabling adaptive governance in response to scientific advancements, while fostering a coherent national framework for Posidonia meadows restoration.

Definition and Spatial Designation of Priority Restoration Areas (PRAs)

The restoration of Posidonia meadows should be spatially delineated within suitable areas. Within these areas, specific provisions should regulate permitted activities and existing pressures in order to ensure the effectiveness of restoration interventions. To date, **no dedicated legal framework exists for the designation of Priority Restoration Areas (PRAs), nor is there a clearly defined procedure for their designation.** However, **under the National Restoration Plan (NRP), which Greece is required to prepare in accordance with the EU Nature Restoration Regulation, specific areas for the implementation of restoration measures are to be identified.** In addition, further areas requiring restoration may emerge outside the NRP, for which no designation procedure is currently provided.

Proposal – Definition:

It is recommended that **the definition of PRAs be added in Article 173 of Law 5037/2023** as follows: “**Posidonia meadow Priority Restoration Areas (PRAs):** marine areas where the ‘Posidonia beds’ habitat type (code 1120*) has been assessed as being in an unfavorable

“
The proposal
addresses the full
restoration cycle,
from planning to
implementation
and monitoring.
”

conservation status, and which are eligible for the implementation of passive and/or active restoration measures aimed at improving their conservation status and restoring the habitat to a favorable status”.

Priority Restoration Sites (PRAs) constitute the primary spatial pillar of the national policy for the restoration of Posidonia meadows. Through their designation, the marine areas in which passive and active restoration actions may be planned, approved, and implemented -in accordance with the current institutional framework- are clearly determined.

Proposal- Designation of Priority Restoration Areas (PRAs):

It is recommended that PRAs be designated either through the National Restoration Plan (NRP) or independently thereof, **subject in both cases to systematic scientific assessment and multi-criteria prioritisation of potential restoration areas.** The assessment **should include, in particular, the evaluation of ecological status, existing pressures, recovery potential, environmental suitability, and the spatial connectivity of *Posidonia oceanica* meadows,** in accordance with the methodology **presented in the Report by Gerakaris et al. (2026), as set out in Annex II, and in particular the multi-criteria assessment and area prioritisation process (see Annex II, Section 2.5).** The application of **this methodology should constitute a necessary prerequisite** for the **evidence-based designation** of any area as a PRA. **However, the following distinction is proposed:**

1) PRAs designated in the context of the National Restoration Plan: Priority shall be given to the designation of PRAs through the NRP, which is developed in compliance with the EU Regulation on Nature Restoration. Indeed, the areas included in the NRP constitute the primary priority zones for the implementation of restoration measures, as they have been assessed at a national scale based on uniform ecological, climatic, and spatial criteria.

- The designation of an area as a PRA within the NRP should, therefore, be carried out in accordance with the Plan’s standard preparation, approval, and implementation process, underpinned by the aforementioned scientific criteria and prioritization tools provided in the Report by Gerakaris and colleagues (2026) (Annex II, Section 2.5).
- This proposal explicitly adopts the principle that **absolute precedence** shall be given to PRAs established through the NRP framework regarding the allocation of public funds, the maturation of projects, and the approval of restoration interventions.
- During the initial phase of implementing the restoration framework, priority may be given to pilot restoration actions for *Posidonia oceanica* meadows within protected areas, Natura 2000 sites, and the two National Marine Parks currently under designation, particularly where approved or emerging Management Plans are already in place and, following the recent legislative amendment, may include restoration actions. As with all measures incorporated into such Management Plans, these restoration actions should be accompanied by monitoring, protection and adaptive management measures to enable the systematic evaluation of their effectiveness and their potential for broader application.

