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NEXT Black Sea Basin



Good governance guidelines for MPA management

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Introduction

The protection of marine biodiversity and ecosystems holds the promise of a future resilient to various pressures. The flow of services generated by the ecosystems, which are part of the Black Sea, can be sustained only if coastal communities ensure conditions that do not disrupt the regeneration of key species populations and conserve important habitats. Marine protected areas are the way to guarantee that the intricate network of dependencies between sea organisms will not unravel under pressures stemming from coastal and maritime activities or climate change. The decision support system, which is a key component of the MARMAPS electronic environmental eFolio, identifies the areas that are most important for establishing or maintaining existing MPAs in the Black Sea basin.

This document examines the challenge of effectively managing new and existing Marine Protected Areas (MPAs), offering practitioners guidance on identifying appropriate solutions. Although each MPA is shaped by its own ecological, social and economic circumstances, the report emphasises that global experience and research can provide valuable support in developing robust, adaptive management strategies. It emphasises that a single approach cannot be applied to all MPAs and that an understanding of the local context – including ecological conditions, community needs and institutional capacity – is essential for setting meaningful objectives and implementing practical measures.

The first section of the report provides a comprehensive overview of current knowledge regarding the evaluation and enhancement of MPA management effectiveness. It summarises findings from international studies, established frameworks and emerging tools used to assess ecological outcomes and governance performance. By clarifying common challenges, such as limited resources, weak enforcement or insufficient stakeholder involvement, this section helps managers to understand where gaps may exist and which strategies have been successful in improving monitoring, compliance and conservation results elsewhere.

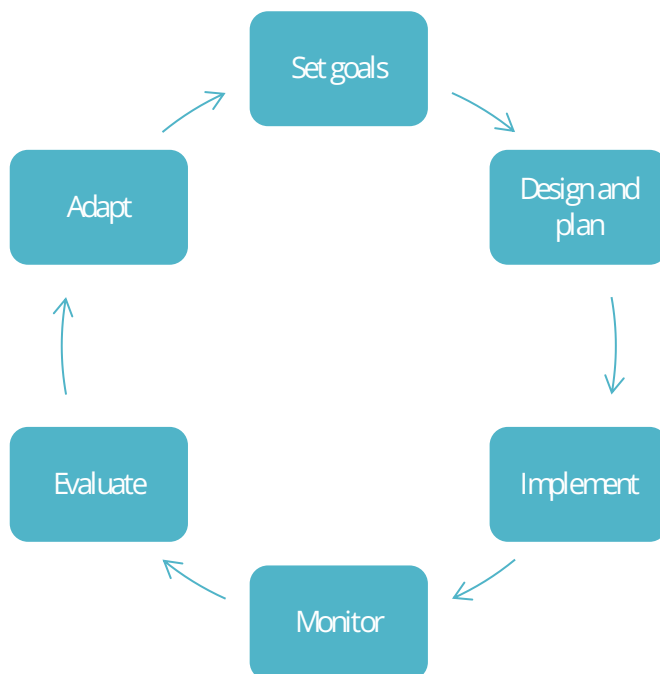
To translate this knowledge into practice, the report presents a selection of case studies that illustrate examples of effective MPA governance from different parts of the world. These cases highlight features such as participatory decision-making, adaptive management, cross-sector cooperation and long-term financing mechanisms. Building on these lessons, the final section offers insights and practical guidelines for the Black Sea region, proposing ways to strengthen managerial approaches, enhance stakeholder engagement, and improve conservation outcomes in its unique marine and coastal environments.

Managing effectively MPAs

Adaptive management

The management of natural resources and complex socio-ecological systems involves uncertainties, which originate from the interaction of natural and human factors and the inherent variabilities in the living systems. The challenges facing decision makers in the field of nature conservation have led to the wide adoption of adaptive management approaches for over four decades. Adaptive management has been introduced as a science-based approach in the last quarter of the 20th century (Holling, 1978) and applied in different contexts. It can be described as a step-by-step process of learning and adaptation in situations where knowledge is incomplete, but despite inherent uncertainty managers must take decisions and act. This happens through structured decision-making aiming to learn, incorporate new information, reach set management goals, and improve future decision-making (Allen and Garmestani, 2015; Williams and Brown, 2018). While the process of learning and adaptation should lead to increased understanding of ecological processes and improved management, the adaptive management approach is not free of challenges to its effective implementation (Månsson *et al.*, 2023).

Figure 1. Adaptive management cycle



Source: Adapted from Månsson *et al.* (2023).

