

**European Union and its Member States' contribution for the 2026 United Nations  
Informal Consultative Process on Oceans and the Law of the Sea  
“Marine ecosystem restoration”**

**European Union**

As accelerating ocean degradation calls for better protection and preservation of marine ecosystems, it is critical to address existing and emergent pressures to prevent future harm. Where marine ecosystems have been harmed, nature restoration actions can enhance biodiversity and ecosystem functions and related services and provide important socioeconomic benefits, including to coastal communities whose livelihoods depend on the ocean. The increasing scientific evidence about the accelerating degradation of habitats and loss of biodiversity across the globe has resulted in a growing recognition of the ecological and socio-economic value of healthy ecosystems, including in the ocean. Healthy marine ecosystems are key to safeguard marine biodiversity. Effective marine nature restoration strategies, both active and passive, can help rebuild and enhance the resilience of degraded marine habitats, safeguard marine biodiversity, and contribute to mitigating the impacts of climate change.

The Kunming-Montreal Global Biodiversity Framework set out a clear target: ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.

To achieve the ocean conservation targets, and maintain them in the long-term, the EU and its Member States are devoted to take effective action to restore marine ecosystems.

**The EU's commitment to marine ecosystem restoration**

At the third UN Ocean Conference held in June 2025 in France, the EU announced targeted actions to address challenges of ocean degradation, climate change and overexploitation of marine resources.

These actions aim at protecting and restoring marine ecosystems. Under the EU Mission Restore our Ocean and Waters, the EU has committed EUR 4 million of technical assistance to up to 50 targeted communities of regions, cities, including small municipalities. This will support the preparation of transition agendas for planned projects aiming at better protecting and restoring the ocean and water.

The EU also committed EUR 10 million under Horizon Europe for research and innovation to develop and test innovative and technically challenging active restoration of deep-sea habitats focusing on their functioning and adaptation potential. In addition, the EU will dedicate EUR 10 million under Horizon Europe for research and innovation to develop hybrid blue-grey nature-based solutions where the design and management of infrastructures aimed at climate mitigation or adaptation can protect, benefit or even restore biodiversity and ecosystem services.

The EU is also taking measures to continuously improve fishing gear selectivity and reduce the impact of fisheries on sensitive species and the seabed. Work is also underway to support the achievement and maintenance of the good environmental status of EU waters under the EU

Marine Strategy Framework Directive and contribute to the EU restoration targets for marine and coastal ecosystems under the EU's Nature Restoration Regulation.

In specific, under the Nature Restoration Regulation, the EU has set out specific restoration targets for marine ecosystems by 2050, namely to:

- improve the condition of areas of habitat types that are not in good condition, with targets for 2030, 2040 and 2050;
- re-establish habitat types in areas where they no longer occur.
- restore degraded areas of habitats covered by the Regulation and of certain marine species to ensure their long-term survival;
- close the knowledge gaps related to the distribution and condition of those habitats.

This regulation creates specific obligations for EU Member States to put in place measures to protect and restore ecosystems until good condition is reached, and to ensure that no subsequent deterioration takes place. This will be achieved through national restoration plans that will outline targets and deliverables.

The EU Common Fisheries Policy provides tools to reduce the impact of fishing on sensitive habitats and species and thus contribute to marine ecosystem restoration. Many of these tools are to be used under the framework of regionalisation, which means that the Member States of a certain sea basin can come up together with targeted measures to protect a specific area or certain species. This process is also being used to contribute to the achievement of goals under associated EU environmental directives. On the basis of this regionalised approach, the EU has adopted legislation to protect sensitive species in EU waters. Two flagship examples focus on fishing closures in the Bay of Biscay and in the Baltic to minimise incidental catches of dolphins and harbour porpoise, respectively. Many other fishing restrictions or prohibitions have also focused on sensitive seabed habitats and marine birds that are present in the Natura 2000 site network, in particular in the North Sea and the Baltic Sea.

Further, protecting and restoring ocean health is one of the six priorities of the European Ocean Pact. Through the European Ocean Pact, the EU supports Member States in restoring degraded coastal and marine habitats, by:

- evaluating and revising the Maritime Spatial Planning rules;
- encouraging the establishment and management of Marine Protected Areas;
- creating European blue carbon reserves.