2) PRAs designated outside the National Restoration Plan: Given the dynamic nature of the marine environment, the continuous evolution of scientific knowledge, and the spatially uneven distribution of anthropogenic pressures, it is acknowledged that the NRP may not fully address the restoration needs of Posidonia meadows at the national level. Consequently, **a dedicated procedure should be established for the designation of additional PRAs outside the NRP framework,** particularly in areas not yet incorporated into national planning, where the presence of degradation or the need for restoration has been scientifically documented. This arrangement is intended to complement -rather than supersede- the NRP, thereby ensuring institutional flexibility and enabling a response to documented ecological needs. **With regard to PRAs established outside the NRP framework,**

the following administrative process is recommended, covering all stages from the initial submission of the proposal to its final approval:

a) Competent authority: The Directorate of Natural Environment and Biodiversity Management of the Ministry of Environment and Energy shall hold primary responsibility for coordinating and completing the official designation process.

b) Initiative for the submission of a designation proposal: The designation of an area as a PRA may be proposed by the NECCA, the Ministry of Environment and Energy, Regional and Municipal authorities, academic and research institutions, civil society organizations, as well as by individuals or legal entities demonstrating a legitimate interest.

c) Submission and content of the dossier: The proposal shall be submitted to the Ministry of Environment and Energy and be accompanied by a scientific documentation dossier, prepared on the basis of the criteria and decision-making tools set out in the Report by Gerakaris and colleagues (2026) (see Annex II and, where relevant, the technical guidance provided in Annex I). This dossier shall include:

- documentation establishing the current or historical presence of *Posidonia* meadows within the proposed area, based on available cartographic data, scientific surveys, or monitoring program results;
- an analysis identifying the drivers of meadow degradation or loss, alongside an assessment of the anthropogenic or natural pressures that have compromised its ecological status;
- an assessment of the feasibility of eliminating or substantially reducing the pressures responsible for the degradation, as a prerequisite for successful restoration;
- an assessment of the physical and environmental suitability of the area (depth, substrate type, hydrodynamic conditions, water clarity, and other relevant parameters);
- documentation demonstrating that the minimum conditions required for the implementation of restoration actions have been met, as specified in Annex II (in particular Section 2.1);
- an overall assessment of the area's suitability for restoration, including justification for the proposed restoration approach (passive or active), based on the prioritization criteria and decision-making methodology set out in Annex II, and in particular the multi-criteria assessment and prioritization process outlined in Section 2.5, as well as the decision-making tools supporting the selection of a restoration approach, as detailed in Section 2.2.

d) Evaluation and opinions: The dossier shall be subject to scientific evaluation by NECCA and subsequently forwarded to the Ministry of Environment and Energy, accompanied by a reasoned proposal. Where applicable, the process may include the opinions of co-competent Ministries, such as the Ministries of Rural Development and Food; Maritime Affairs and Insular Policy; Culture; National Defense; Economy and Finance; Infrastructure and Transport; and Tourism, as well as consultation with the relevant Regions and the Decentralized Administration. In cases concerning areas within the Natura 2000 network, the opinion of the "Nature 2000" Committee may also be requested.

e) Formal designation and publication procedure: The designation of a PRA shall be formalized by a Decision of the Minister of Environment and Energy, published in the Government Gazette, setting out the geospatial delimitation of the area, the core protection framework applicable during the restoration phase, and the general provisions governing the planned interventions.

Each designated PRA shall be registered in an open-access national digital database, integrated within the National Restoration Plan, with a view to ensuring transparency, public oversight, and enhanced coordination among competent authorities. Priority Restoration Areas (PRAs) shall be taken into account in national, regional and sectoral spatial planning.

Restoration Action Plan: Content, Approval Procedure and Administrative Acts:

The designation of an area as a Priority Restoration Area (PRA), whether through the National Restoration Plan (NRP) or otherwise, shall not in itself constitute approval of a specific restoration project. Rather, it shall establish the institutional precondition for the subsequent initiation of restoration implementation procedures.