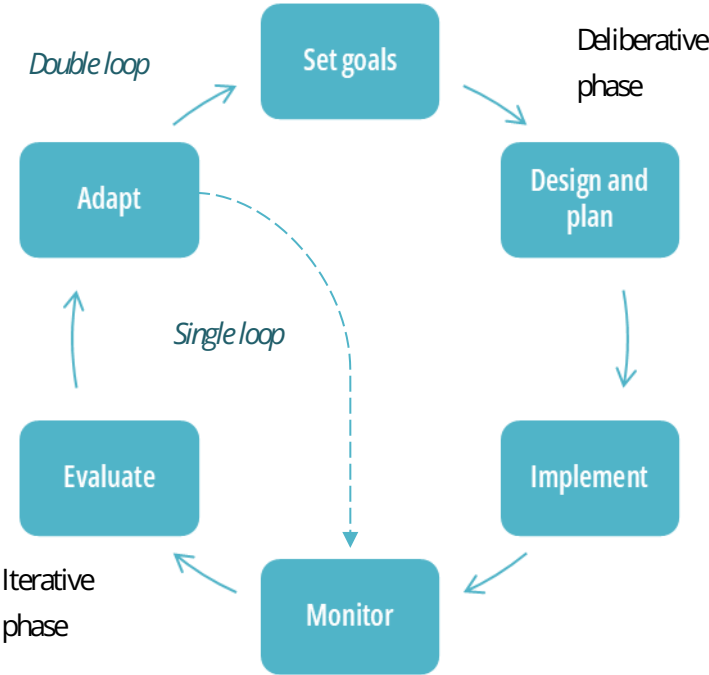
A characteristic feature of adaptive management is that it follows a circular, rather than a linear management model. The management cycle or loop relies on monitoring and learning to improve the decision-making process and if necessary to adjust the goals during the next iteration. In this it shares many common features with other continual improvement processes, such as the well-established Plan-Do-Check-Act managerial approach applied in environmental management systems aiming to reduce the impact of organisations on nature.

The adaptive management cycle includes six steps or stages (Fig. 1):

- 1) Assessment of the problem. Definition of scope, vision, goals and objectives.
- 2) Setting up actions and possible alternatives. Development of operational plan.
- 3) Implementation of planned actions.
- 4) Monitoring and recording of effects on the system in response to the employed actions.
- 5) Evaluation of the system changes and updating of knowledge about the system.
- 6) Adaptation of the objectives and actions according to the new knowledge.

The process of going through all the stages of the cycle from the initial assessment to the evaluation and adaptation of the management goals and objectives usually takes several years. The length of the cycle is determined by the variability of the systems subject to management and monitoring and the institutional framework.

Figure 2. Adaptive management cycle with double loop



Source: Williams and Brown (2018).

An attempt to introduce more flexibility in the management cycle is a variant with a double loop which distinguishes between two phases of the cycle (Fig. 2).

The deliberative phase includes problem assessment and goal setting, design of the decision architecture and implementation. The second, iterative phase covers monitoring, evaluation of monitoring results and adjustment of management strategy. The model of Williams and Brown (2018) with double loop distinguishes between decision adjustment based on technical learning and change of organisational architecture based on technical and institutional learning. The single loop occurs within the iterative phase and contains options for adjustment of technical measures within the accepted strategy. The double loop adds institutional learning in the deliberative phase, thus allowing for adjustment of the management strategy to the evolving social conditions.

The adaptive management approach is not free from possible obstacles. A systematic review of adaptive management in conservation identified three domains with potential barriers to effective management: the management process itself, ecosystem constraints and the governance system (Månsson *et al.*, 2023). Obstacles related to the adaptive management process may be encountered at every stage, from the initial planning and establishment of objectives, to implementation, to adjusting management in light of new knowledge.

Impediments most often occur during the set-up phase due to a failure to define clear objectives, realistic timelines, and adequate structures for interacting with stakeholders. Another group of obstacles relates to resources, such as sufficient staff and training, financing, and time. Organisational culture issues and poor leadership can hinder flexibility and coordination.

Knowledge gaps about the ecosystem to be managed may pose difficulties in the initial iterations of the adaptive management approach. Sudden changes in populations, invasive species or major weather events may disrupt experimental trials and management procedures.

Rigid legal frameworks and inadequate institution structures hinder adaptive shifts, especially when rapid response is needed. Fragmented institutions with weak cross-sector collaboration create bureaucratic inertia that stalls adaptive revisions.

Strategies for overcoming obstacles to adaptive management encompass strengthening the management structure and its resources, enhancing stakeholder engagement and involvement, facilitating learning processes, and ensuring institutional and political support.

Management effectiveness

The connection between actions and results is not always straightforward. Many managers are unable to regularly take a step back from their daily duties and reflect on the cumulative results of their efforts. Without this kind of reflection, resources may be wasted and objectives may remain out of reach. Evaluating management effectiveness provides a structured approach to learning from successes and failures and helps people to understand how and why management practices evolve. (Pomeroy *et al.*, 2005).

A tested framework for assessing management effectiveness of protected areas provides the International Union for Conservation of Nature, IUCN. The main objectives of the evaluation are:

- To enhance adaptive management in response to change
- To improve resource allocation
- To increase transparency and accountability
- To build community engagement and public support

The evaluation framework is based on the concept of adaptive management and the principle that good protected area management should follow a cyclical process with six elements (Fig. 3).

Figure 3. Framework for assessing management effectiveness of protected areas



Source: Hockings, Stolton and Leverington (2006)

The six elements of the evaluation are: context, planning, inputs, processes, outputs and outcomes. A generalised example that can be adapted to a specific MPA is shown here.

1. Context: status and threats – *Where are we now?*

- Ecological values: The MPA protects critical marine habitats such as seagrass beds, breeding or nursery grounds for fish and marine mammals.
- Cultural and social values: Includes areas of significance to local fishing communities (e.g., traditional fishing grounds, spiritual sites).
- Legal status: Officially designated under national legislation as a marine protected area.
- Governance: Co-managed by a national marine authority and local communities through a participatory management board.
- Threats: Overfishing, illegal fishing pollution (plastic, agricultural runoff), climate change, and tourism pressure.