The European Ocean Pact is centred around research and science. Advancing ocean research, marine knowledge, skills and innovation is essential to improving our understanding of the ocean and, in turn, protecting it. This knowledge must be readily available to scientists, citizens, entrepreneurs and policymakers to be able to design the most effective ways to restore marine and coastal habitats. To this end, under the European Ocean Pact, the European Ocean Observation Initiative will strengthen the entire marine knowledge value chain, starting with comprehensive and sustained ocean observation, continuing with the availability of high-quality, open marine data, to the development of advanced digital applications. Through the

development of a European Digital Twin Ocean, which will be operational by 2030, the EU aims to establish a publicly available tool to support and facilitate the use of best available scientific knowledge for marine environmental protection and restoration.

Finally, under the European Ocean Pact, support to coastal communities to build new business models that benefit both nature and people including European blue carbon reserves is envisaged. Coastal blue carbon ecosystems such as mangroves, salt marshes and seagrass meadows are not only highly effective at absorbing and storing carbon from the atmosphere in their vegetation and soils, hence contributing to climate mitigation, but they also provide a range of ecosystem services including coastal protection, biodiversity support and human livelihoods. While work is ongoing to assess the role of blue carbon ecosystems in carbon sequestration, complementary information on credits for biodiversity, ecosystem restoration and ecosystem services is needed. Similar principles such as those envisaged for blue carbon certification including additionality, attribution and measurability can be applied.

### **Ocean monitoring for marine protection and restoration**

Ocean monitoring is critical for providing data streams, assessing ecosystem functioning and forecasting future scenarios. It is crucial that policy makers have access to the best available knowledge about the marine environment to support timely and sound decision making, allowing for the sustainable management of marine resources, biodiversity conservation, and sustainable blue growth.

The Copernicus Marine Service (CMEMS) provides a world-leading digital information service for the global ocean and EU regional seas. CMEMS is part of the Copernicus programme, which is the EU's state-of-the-art space infrastructure for Earth Observation. This flagship programme is providing global data from satellites and ground, airborne, and seaborne measurement systems and modelling capabilities to help service providers, public authorities, and other international organisations better understand and sustainably manage our environment. The information services provided are free and openly accessible to users.

In this regard, the Copernicus Marine Service plays a vital role by providing free, open, regular, and systematic reference information on the blue (physical), white (sea ice), and green (biogeochemical) ocean state, variability and dynamics. The Copernicus Marine Service provides a vast range of satellite and in situ ocean monitoring products and it can forecast and examine ocean physics and aspects of biogeochemistry. This European service is committed to continuously improving the quality and relevance of its products and sub-services.

A major extension of the Copernicus Marine Service for marine biology, marine biodiversity conservation and food resources management will be initiated within 2026 with the objective to enrich the Copernicus Marine catalogue with innovative ecosystem products. This extension will transform the European capability to predict and protect the biodiversity of marine ecosystems, delivering new modelling products related to fisheries, pollution, and benthic habitats, enabling the Copernicus Marine Service to better inform ocean policymakers, managers, and the public.

### **Marine ecosystem restoration in areas beyond national jurisdiction and in third countries**

The entry into force of the Agreement under UNCLOS on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ Agreement) on 17 January 2026 is a historic milestone for marine biodiversity conservation in the high seas. This Agreement is the result of long-standing international collaboration and aims to protect, preserve, restore and maintain biological diversity and ecosystems. It also aims to enhance their productivity and health, and strengthen their resilience to stressors, including those related to climate change, ocean acidification and marine pollution. In order to achieve the objectives of this Agreement, Parties shall be guided by certain principles and approaches, including an approach that builds ecosystem resilience. This approach aims to take into account the adverse effects of climate change and ocean acidification, and maintain and restore ecosystem integrity, including the carbon cycling services that underpin the role of the ocean in climate.

The BBNJ Agreement must be implemented in line with an approach that builds ecosystem resilience, including to adverse effects of climate change and ocean acidification, and maintains and restores ecosystem integrity, including the carbon cycling services that underpin the role of the ocean in climate mitigation and adaptation.