Proposal – Content:

It is recommended that **restoration actions** within each Priority Restoration Area (PRA) **proceed only following the approval of a specific Restoration Action Plan**, submitted by the prospective implementing body to the Ministry of Environment and Energy and subject to scientific evaluation by NECCA (OFYPEKA).

The Restoration Action Plan shall clearly define the following: restoration interventions; implementation timeline; competent implementing bodies; technical specifications; monitoring obligations; and indicators for assessing measure effectiveness. In addition, it shall provide robust documentation to justify the selection of both the intervention site and the restoration approach, according to the criteria, methodologies, and decision-support tools set out in the Report by Gerakaris and colleagues (2026), and particularly the procedures relating to approach selection and feasibility assessment (Annex II, Sections 2.2 and 2.3).

The dossier submitted for the approval of a Restoration Action Plan shall strictly comply with the technical specifications and guidelines set out in the Report by Gerakaris and colleagues (2026), particularly with regard to intervention methods and implementation protocols (Annex I, see relevant implementation sections). Specifically, the dossier shall address:

- the minimum prerequisites for the implementation of restoration actions;
- the criteria for selecting passive or active restoration;
- the criteria for assessing the feasibility of implementing active restoration;
- the technical specifications governing the design and implementation of restoration interventions;
- the protocols for the collection, selection, and preparation of plant material;
- transplanting methodologies;
- anchoring and stabilizing techniques;
- the criteria for scaling up active restoration actions; as well as
- monitoring and assessment protocols.

The Restoration Action Plan may be prepared either directly by NECCA or by any interested public or private implementing body, including local authorities; legal entities under public or private law; academic or research institutions; civil society organizations; charitable foundations; enterprises; and natural persons.

Proposal – Approval procedure:

The **Restoration Action Plan** shall constitute the principal instrument for the implementation

of restoration actions. It is recommended that its submission and approval follow a formal administrative procedure that ensures the assessment of its scientific adequacy and the clear designation of the competent implementing body.

The following procedure is recommended for the approval of each Restoration Action Plan: The Action Plan shall be submitted by the implementing body to NECCA for assessment. The scientific evaluation shall be carried out by NECCA, based on the technical specifications and protocols set out in the Report by Gerakaris and colleagues (2026), as detailed in Annex I, and the decision-making tools, presented in Annex II. In particular, this evaluation shall include **assessment of:**

- the feasibility of active restoration in relation to the ecosystem's natural recovery potential;
- compliance with the environmental and technical prerequisites for the implementation of the proposed interventions;
- the suitability of the selected restoration approach in relation to the characteristics of the intervention site; and
- the expected effectiveness of the proposed measures.

In this context, the decision-making tools relating to restoration approach selection and active restoration feasibility shall be applied (see Annex II, Section 2.2 "Approach Selection: Passive or Active Restoration" and Section 2.3 "Decision-Making Flowchart for Active Restoration").

The final approval of the Plan shall be granted by the competent body of the Ministry of Environment and Energy, following a reasoned opinion issued by NECCA.

Proposal – Securing Restoration Outcomes:

Where implementation of the Restoration Action Plan requires the imposition of administrative restrictions, protection measures or prohibitions on activities, particularly to prevent the recurrence of pressures or to safeguard restored *Posidonia oceanica* meadows, it is recommended that the Restoration Action Plan be approved **by decision of the Director General for Environmental Policy of the Ministry of Environment and Energy**, following a proposal by NECCA (OFYPEKA) or, where appropriate and concerning protected areas, by decision of the Minister of Environment and Energy, in accordance with the recently introduced amendment to Article 19(7) of Law 1650/1986 by Law 5299/2026. The restrictions or protection measures may be either temporary or permanent and may apply for the duration of the restoration actions and, where necessary, for a period following their completion. The need for such measures should be duly justified on the basis of monitoring results and the principles of adaptive management, as further elaborated in Gerakaris et al. (2026), Annex I, and complemented by the decision-support tools set out in Annex II.