2. Planning – *Where do we want to be and how will we get there?*

- Vision and objectives: Long-term conservation of biodiversity, sustainable use of marine resources, and enhancement of local livelihoods.
- Management plan: A multi-year strategic management plan is in place, with clear zoning (e.g., no-take zones, buffer areas) and measurable conservation targets.
- Zoning strategy: Core zones for biodiversity protection, sustainable use zones for artisanal fishing, and recreational zones for ecotourism.
- Risk assessments: Includes threat analyses (e.g., vessel traffic, sedimentation), with contingency plans for oil spills and climate forcing events.

3. Inputs – *What do we need?*

- Human resources: Staff includes marine rangers, community enforcement officers, scientific advisors, and outreach personnel.
- Financial resources: Funded by a mix of government allocations, international donor support (e.g., GEF, WWF), and tourism levies.
- Equipment and infrastructure: Patrol boats, surveillance equipment (drones, radios), mooring buoys, and a visitor education centre.
- Data systems: Ongoing biodiversity monitoring supported by GIS and marine biodiversity databases; community-based catch logbooks are also used.

4. Processes – *How is management implemented?*

- Decision-making: Inclusive management board with representation from local fishers, NGOs, scientists, and government officials.
- Surveillance and enforcement: Routine patrols, community-based monitoring, and satellite surveillance to detect illegal fishing.
- Community involvement: Local fishers are engaged through stewardship programs, eco-guard roles and participatory research.
- Adaptive management: Management plans are revised based on annual monitoring and stakeholder feedback (e.g., key species health, fish biomass).

5. Outputs – *What did we do and what products or services were produced?*

- Conservation activities: Restoration of degraded habitats and enforcement of seasonal fishing bans.
- Awareness programs: Environmental education campaigns in schools, training for local guides, and signage throughout the MPA.
- Capacity building: Training workshops on sustainable fishing, ecotourism operations, and alternative livelihoods (e.g., seaweed farming).
- Tourism infrastructure: Creation of snorkelling trails, mooring buoys to prevent anchor damage, and waste disposal facilities.

6. Outcomes – *What has been achieved?*

- Ecological results: Increases in seagrass, mussel beds and fish biomass in no-take zones; observed return of key species.
- Social and economic benefits: Increased income from tourism and alternative livelihoods; improved community perception of the MPA.
- Threat reduction: Decline in illegal fishing incidents and better compliance with zoning rules.
- Governance outcomes: Strengthened local institutions, trust among stakeholders, and influence on regional marine policy.

This framework offers a systematic, adaptive and evidence-based approach to assessing and enhancing the management of protected areas, thereby promoting accountability and learning over time. It is flexible and can be customised to different contexts and scales. The framework can be applied in various formats: from rapid site audits to in-depth, systematic evaluations. It can assess either a single protected area or an entire network of MPAs, and the frequency of assessments can range from occasional audits to regular monitoring cycles. The steps for applying an evaluation include:

- Clarify the evaluation's scope, purpose and audience
- Select appropriate methods and indicators
- Collect data
- Analyse results
- Report and communicate the outcomes
- Apply findings to adaptive management and future planning.

The framework for assessing management effectiveness has been adopted by parks and protected areas authorities from Finland (Stolton *et al.*, 2024) to Australia and endorsed by international networks in the field of nature conservation.

The effectiveness debate

Although marine protected areas (MPAs) are essential tools for conserving marine biodiversity, the effectiveness of these protections depends far more on the quality of their design, governance and monitoring than on simply expanding the area covered. Giakoumi *et al.* (2024) present empirical evidence from southern Europe showing that

many MPAs have significant deficiencies in monitoring and implementation. In many locations, baseline data is lacking, monitoring protocols are inconsistent or absent, and the frequency of sampling is insufficient to detect meaningful ecological change. These shortcomings undermine managers' ability to evaluate whether conservation goals are being met or to apply adaptive management strategies. Even where MPAs are formally designated, weak enforcement and poorly articulated regulations often limit ecological gains. In practice, nominal protection frequently fails to translate into measurable improvements in biodiversity, biomass or ecosystem resilience.

Meehan *et al.* (2020) take a broader approach to the problem by assessing the range of indicators available for evaluating entire MPA networks. Their review reveals that, despite the existence of dozens of proposed indicators, there is no coherent or widely adopted set capable of capturing the full range of qualitative elements embedded in international biodiversity targets. Critical dimensions, including ecological representativeness, connectivity among protected sites, management effectiveness and governance equity, are only partially or inconsistently measured. This fragmented indicator landscape prevents reliable assessments of whether MPA networks are functioning as intended on a regional or global scale. While area-based targets such as "30×30" have generated political momentum, Meehan *et al.* (2020) argue that, without a harmonised, scientifically grounded indicator framework, these targets will not be effective.

Both studies highlight a key message: MPA success hinges on quality, not just quantity. Giakoumi *et al.* (2024) demonstrate that deficits in implementation and monitoring at the site level hinder the evaluation of ecological outcomes, while Meehan *et al.* (2020) show that even when data are available, the absence of a standardised, network-level framework impedes broader assessments of effectiveness. Together, their findings highlight the need for investment in capacity, including adequately funded monitoring programmes, standardised protocols and stronger enforcement mechanisms. They also advocate the development and adoption of a concise yet comprehensive set of indicators that span ecological, managerial and social dimensions, and that can be applied consistently across regions.