The BBNJ Agreement will allow the establishment of measures such as area-based management tools, including marine protected areas, which will be crucial for the restoration and protection of marine ecosystems in Areas Beyond National Jurisdiction. The Conference of the Parties will have the possibility to discuss opportunities to support rehabilitation and ecological restoration of marine ecosystems.

The EU and its Member States continue to encourage the swift ratification and implementation of the BBNJ Agreement, including through supporting partner countries in ratifying and implementing the Agreement.

The EU is also supporting several external actions in developing countries aiming at restoring marine and coastal ecosystems such as mangroves in Surinam and Guyana, or depollution of Hann Bay in Senegal.

The EU is also supporting international efforts within Regional Fisheries Management Organisations to adopt measures to protect certain areas where vulnerable marine ecosystems exist or are likely to exist from bottom fishing, thus enabling ecosystem's restoration. This includes measures brought forward through the North-East Atlantic Fisheries Commission (NEAFC) to include a prohibition to fish outside existing fishing areas. However, additional efforts are needed to ensure that these types of measures are not only adopted but also enforced, given that some Parties disregard the prohibition to fish in restricted areas.

### **Aquaculture as an ecosystem restoration services provider**

Aquaculture could contribute to marine ecosystem restoration. Low-trophic marine aquaculture systems such as macroalgae (seaweed) cultivation and bivalve mollusc farming (e.g. mussels, oysters) present a triple opportunity: (1) to produce nutritious food and valuable ingredients and raw materials for other sectors, while (2) actively supporting water-quality improvement, habitat formation, biodiversity recovery, and coastal resilience to climate change impact, and (3) contributing to the livelihood of coastal communities. Macroalgae and bivalve molluscs are especially suited as they rely on naturally available nutrients and filtering capacity and can serve as “nature-positive” components of a broader marine ecosystem restoration strategy.

The 2021 EU Strategic Guidelines frame aquaculture as a sector that must become more competitive and resilient while contributing to the green transition of the EU economy. They specifically call for diversification toward low-trophic species, and for promoting aquaculture production models that deliver ecosystem services. Building on this, the EU Algae Initiative explicitly promotes micro and macro algae as a strategic sector for the green transition, recognizing their potential for biodiversity protection, ecosystem services, restoration, and circularity.

At the international level, the FAO Guidelines for Sustainable Aquaculture (GSA) provide a recognised framework to guide aquaculture expansion in ways that respect ecological limits and promote ecosystem-based management. Among their objectives is the protection and restoration of living aquatic resources and habitats. The Guidelines explicitly support the idea that aquaculture — including extensive or low-input systems — can contribute to the restoration of marine and coastal ecosystems, for instance by alleviating pressure on wild stocks, supporting habitat recovery, and mitigating impacts of environmental change.

Together, these policy frameworks position restorative aquaculture as a legitimate tool for delivering on the UN Sustainable Development Goals (especially goals related to life below water, food security, sustainable production and climate action), as well as supporting global climate objectives.

In Europe, pilot and commercial initiatives are increasingly showing how restorative aquaculture can operate in real conditions. In the Baltic Sea, mussel farms are being tested as a tool to remove excess nitrogen and phosphorus from eutrophicated coastal waters, helping to counteract algal blooms and improve water clarity. Seaweed farms in the North Sea, including those co-located with offshore wind farms off the Dutch coast, demonstrate how cultivated macroalgae can take up nutrients, contribute to local carbon sequestration and provide habitat and nursery areas for fish and invertebrates. In the Atlantic Sea basin, seaweed culture is expanding, testing cultivation methods that can reduce pressure on wild beds and provide substrates and local recruitment that help restore coastal habitats. Mediterranean initiatives — including oyster and mussel restoration pilots, and projects protecting the fan mussel — illustrate how bivalve mollusc restoration and sustainable aquaculture can be combined to recover native reef habitats, improve water quality and strengthen coastal resilience. Projects that integrate restoration methods into existing coastal aquaculture (for example, combining mussel on-grow operations with oyster reef modules) show promise in the Mediterranean context.