The decision shall be published in the Government Gazette where it establishes binding conditions or regulatory provisions governing land or sea uses and activities.

Monitoring, compliance, and enforcement

Monitoring the progress of *Posidonia* meadow restoration is key to both assessing the ecological effectiveness of restoration actions and ensuring compliance with national reporting obligations under the Regulation on Nature Restoration and Law 5037/2023.

Proposal:

It is recommended that **the implementing body of each restoration project be responsible for the monitoring process**, in cooperation with qualified scientific personnel from academic and research institutions governed by public or private law.

Restoration Action Plans shall include clearly defined indicators for monitoring and assessing the ecological response of *Posidonia* meadows, in accordance with the protocols, technical guidance, and methodologies set out in the Report by Gerakaris and colleagues (in particular Annex I, with regard to monitoring methodologies and assessment indicators), as well as the adaptive management principles specified in Annex II.

Monitoring shall be carried out at predetermined intervals to address both the structural and functional status of the meadow and the evolution of environmental conditions within the intervention area. The collected data shall be submitted to a national digital database integrated within the National Restoration Plan, thereby ensuring the systematic documentation of restoration actions, the comparability of results, and the effective implementation of adaptive management at national level.

As part of adaptive management and to ensure the long-term effectiveness of restoration actions, Restoration Action Plans may, based on the results of monitoring, provide for additional post-restoration protection measures for the restoration area. These may include, where justified on the basis of an ecological assessment, the designation of protection or activity-restriction zones (buffer zones) to prevent the recurrence of the pressures that led to the degradation of the *Posidonia oceanica* meadow. Such measures shall be approved in accordance with the procedure applicable to the relevant Restoration Action Plan.

Compliance

Proposal:

It is **recommended** that NECCA be responsible for monitoring compliance with the approved Restoration Action Plans and overseeing the effective implementation of interventions, in cooperation -where appropriate- with other competent authorities, including the competent services of the Ministry of Environment and Energy, Decentralized Administrations, Regional authorities, and the Coast Guard.

Enforcement

Proposal:

It is **recommended** that the administrative and criminal sanctions provided for under **Articles 28 and 30 of Law 1650/1986**⁹⁸ apply in the following cases: non-compliance with the requirements set out in the approved Restoration Action Plans; degradation of restored *Posidonia* meadows; and the undertaking of unauthorized activities within PRAs or other restoration areas.

Special institutional arrangements for implementation

This sub-section introduces **special institutional arrangements intended to address administrative and regulatory constraints that, under the current general framework, may hinder or delay the effective implementation of *Posidonia* meadow restoration initiatives**. These provisions do not modify the core framework governing the protection of the marine environment; rather, they adapt existing administrative instruments to the characteristics and requirements of restoration projects, in accordance with Law 5037/2023 and the Regulation on Nature Restoration.

The need for dedicated administrative and regulatory provisions is directly linked to the fact that *Posidonia* restoration constitutes a new type of activity which, in the absence of an appropriate framework, may give rise to additional administrative delays. At the same time, such actions take place on the seabed, which is a public environmental asset of high ecological value.

⁹⁸ Law 1650/1986 on the protection of the environment. GG A 160/16.10.1986. (in particular Articles 28 and 30 on criminal and administrative sanctions).

1) Seabed use authorization for restoration projects: The implementation of in-situ Posidonia meadow restoration projects is closely linked to the institutional framework governing the authorization of seabed use. The current legislation, and in particular **Law 2971/2001 on the seashore, beach, and seabed**, primarily regulates the granting of rights for the use of marine areas in connection with economic or development activities; however, it does not establish provisions adapted to the non-invasive and restorative nature of ecosystem restoration interventions.

Consequently, the existing authorization procedures may give rise to administrative delays and legal uncertainty in relation to the implementation of restoration actions, particularly where such interventions are solely directed towards environmental restoration and ecosystem recovery objectives.