Overall, these studies reveal a discrepancy between the global ambitions for marine protection and the practical tools and capacities required to achieve them. Closing this gap requires strengthening on-the-ground monitoring and management, and improving the conceptual and methodological foundations for assessing network performance. Effective marine conservation depends on bridging these two areas – ensuring that MPAs are numerous, strategically designed, well managed and rigorously evaluated.

This assertion is validated by studies with a regional focus that support the conclusion that high MPA effectiveness is linked to strong stakeholder support, clear objectives, and robust management practices, including enforcement and monitoring (Batista and Cabral, 2016). Improving MPA coverage is essential, but it should consider existing networks to ensure coherence and representativeness. Establishing new restricted areas in key

conservation locations will enhance biodiversity protection. Both effective governance and expanded MPA networks are crucial for achieving long-term conservation goals.

Focus on the Black Sea

Recent studies from the Black Sea region have also emphasised the importance of ecological data and habitat-specific monitoring when planning the effectiveness of MPAs, as well as the need to account for climate change. A compelling example of this comes from the work of Almpandou, Doxa and Mazaris (2021), who used a cumulative risk index and species distribution data to identify areas of the Black Sea that are important for marine biodiversity conservation. Rather than assuming protection based on existing boundaries, this study uses a spatially explicit approach to highlight zones where biodiversity is both rich and vulnerable. This demonstrates that protection planning must be data-driven and risk-aware, particularly in regions experiencing multiple anthropogenic pressures.

Advances in baseline ecological data complement this approach, enhancing the ability to evaluate benthic biodiversity, which is crucial for ecosystem functioning. A comprehensive dataset focusing on zoobenthos incorporates records of 215 macrozoobenthic taxa, along with 27 biological traits of half of these taxa (Chevalier *et al.*, 2025). These were collected over two decades from the northwestern shelf of the Black Sea. Enriched by substrate and abiotic variables, this dataset provides a more comprehensive baseline against which future environmental changes, whether due to human activities or climate change, can be measured. Combining species occurrences with trait and environmental data enables functional diversity analyses and modelling of ecosystem functions such as bioturbation and nutrient cycling. This is a significant development for the management and monitoring of Black Sea benthic ecosystems.

Finer-scale studies also demonstrate the importance of habitat exploration within MPAs. A study of benthic diversity in MPAs along the southern Romanian Black Sea coast – Cape Tuzla and Mangalia Sulfur Springs – identified seven distinct habitats and described species composition and diversity levels (Begun *et al.*, 2022). This study calls for further research to carefully document the valuable coastal habitats within the framework of MPAs, and to evaluate the impact of specific pollutants on organisms most susceptible to these stressors. It also touches upon the issues of ineffective management and insufficient stakeholder involvement in the establishment of MPAs, which can give rise to public conflicts due to a lack of consensus.

A study examining the protection of *Phyllophora crispa* communities in southwestern Crimea calls into question the effectiveness of existing MPAs (Alexandrov and Milchakova, 2022). Despite the presence of these protections, significant declines in biomass and density were observed between the 1960s and 2015–2020. No substantial differences in average biomass or density were found between protected and unprotected areas, except at a depth of 10 metres, where values were higher inside MPAs. The limited size of

the MPAs and their proximity to negative impacts may undermine their effectiveness, prompting recommendations to increase coverage and create buffer zones to improve conservation efforts.

The Russia–Ukraine war, and especially the destruction of the Kakhovka Dam, has caused major disruptions to Black Sea biodiversity by releasing vast amounts of freshwater, sediments, industrial pollutants, and debris into coastal and estuarine ecosystems. This sudden environmental shock altered salinity, temperature, and oxygen levels, damaging seagrass beds, macroalgae, benthic invertebrates, and fish communities while degrading critical habitats across the northern Black Sea (Kvach *et al.*, 2025). Oil spills, shelling, and military activity further increased contamination and physical destruction. Although some species show resilience, and reduced human activities such as fishing and shipping have temporarily eased pressure, the overall impact remains strongly negative, with long-term consequences for ecosystem structure and recovery.

In summary, this recent body of research highlights several interrelated conclusions. Effective marine conservation in the Black Sea requires data-driven, risk-aware planning that goes beyond the mere designation of protected areas. Priority zones should be identified based on species distributions, habitat types, and cumulative stressors. High-quality baseline data on marine communities and use of habitat-specific and function-oriented approaches are essential for understanding ecosystem health, resilience, and function. MPAs must be regarded as heterogeneous, dynamic social-ecological systems. Conservation planning and monitoring must integrate habitat diversity, ecological function and long-term environmental change, including the impact of climate change, while periodic resampling and functional assessments are necessary to ensure that MPAs deliver real conservation and ecosystem service benefits. Improved habitat mapping, regular monitoring and combining biotic and abiotic data will be key to fulfilling the potential of MPAs in the Black Sea region in the future. This should be accompanied by stakeholder involvement in the designation and management of MPAs and the implementation of good governance practices.

Case studies

Each case study adheres to a consistent structure. It begins with a concise introduction to the Marine Protected Area (MPA), covering its name, the country in which it is located, and the year of its establishment. The introduction also outlines the MPA's key characteristics, such as whether it is estuarine, island-based, coastal or in open water, and describes its primary conservation objectives. These may range from protecting biodiversity, habitats and geological formations to safeguarding spawning grounds and essential fishery resources. A brief description of the local socio-economic and environmental context is provided to offer further insight, along with information on whether the site is part of a wider MPA network.