This geographic breadth demonstrates that restorative aquaculture is not limited to particular climates or regions. If managed sustainably certain types of aquaculture can serve as a restoration tool in very different ecological contexts.

When integrated into spatial planning, environmental policy and blue-economy strategies — and supported by research, innovation and markets — restorative aquaculture can deliver nature-positive outcomes. Implemented at scale and across regions, this approach offers a practical pathway to use aquaculture as an active marine restoration tool — delivering measurable environmental gains while supporting sustainable coastal economies and community well-being.

## **Mobilising investment**

From a financing and investment perspective, the EU is advancing marine ecosystem restoration through an integrated strategy that combines public funding, regulatory signals, innovation support and mechanisms to mobilise private capital at scale. As mentioned above, a key pillar is the EU Mission “Restore our Ocean and Waters by 2030”, which brings together research, innovation, community engagement and financing across all European sea basins. Complementary public resources, including Horizon Europe and the European Maritime, Fisheries and Aquaculture Fund, support science-based and operational restoration projects while generating investable pipelines.

In the investment sphere, the European Investment Bank (EIB) and European Investment Fund (EIF) provide essential financing frameworks. The EIB’s Green Bond Programme—exceeding €100 billion in cumulative issuance—funds marine and coastal projects ranging from renewable energy to water management. Under InvestEU’s dedicated Blue Economy instrument, the EIF has invested as a limited partner in ocean-focused impact funds such as Ocean 14 Capital and the Blue Revolution Fund, which aim to deliver market-rate returns while contributing directly to marine biodiversity protection.

The EU also places strong emphasis on improving the enabling conditions for private investment. Apart from accelerating a pipeline of sustainable ocean technology projects and matching them with investors, the BlueInvest Initiative enhances investor readiness and de-risks blue economy investments through capacity-building workshops, structured dialogue with asset owners, and technical assistance for impact-oriented business models. A dedicated series of Global Asset Owner Meetings on Biodiversity helped develop practical financial structuring solutions to enter biodiversity-positive investment vehicles, including those targeting ocean health. One concrete outcome is a forthcoming *Biodiversity Investment Handbook* designed to guide institutional investors in scaling nature-positive finance.

Beyond institutional finance, the EU is developing innovative market-based mechanisms to reward measurable restoration outcomes. The Nature Credits Roadmap outlines the creation of high-quality, science-based nature credit markets that can channel private capital toward restoration, while pilot initiatives such as “RESTORE” explore biodiversity certificates and investment frameworks tied to verified ecological improvements.

Together, these instruments form a coherent EU approach that blends public finance, private capital mobilisation, regulatory clarity and innovation to accelerate marine ecosystem restoration at scale.

### **Maritime transport’s role in marine ecosystem protection and restoration**

Maritime transport plays a vital role in global commerce, but its environmental footprint necessitates transformative action. Capacity building in the context of the energy transition involves developing skills, knowledge, and infrastructure to adopt and optimize new marine technologies. Initiatives such as technical training programs, collaborative research projects, and public-private partnerships are becoming increasingly prominent in this area. The International Maritime Organization (IMO) has been instrumental in promoting capacity-building efforts, particularly in developing countries, through initiatives like the IMO Global

MTCC Network. Funded by the EU, this program supports climate mitigation in the maritime shipping industry.

A critical area of focus in capacity building is enabling the use of new types of fuels (e.g., bio- or e-methanol and -ammonia) and technologies (e.g., fuel cell-based technologies, wind-assisted propulsion) on ships. This endeavour involves equipping seafarers and the maritime workforce with the necessary skills to handle alternative fuels and new technologies, which require specialised bunkering, storage, handling, and safety protocols. At the IMO level, guidelines are being developed with strong support from the EU and its Member States not only for training seafarers in using alternative fuels and new technologies but also for integrating environmental considerations into operational practices.

Finally, the EU, under its Global Gateway Policy, is developing a flagship initiative to promote the creation of green shipping corridors with partner countries worldwide.