Proposal:

In order to address this issue, it is recommended that **a special provision be introduced into Article 14 par.3 of Law 2971/2001**, providing that, by way of derogation from any general or special provision, authorizations for seabed use granted exclusively for the restoration of Posidonia meadows benefit from a simplified and expedited administrative procedure.

Such authorizations shall be conditional upon:

- The relevant intervention having been formally designated as an ecological restoration project under **Law 5037/2023**;
- implementation taking place within a designated **Priority Restoration Area (PRA)**; and
- implementation being carried out pursuant to an approved Restoration Action Plan, prepared and evaluated in accordance with the technical specifications and decision-support tools set out, respectively, in Annex I and II to the present document.

This provision aims to ensure that seabed-use authorization procedures do not constitute an administrative barrier to the implementation of actions serving exclusively environmental restoration and public interest objectives.

2) Environmental permitting of restoration projects: Environmental permitting: the implementation of Posidonia meadow restoration projects may also give rise to questions regarding their treatment under existing environmental permitting procedures. However, unlike activities that may generate environmental pressures, passive and active restoration interventions are undertaken exclusively for the purpose of restoring and improving the ecological status of natural ecosystems. Where such interventions are designed and implemented in accordance with the applicable technical guidance, they should not be regarded as projects or activities that introduce significant alterations to the natural environment, but rather as measures for ecosystem restoration and environmental management.

Proposal:

It is recommended that this be clarified either through a specific provision in **Law 5037/2023** or, alternatively, through an interpretative circular or administrative guidance, providing that Posidonia meadow restoration actions:

- are implemented exclusively for ecological restoration purposes under Law 5037/2023;

- are implemented within a designated **Priority Restoration Area (PRA)**;
- comply with the technical specifications and guidance set out in the Report by **Gerakaris et al. (2026)** and in **Annexes I and II** of the present report; and
- are approved through a **Restoration Action Plan**,
- shall **not** be considered projects or activities subject to the formal environmental permitting procedures established under the applicable legislation, provided that they do not involve substantial engineering works or significant alterations to the natural environment.

3) Integration with other policy instruments: The implementation of measures for the protection and restoration of Posidonia meadows should be functionally integrated with **Special Environmental Studies, Presidential Decrees, Management Plans for protected areas**, and national, regional, sectoral and marine spatial planning instruments. Such integration is essential to ensure coherent, ecosystem-based and adaptive management of the marine environment, in accordance with the principles of **Law 4759/2020** on Marine Spatial Planning and the **National Spatial Strategy for the Marine Space** (Government Decision No. 6/17.4.2025)⁹⁹.



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⁹⁹ Act of the Council of Ministers No. 6/17.4.2025 approving the National Spatial Strategy for the Marine Space (Government Gazette, Series D, No. 227).

Conclusions and prospects for implementation

The establishment of a coherent, operational, and scientifically robust framework for the restoration of *Posidonia* meadows constitutes both an environmental necessity and a strategic priority for the conservation of essential ecosystem services, the resilience of coastal areas, and climate change adaptation.

This proposal seeks to address the existing gap between ambitious restoration targets and their effective implementation at national level. To this end, it introduces a clear institutional framework covering all stages of the restoration process, including spatial planning, technical specifications, implementation procedures, monitoring, compliance, and enforcement.

The proposed framework may serve as a reference for the development of similar approaches to the restoration of other marine and coastal ecosystems of high ecological value, further strengthening Greece's role as a Member State actively contributing to the implementation of the Regulation on Nature Restoration. At the same time, this framework establishes the institutional conditions necessary to enable innovative financing mechanisms, promote stakeholder engagement, and mainstream ecosystem restoration into national environmental and spatial planning policies.

In this context, the restoration of *Posidonia oceanica* meadows extends beyond the protection of a flagship marine habitat and **constitutes an investment in Greece's natural capital and the long-term sustainability of the country's coastal and island regions.**

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Restoring
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Greece's seas.
”



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