The case study then identifies the managing authority and evaluates its performance in delivering conservation outcomes. The specific management measures implemented are summarised and grouped into technical, legal, economic and educational actions. Attention is paid to how these measures balance necessary restrictions with support for local communities, with a focus on efforts to maintain sustainable livelihoods while ensuring ecological protection. The involvement of stakeholders is described in detail, emphasising consultation processes, co-management arrangements, and the role of local knowledge.

Finally, each case study notes the resources dedicated to the MPA, including staff, funding and equipment, and assesses the observable effects of management interventions. These effects are presented in ecological terms, such as changes in species populations or habitat condition, and in economic terms, including changes in fisheries productivity and tourism benefits, as well as other socio-economic outcomes. This structure ensures that each example provides a clear, comparable overview of governance approaches and real-world impacts.

The basic structure of each case study follows the same outline:

Marine protected area name	Managing performance
Country	Types of measures: technical, legal, economic, literacy / awareness / education
Establishment year	Balance between restrictions and support for local stakeholders
Characteristics	Stakeholder involvement
Objectives: biodiversity protection, species, geological formation, fishery spawning area, etc.	Dedicated resources: human, financial, equipment
Local context	Effects: ecological; economic
Part of MPA network	
Managing authority	

National Marine Park of Alonissos Northern Sporades, Greece

<https://alonissos-park.gr>

<https://necca.gov.gr/en/mdpp/management-unit-of-alonissos-northern-sporades-national-park-and-protected-areas-of-eastern-thessaly>

Establishment Year

- Founded by Presidential Decree on May 16, 1992; zoned and its management authority formalised in 2003

Characteristics

- Type: Coastal and open-water MPA encompassing sea around Alonissos and six smaller islands plus 22 islets with a total area of 2,260 km²
- Zones:
 - Zone A (1,587 km²): Highly protected areas (Piperi core, outer ring) with strict restrictions
 - Zone B (678 km²): Buffer where regulated activities like amateur fishing and tourism are allowed
- Habitats: Steep rocky shores, sheltered coves, sea caves; Posidonia meadows; supports diverse marine communities with over 300 fish species, seabirds and Mediterranean monk seals

Objectives

- Monk seal (*Monachus monachus*) protection – one of the world's last colonies (about 60 individuals with 9 pups per year)
- Preserve marine biodiversity (fish, corals, dolphins, whales, sea turtles) and key flora and fauna species
- Safeguard marine habitats as part of Natura 2000 network and network of MPAs
- Promote research, monitoring, and environmental education

Local Context

- Remote community of more than 3000 residents across Alonissos and nearby islands
- Local fishermen initiated MPA creation before 1992 to sustain livelihoods via fish-stock conservation
- Tourism-based restrictions exist, including 3 nm exclusion zone from Piperi for seal protection; access only via permits

Part of MPA Network

- Core of Greece's first marine national park, Europe's largest marine reserve
- Integrated in Natura 2000 (SCIs/SACs), MedPAN, and national Cetacean Sanctuary

Managing Authority

- Management Unit of Sporades National Park under the Natural Environment and Climate Change Agency, joint board (ministries, regional authorities, fishermen, NGOs like MOM)
- Enforcement by Coast Guard, with NGO support (MOM, Thalassa Foundation, Sea Shepherd)

Managing Performance

- External support:
 - 2019 speedboat donation from Thalassa Foundation increased patrols

- Long-term ichthyological studies show stable fish stocks, good monk-seal reproduction (~4–8 pups annually)
- 2025 EU-sponsored dive cleanup raised awareness over marine litter in hotspot zones

Types of Measures

- Technical
 - Zoning system (A1, A2, B) with spatially explicit restrictions
 - Patrolling: vessels, 3G cameras, NGO-assisted monitoring
 - Scientific programs: seal tagging, fish surveys, water quality mapping (ODYSSEA, ecosystem monitoring, monk seal conservation projects)
- Legal
 - Presidential Decree and Joint Ministerial Decision (1992/2003) establish zones and regulations
 - Bans: professional fishing in A zones, bottom-trawling banned in MPA areas (Sea Shepherd partnership)
- Economic
 - EU, national and NGO funding; private donations (boats, staff)
 - Fishermen supported via sustainable-net schemes; tourism driven by nature experiences
- Education / Awareness
 - Extensive outreach: public meetings, school programmes, Oceanography summer schools
 - Visitor support for eco-tourism: seal rehabilitation centre, dive-accessible shipwreck trails, citizen cleanups

Balance: Restrictions vs Stakeholder Support

- Core protected zones shield seal breeding; buffer zones allow sustainable fishing and tourism
- Local fishermen actively engaged: self-imposed gear restrictions (≥ 22 mm mesh, limited hours) to support resource renewal
- NGOs, park authority, and communities collaborate through participatory governance and shared objectives

Stakeholder Involvement

- Fishermen's Cooperative were founding advocates; represented on management board
- NGOs (MOM, Thalassa, Sea Shepherd) co-manage research, outreach, and enforcement
- Multi-stakeholder platforms convene national MPA managers to share best practices