## Spain

With regard to **shallow benthic habitats**, Spain is addressing the degradation of shallow benthic habitats, particularly seagrass meadows such as *Posidonia oceanica*, through a comprehensive approach based on knowledge, pressure reduction, and the development and support of active and passive restoration projects. First, knowledge of the distribution and status of these meadows is being systematically improved through detailed mapping and specific monitoring programs. Based on this, measures to reduce pressure are being implemented, combining specific regulatory instruments (such as the regulation of anchoring and activities through regulations protecting seagrasses) with concrete actions on the ground. These include the management of anchoring through low-impact buoy fields, which prevent further degradation from anchors and chains.

Furthermore, in recent decades, a scientific knowledge base has been consolidated thanks to pioneering projects for the replanting of *Posidonia* and other seagrasses at various points along the coast, jointly promoted by public administrations, research centers, the private sector, and the third sector. Finally, the Ministry for the Ecological Transition and the Demographic Challenge (MITECO) has launched a *Posidonia* seedling production center in Portmán (Murcia), established to supply plant material to a broad network of pilot projects led by public administrations, NGOs, and associations. The aim is to scale up the replanting of seagrass meadows and thus contribute to the future restoration of these structural habitats, vital to the Mediterranean. This first production center will be followed by a National Center for the Production of Threatened Marine Species, currently under construction, which will be located in Águilas (Murcia).

In terms of **deep benthic habitats**, Spain is promoting the restoration of deep benthic habitats and other structural seabeds through an approach that combines knowledge generation, fisheries management measures, and active restoration. Ecological restoration initiatives are being developed for coral communities and other habitat-engineering organisms, testing recovery techniques and evaluating their effectiveness. Within this context are projects such as LIFE ECOREST, jointly driven by the scientific community, public administrations, the fishing sector, NGOs, and other local stakeholders. These projects, working closely with local fishing associations, test active restoration techniques (recovery on land of accidentally caught structural organisms and their subsequent return to the seabed under conditions favorable for recolonization). These projects are moving towards governance models aimed at restoring the ecological functionality of these deep-sea habitats and their ecosystem services, while strengthening the long-term sustainability of fisheries and the coastal communities that depend on them.

It is worth highlighting the fundamental role of science and knowledge in the conservation and restoration of biodiversity, therefore, below we list some of the work that is being carried out by the Spanish Institute of Oceanography and that directly affects the restoration of marine ecosystems.

### 1. SUMMARY

The information provided is structured according to the hierarchy of action on which ecosystem restoration must pivot and which entails, at least, the following steps:

## I. Identifying the context

In order to carry out the restoration, it is essential to know the original habitat and its structure, as well as its current state, in as much detail as possible. In no case should restoration be understood as the replacement of habitat. Among the IEO's activity in this area it is worth mentioning that it is currently updating or preparing the initial scientific information for decision-making in the field of restoration of angiosperm meadows, specifically:

- The Atlas of marine angiosperms, which includes the latest update on the distribution of these species on the Spanish coast;
- Maps of the conservation status of angiosperm habitats.

In the deep ocean, work is being done on modelling techniques to identify suitable areas for the passive restoration of corals such as *Isidella elongata* or *Funiculina quadrangularis*.

Another essential step in the identification of the context will be to know and evaluate the causes of degradation, which is why the IEO works on the identification and evaluation of pressures. Among the works currently being carried out by the IEO in this area are:

- Development of a cumulative pressure index aimed at the conservation of marine angiosperms;
- The index of sensitivity of benthic habitats to bottom trawling (BESITO) has been developed and applied in some areas of the marine Natura 2000 network.

## II. Passive Restoration

Identifying and eliminating the causes of degradation, which is also known as passive restoration, is a sine qua nom condition for initiating any restoration action and increasing its guarantees of success. Sometimes, it will be the only type of action necessary to achieve habitat restoration over time.