Dedicated Resources

- Human: park authority, Coast Guard, NGO-supplied teams
- Financial: Management Unit of Sporades National Park budget, EU funds, ministries, NGOs, donations of equipment
- Equipment: speedboats, monitoring cameras, seal centre, diver trails, tagging gear

Effects

- Ecological

- Monk seal numbers stable; regular births (~9/year)
- Healthy fish populations; better catches than other Greek waters
- Habitat protection supports seabirds, marine megafauna and biodiversity across habitats
- Economic / Social
 - Eco-tourism growth: divers, seal-spotting, and cultural visits sustained livelihoods
 - Fisher community mixed: benefits from spill-over and tourism, but some feel regulatory burdens are not compensated by economic returns

Summary

The Alonissos Marine Park represents a landmark in Mediterranean conservation: balancing stringent habitat protection, local community involvement, and scientific oversight. Its success in supporting endangered seals, robust fish stocks, and eco-tourism is tempered by ongoing calls from fishers for more tangible socioeconomic gains. It stands as a model for participatory MPA governance with measurable ecological outcomes.

National Marine Park of Zakynthos, Greece

<https://www.nmp-zak.org/>

<https://necca.gov.gr/en/mdpp/management-unit-of-zakynthos-and-ainos-national-parks-and-protected-areas-of-the-ionian-islands>

Greece, Ionian Sea (Laganas Bay, Zakynthos)

Establishment Year

- Created by Presidential Decree in December 1999, zoning and management authority formalised in 2000–2003

Characteristics

- Type: Coastal open-water park (~135 km² marine + ~45 km² terrestrial adjacent), includes nesting beaches, Keri Lake wetland, Strofades islets (44 km south-southeast of the island of Zakynthos)
- Habitats: Sand dunes, beaches, Posidonia beds, submerged reefs; important for *Caretta caretta*, *Monachus monachus*, seabirds

Objectives

- Protect loggerhead sea turtles, hosting 900–2,000 nests (~80% of Mediterranean nests)
- Conserve monk seals, seabirds, endemic plants, Posidonia
- Support sustainable eco-tourism, fisheries, environmental education and biodiversity monitoring

Local Context

- Area includes tourist heavy Laganas and Kalamaki, Marathonisi islet (“Turtle Island”), Strofades
- Local fishermen, NGOs (ARCHELON, MEDASSET) initiated protection in the 1990s

Part of MPA Network

- Greece’s first marine park for protection of sea turtles, part of Natura 2000 (SCI/SPA) designations, integrated in national Cetacean Sanctuary

Managing Authority

- Managed by Management Unit of Zakynthos and Ainos National Parks and Protected Areas of the Ionian islands operates under N.E.C.C.A., overseen since 2000
- Enforcement by Coast Guard, park rangers, and NGO partners (ARCHELON, Sea Shepherd, MOM)

Managing Performance

- Strong community representation: 6 of 10 authority members are local
- Persistent challenges: vessel speed violations (2022: 1,803 speed infractions), nighttime beach disturbance, litter and illegal landfill
- Nesting counts rising: 1,200+ nests in 2024 on Sekania alone; long-term conservation credited

Types of Measures

- Technical
 - Zoning A/B/C (and D): strict protection (Zone A), regulated access (Zones B and C)

- Patrolling via boats, CCTV; scientific monitoring (nest counts, water, wildlife surveys)
- Legal
 - Presidential Decree (1999) and subsequent regulations ensure protection of zones, beaches, activities
 - Night access, boat speed/anchoring limits, fishing bans in strict zones
- Economic
 - Funded by government, EU/LIFE programs, NGO donations (boats/equipment)
 - Eco-tourism: controlled boat trips, guided beach access, low-impact visitor services
- Literacy / Awareness / Education
 - Info stations on beaches, public awareness campaigns, school programs, outreach to tourists (over 60,000 informed annually)
 - Codes of conduct for ecotourism, strict nest protection, beach visitor rules

Balance: Restrictions vs Stakeholder Support

- Zoning offers strict core protection with regulated use in the periphery
- Local communities and NGOs actively involved; participatory governance and bottom-up initiatives
- Enforcement gaps persist; need stronger funding for surveillance and litter control

Stakeholder Involvement

- Management board includes local society, fishermen, ministries, NGOs
- NGOs (ARCHELON, Sea Shepherd, MOm, MEDASSET) support monitoring, enforcement, education

Dedicated Resources

- Human: Park authority staff, rangers, Coast Guard, NGO volunteers (ARCHELON)
- Financial: State budget, EU grants, NGOs, donations
- Equipment: Patrol vessels, CCTV, nesting beach cages, info stations

Effects

- Ecological
 - Stable or increasing loggerhead sea turtle nesting (record nests in 2024, ~60% of Mediterranean total)
 - Monk seals present, but no pupping within park boundaries; occasional sightings documented
- Economic / Social
 - Eco-tourism sustained; visitor education valued though concerns persist about beach crowding and light pollution
 - Mixed feedback: while many support protection and tourism revenue, some locals cite regulation burdens amid enforcement gaps

Summary

The Zakynthos MPA is an important conservation model: a legally robust, community-supported, science-driven marine park safeguarding Mediterranean sea turtles and monk seals. It combines strict zoning, education, and stakeholder engagement, although enforcement and pollution remain persistent challenges.