In many cases, passive measures are associated with regulations or declaration of areas with limited activities, an area in which the IEO participates by collecting and analysing relevant information for the competent public administrations. In this sense, the IEO:

- It collects information on marine habitats that have led to the declaration of marine protected areas of the Natura 2000 Network, such as: El Cachucho, Banco de Galicia, Avilés submarine canyon system, Mud volcanoes of the Gulf of Cadiz, South of Almeria-Seco de los Olivos, Menorca Channel, Columbretes Islands, Western submarine canyon system of the Gulf of Lion, Banco de la Concepción, East and South of Lanzarote-Fuerteventura, Capbretón Submarine Canyon, Cabo Tiñoso Submarine Canyons and Pockmarks and Submarine Mountains of the Mallorca Channel;
- It carries out monitoring work in areas that have environmental and/or fishing protection figures and, therefore, accounts for the effectiveness of passive restoration that takes place thanks to the implementation of these measures.

In certain contexts, it is possible that applying certain management techniques leads to the mitigation of impacts and, with it, the recovery of the habitat. In this sense, the IEO designs

and evaluates technical management measures associated with professional fishing operations, for example:

- The return of the gorgonian bycatch, if it is associated with a firm and heavy substrate, when returned to the sea, is incorporated into the bottom and positioned in the same way as it was found as it is caught by the net and therefore the impact of a fishing operation on sensitive benthos on coralligenous bottoms is minimised. It also develops and evaluates the efficacy of innovative improvements in the treatment on board of catches of macroalgae, invertebrates and elasmobranchs, so that they can be returned to the sea and survive;
- The management of trawling, with the aim of reducing its impact on rhodolith/maërl bottoms (H1110) and on vulnerable species such as elasmobranch fish. These are technical improvements that eliminate the contact of elements of these fishing gears with the seabed and reduce the catch of species of macro-algae and invertebrates (sponges and sea squirts), without commercial interest, which form a very important part of the discards of this fishery.

### III. Active Restoration

Where passive restoration techniques are not sufficient to achieve the desired habitat type and structure, specific measures for active restoration will need to be designed. The IEO leads various projects that include the active restoration of species such as the pen shell or the flat oyster, in the case of molluscs.

In the case of the pen shell (*Pinna nobilis*), a species that is in danger of extinction and that has also been declared critical, the following lines of work are developed:

- Monitoring of populations both in coastal lagoons and of survivors left in the open sea;
- Management of specimens such as beaconing or translocation of individuals in those cases whose survival is threatened;
- Research on the reproductive cycle of the species and captive breeding, as a means of obtaining seed for future active restoration programmes of the species in the open sea;
- Studies of ecological connectivity of the species, so that connected areas have been identified and prioritized to plan future restoration actions.

On the other hand, since 2020 work has been underway on the restoration of the flat oyster, *Ostrea edulis* for bioremediation purposes, specifically in the Mar Menor.

## 2. EXTENDED INFORMATION

As already indicated, in the hierarchy of action in the field of restoration, it is a sine qua non to eliminate the causes of degradation, which is why the IEO works on the identification and evaluation of pressures. In this area, it is currently working on an index of accumulated pressures aimed at the conservation of marine angiosperms. The index of sensitivity of benthic

habitats to bottom trawling <sup>1</sup> (BESITO) has also been developed and applied in some areas of the marine Natura 2000 network.

It is also essential to have information on the state and distribution of marine habitats, both past and present, an issue on which the IEO is working. As an example, it is currently developing the scientific information for decision-making on the restoration of angiosperm meadows, specifically:

- The Atlas of marine angiosperms<sup>2</sup>, which includes the latest update on the distribution of these species on the Spanish coast;
- Maps of the conservation status of angiosperm habitats.

In the deep ocean, work is being done on modelling techniques to identify suitable areas for the passive restoration of corals such as *Isidella elongata*<sup>3</sup> (adjunct 1) or *Funiculina quadrangularis*<sup>4</sup>.