Brijuni National Park, Croatia

<https://www.np-brijuni.hr/>

Croatia, Adriatic Sea

Establishment year

- 1983 (official designation of the public institution managing the park)

Characteristics

- The Brijuni Islands is an archipelago of 14 small islands in the Croatian part of the northern Adriatic Sea, separated from the west coast of the Istrian peninsula by the narrow Fažana Strait. The largest island, Veliki Brijun, with an area of 5.6 km², lies 2 kilometres off the coast. The second-largest island is Mali Brijun with an area of one square kilometre, and twelve much smaller islands. Known for their scenery, the islands are a holiday resort and a National Park. It is primarily a coastal and island-based MPA, with extensive open-water marine habitat. Approximately 80% of the park is marine, and 20% is terrestrial.

Objectives

- Protection of marine and terrestrial biodiversity
- Conservation of habitats, including seagrass meadows (e.g., *Posidonia oceanica*)
- Protection of endangered and protected species such as dolphins, sea turtles, noble pen shells, and various bird species
- Preservation of fish spawning and nursery grounds in the northern Adriatic
- Protection of geological, paleontological, and cultural heritage (e.g., fossil sites, historical structures)
- Support for ecological resilience and climate-related functions (e.g., carbon sequestration in seagrass habitats)

Local Context

- The MPA is located off the coast of the Istrian Peninsula, near Pula, and is integrated into a region combining high natural biodiversity with rich cultural and historical heritage. It is also a key tourist destination.

Part of MPA Network

- Brijuni National Park is part of the EU Natura 2000 network and belongs to the global Blue Parks network (Gold Award recipient).
- The Croatian network of MPAs (CroMPA) was initiated by the Public Institution Brijuni National Park in 2021. The network's objectives include improving management effectiveness and capacity building, sharing data, taking a common approach to solving management problems, influencing the development of a strategic legal framework, and planning, preparing and implementing joint projects. All parks are part of MedPAN, the network of managers responsible for MPAs in the Mediterranean.

Managing Authority

- Managed by the Public Institution Brijuni National Park, established by the Government of Croatia. Classified under IUCN Category II (National Park).

Managing Performance

- Conducts long-term environmental and ecological monitoring
- Collaborates with scientific institutions
- Recognized internationally for effective management (Blue Park Gold Award)
- Balances conservation and sustainable tourism within a regulated framework

Types of Measures

- Technical measures
 - Environmental monitoring
 - Mapping of habitats, scientific research
 - Regulated zones for anchoring, navigation, diving, and fishing
- Legal measures
 - Formal national park protection,
 - Activity restrictions, zoning (including no-take and scientific research areas), species and habitat protection under Croatian and EU law.
- Economic measures
 - Sustainable financing through tourism revenue (visitor services, guided tours, diving programs). The park is financially self-sustaining.
- Literacy / awareness / education
 - Public education programs, visitor centres, exhibitions, guided tours
 - Scientific outreach, and environmental education initiatives

Balance between restrictions and stakeholder support

- The park enforces strict conservation rules while allowing regulated tourism, which in turn finances conservation. Certain areas (including parts under state or military jurisdiction) limit access, contributing indirectly to habitat protection. Recreational fishing is allowed only under permit and within designated zones.

Stakeholder Involvement

- Collaboration with tourism operators, local communities, scientific institutions, NGOs, and government authorities. Emphasis on cooperative management and sustainable use.

Dedicated Resources

- The managing institution employs on the order of ~330 staff (professional service staff, nature guards, etc.) focused on preservation, monitoring and park administration
- Financing comes primarily from tourism revenues and visitor services, supplemented by EU projects
- Equipment for monitoring, patrolling, tourism management, and scientific research

Effects

- Ecological effects
 - Maintenance of high marine biodiversity
 - Protection of seagrass meadows, fish stocks, and endangered species
 - Functioning fish nursery and spawning zones
 - Positive ecological indicators recognized by international awards
- Economic effects
 - Strong tourism-driven revenue supporting both conservation and local economy
 - Employment for local communities
 - Enhanced regional visibility as a high-value natural and cultural destination

Summary

Brijuni National Park is a well-managed MPA (Maestro *et al.*, 2022) established to conserve rich biodiversity and cultural heritage. It protects seagrass meadows, endangered species, and key fish spawning grounds while balancing conservation with regulated tourism. Strong governance, sustainable financing, and scientific monitoring have resulted in positive ecological outcomes and significant economic benefits.

MPA Torre Guaceto, Italy

<https://www.riservaditorreguaceto.it/index.php/en/>

Italy, Apulia, southeastern Adriatic coast

Establishment year

- 1991

Characteristics

- Coastal and marine area on the Adriatic Sea, including seagrass meadows (*Posidonia oceanica*), rocky reefs, sandy bottoms, wetlands, and transitional habitats. Adjacent to the Torre Guaceto State Nature Reserve (terrestrial and wetland).

Objectives

- Conservation of marine biodiversity and habitats
- Protection of endangered or sensitive species
- Recovery of fish stocks and nursery areas, promotion of sustainable fisheries
- Restoration of seagrass meadows and coastal ecosystems
- Integration of marine conservation with sustainable terrestrial wetland protection
- Implementation of environmental education programs

Local Context

- Located in Apulia (Puglia), near Brindisi, in a region with high tourism pressure, traditional small-scale fisheries, and valuable coastal wetlands. The MPA is closely tied to local cultural practices and community-based resource management.