Passive measures are also associated with regulations or declaration of areas with limited activities, an area in which the IEO participates by collecting and analysing relevant information for the competent public administrations. To cite a recent example, this Institute carries out monitoring work in areas that have environmental and/or fishing protection figures and, therefore, accounts for the effectiveness of passive restoration that takes place thanks to the implementation of these measures. A recent example is the Report of conclusions on trawling in the SCI Canal de Menorca (see attachment 2). This report, which was submitted to the Sub-Directorate General for Biodiversity, Forests and Desertification of the Ministry for the Ecological Transition and the Demographic Challenge and to the Environmental Coordination Division of the General Secretariat for Fisheries of the Ministry of Agriculture, Fisheries and Food, includes, among other information, scientific evidence of the recovery of rhodolith/maërl bottoms and *Laminaria rodriguezii* forests, as a result of the management measures implemented by the Spanish State. These results are also supported by the publication of two articles in international scientific journals<sup>5</sup>. It has also collected information on marine habitats that have led to the declaration of marine protected areas of the Natura 2000 Network, such as: El Cachucho, Banco de Galicia, Avilés submarine canyon system, Mud volcanoes of the Gulf of Cadiz, South of Almeria-Seco de los Olivos, Menorca Channel, Columbretes Islands, Western submarine canyon system of the Gulf of Lion, Banco de la Concepción, East and South of Lanzarote-Fuerteventura, Capbretón submarine canyon, Cabo Tiñoso submarine canyons and pockmarks and seamounts of the Mallorca Channel. As for the active measures, they are the most complex to carry out and difficult to assess for the effects on the ecosystem, due to their usually low extensive implementation.

On the way to both are restoration measures that, being considered active, are part of the passive restoration carried out in normal operations. Among them, and considered to be one of the most efficient, are the measures associated with bycatch management, which is the capture of bycatch species of no commercial interest during professional fishing operations.

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<sup>1</sup> <https://doi.org/10.1093/icesjms/fsy030>

<sup>2</sup> <https://www.ieo.es/es/atlas-praderas-marinas>

<sup>3</sup> DOI: 10.1093/icesjms/fsac123

<sup>4</sup> <https://doi.org/10.1093/icesjms/fsaf121>

<sup>5</sup> <https://doi.org/10.3390/d14010020>; <https://doi.org/10.1007/s10531-024-03000-x>

This has been investigated in the Mediterranean Sea, one of the richest seas in biodiversity on the planet, but also one of the most threatened by human activity and with a documented history of anthropic activities that raises the sensitivity of marine ecosystems to levels close to the point of no return. In recent decades, activities such as fishing, pollution, intensive coastal tourism and global change have been the main source of impact on benthic ecosystems.

Part of the solution also lies in the anthropic activity itself and not only in the resilience capacity of species or ecosystems to impacts of varying intensity and duration. Thus, marine restoration has become a tool to minimize anthropic impacts aimed at maintaining the condition of ecosystems, the health of the Mediterranean and ensuring its ecological, social and economic benefits.

In the Mediterranean, traditional fishing by trammel nets on rocky and coralligenous bottoms (H1170) has a certain impact on benthic communities. This impact can be minimised through improvements, both in the fishing gear itself and in the process of the activity. To be managed in trammel fishing is bycatch, which is the capture of bycatch species of no commercial interest during the fishing operation. In the fishing activity carried out on the H1170 bottoms, structural species associated with robust substrate (stone, pebble, pebble, boulder) may appear, this catch, considered bycatch, is returned to the sea. In some cases they are gorgonians, large sponges or macroalgae. The return of this bycatch, if it is associated with a firm and heavy substrate, when returned to the sea, is incorporated into the bottom and positioned in the same way as it was when it was caught by the net and therefore the impact of a fishing operation on sensitive benthos on coralligenous bottoms is minimized.

The return of bycatch associated with a weight that occurs repetitively in fishing operations on artisanal vessels, has been actively replicated in structural species that appear in the nets, adding a natural artificial substrate. When a heavy substrate is added to the captured species and when it is returned to the sea, it falls like a badminton feather so that it always falls in the same position. The impact is minimal and through a complementary action a mixed restoration measure is carried out that is very efficient.

This activity has been developed in several research projects in collaboration with artisanal fishermen with very good results. Thus, this action, called the badminton effect, is easy to apply and allows it to be carried out for multiple species and during the process of the same fishing activity. So it is presented as a mixed restoration action, which can be carried out by the same user, easy to apply and in a multitude of captured structural species. It is presented as a low-cost action with a wide spectrum of applicability.

Similarly, technical management measures for trawling have also been evaluated, with the aim of reducing its impact on rhodolith/maërl bottoms (H1110) and vulnerable species such as elasmobranch fish. These are technical improvements that eliminate the contact of elements of these fishing gears with the seabed and reduce the catch of species of macro-algae and invertebrates (sponges and sea squirts), without commercial interest, which form a very important part of the discards of this fishery. These results are also supported by the publication of two articles in international scientific journals<sup>6</sup>. Likewise, the efficacy of innovative

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<sup>6</sup> <http://dx.doi.org/10.1016/j.marpol.2017.06.007>; <https://doi.org/10.1016/j.fishres.2021.105985>

improvements in the treatment on board of the captures of macro-algae, invertebrates and elasmobranchs has been developed, so that they can be returned to the sea and survive.

These technical measures to reduce the impact of fishing with trammel nets and trawl gear are part of the report Diagnosis of the impact of human activities and climate change on the marine RN2000 and proposals to control, eliminate or mitigate its effects on the continental shelf of the SCI Canal de Menorca: Professional fishing (see attachment 3). This report is one of the deliverables of Action A4 of the LIFE IP INTEMARES project, which was delivered to the Biodiversity Foundation, of the Ministry for Ecological Transition and the Demographic Challenge. These results were also presented in the participatory workshops for the development of the management plan for the SCI Canal de Menorca.

As for active restoration measures, they involve direct actions on ecosystems and species, interventions aimed at accelerating ecosystem recovery, especially in situations where natural recovery processes are too slow or hindered to achieve conservation objectives. The IEO leads various projects that include this type of measure for the active restoration of species such as the pen shell or the flat oyster, in the case of molluscs.

In the case of the pen shell (*Pinna nobilis*), a species that is in danger of extinction and has also been declared in critical condition due to the massive mortality that the species has suffered since 2016, the IEO is actively working on its recovery and restoration. To this end, it monitors populations both in coastal lagoons and survivors left in the open sea, which will be critical for future restoration programs. It coordinates projects where it collaborates with the regional administrations in management actions for these specimens such as beaconing or translocation of individuals in those cases whose survival is threatened (Claramonte et al., 2024; Maresca et al., 2025). In addition, it is one of the institutions that works to close the reproductive cycle of the species and captive breeding (Hernandis et al., 2022, 2023), as a means of obtaining seed for future active restoration programs of the species in the open sea. Other studies he is working on address the ecological connectivity of the species, which has been identified as the most promising strategy when the goal is to restore species populations. In these works, connected areas have been identified and prioritized to plan future restoration actions of the species (Coupé et al., 2023; Feria et al., 2024; Nebot-Colomer et al., 2022ab, 2024ab, 2025).

Also in the Mediterranean, since 2020 work has been underway on the restoration of the flat oyster, *Ostrea edulis*<sup>7</sup> for bioremediation purposes, specifically in the Mar Menor. This initiative is part of the NORA Alliance for the restoration of the native oyster<sup>8</sup>. Native oyster reefs and banks have disappeared in more than 95% of European seas and with them their ecosystem services. The IEO initiative contemplates laying the scientific-technical foundations for the restoration of oyster reefs together with actions of bioextraction of nutrients with oysters through restorative aquaculture techniques<sup>9</sup>. The Mar Menor lagoon has been selected as a case study because an important oyster population developed decades ago and because of the eutrophication problems it has suffered since 2016. The IEO is currently organizing the

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<sup>7</sup> <https://nora-europe.eu/spain-the-mar-menor-oyster-initiative/>

<sup>8</sup> <https://nora-europe.eu/>

<sup>9</sup> <https://nora6.es/>

biannual conference of the Alliance <sup>10</sup> in Cartagena in order to promote species/habitat restoration in the Mediterranean.<sup>11</sup>

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<sup>10</sup> [chrome-extension://efaidnbmnnnibpcajpcgiclfefindmkaj/https://www.nature.org/content/dam/tnc/nature/en/documents/TNC\\_PrinciplesofRestorativeAquaculture.pdf](chrome-extension://efaidnbmnnnibpcajpcgiclfefindmkaj/https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_PrinciplesofRestorativeAquaculture.pdf)

<sup>11</sup> The articles and reports included in this report are available at: <https://saco.csic.es/s/JLnpdQbRDeq5Jo6>