Part of MPA Network

- Part of the Natura 2000 network and an internationally referenced model for community-based MPA governance.
- Specially Protected Areas of Mediterranean Importance (SPAMI), MedPAN

Managing Authority

- Consorzio di Gestione di Torre Guaceto (Consortium for the Management of Torre Guaceto), composed of the Municipalities of Brindisi and Carovigno and WWF Italia

Managing Performance

- Internationally regarded as a “best-practice” MPA due to strong enforcement, scientific monitoring, community co-management, and successful ecological recovery. Frequently cited in EU marine policy literature.
- EMAS, ISO 14001:2015, Blue Parks

Types of Measures

- Technical measures:
 - Habitat restoration, scientific monitoring
 - Sustainable fishing protocols
 - Strict zoning (including no-take areas)
- Legal measures:

- Nationally designated MPA with regulated activities
- Enforcement patrols, and formal co-management agreements
- Economic measures:
 - Regulated, low-impact fisheries
 - Eco-tourism programs
 - Reinvestment of revenue in conservation and community support
- Literacy / awareness / education:
 - Visitor centres
 - Educational programs, guided experiences
 - Community engagement, and public outreach campaigns

Balance Between Restrictions and Stakeholder Support

- Restrictions, such as no-take zones and limited fishing access, are balanced through negotiated agreements with local fishers, who benefit from increased fish biomass and improved long-term yields. Tourism operators participate under sustainability guidelines.

Stakeholder Involvement

- The MPA is known for strong collaboration between local fishers, municipalities, conservation NGOs, and scientists. Co-management is a core principle.

Dedicated Resources

- Dedicated staff for enforcement, research, education, and visitor management; sustainable financing through public funds, EU projects, and regulated tourism; equipment for monitoring and patrols.

Effects

- Ecological effects:
 - Significant increases in fish biomass, recovery of commercial species, improved habitat quality, and successful protection of *Posidonia* meadows.
- Economic effects:
 - Higher value and stability of small-scale fisheries, growth of eco-tourism, and improved local economic resilience tied to sustainable use.

Summary

Torre Guaceto MPA is a nationally designated coastal and marine reserve known for strong governance and community co-management. Strict protection measures, including no-take zones, have led to major ecological recovery, notably in fish biomass and seagrass habitats. Local fishers and tourism operators benefit economically from sustainable, high-value activities supported by the MPA's management system.

Gulf of Orosei, Sardinia, Italy

<https://www.mase.gov.it/portale/parco-nazionale-del-golfo-di-orosei-e-del-gennargentu>

National Park of the Gulf of Orosei and Gennargentu / Parco Nazionale del Golfo di Orosei e del Gennargentu

Italy, eastern coast of Sardinia, Province of Nuoro

Establishment Year

- 1998 (Decree of the President of the Republic)
- Biderosa Nature Reserve: Established in the early 2000s.
- Grotte del Bue Marino: Recognized as a protected site since the late 20th century.
- Other protections: Various regional and municipal conservation measures since the 1980s and 1990s.

Characteristics

- Type of Environment:
 - Coastal: Over 40 km of rugged coastline with cliffs up to 300 m high.
 - Island: Situated on the island of Sardinia.
 - Open Water: Gulf of Orosei, part of the Tyrrhenian Sea.
 - Karstic Caves: Grotte del Bue Marino.
 - Beaches: Cala Luna, Cala Mariolu, Cala Goloritzè, Osala, and Biderosa.
 - Forests and Highlands: Supramonte massif and evergreen oak forests.

Objectives

- Biodiversity Protection:
 - Protects habitats for over 700 plant species, including *Juniperus phoenicea* (Phoenician juniper), *Pistacia lentiscus* (mastic tree), *Quercus ilex* (holm oak).
 - Marine habitats include *Posidonia oceanica* seagrass meadows—vital for Mediterranean biodiversity.
- Species Conservation:
 - Marine fauna:
 - Loggerhead sea turtle (*Caretta caretta*)—nesting and foraging area.
 - Groupers (*Epinephelus marginatus*), amberjack (*Seriola dumerili*), and dentex (*Dentex dentex*).
 - Historical presence of the endangered Mediterranean monk seal (*Monachus monachus*), last seen in the 1980s.
 - Bottlenose dolphin (*Tursiops truncatus*) sightings are frequent.
 - Birds:
 - Peregrine falcon (*Falco peregrinus*), Audouin's gull (*Larus audouinii*), shag (*Phalacrocorax aristotelis*).
 - Terrestrial fauna:

- Sardinian wild boar (*Sus scrofa meridionalis*), mouflon (*Ovis aries musimon*), and the endemic Sardinian deer (*Cervus elaphus corsicanus*).
- Geological Formation Preservation:
 - Grotte del Bue Marino (stalactites, underground lakes), Ispinigoli Grotto (38 m high stalagmite, among the world's tallest).
 - Gorropu Gorge: up to 500 m deep, among Europe's deepest canyons.
- Fishery Spawning Area Designation:
 - Posidonia beds and rocky reefs serve as nurseries for commercial fish species.

Local Context

- Dorgali, a Sardinian community of about 8,500 residents, is rich in archaeological and cultural heritage, from the Nuragic sites to Roman and medieval remains. Known for its traditional crafts and signature foods like local wine, cheese, and local pastries, as well as festivals, the area welcomes over 100,000 visitors each year. Its dramatic landscapes offer hiking, caving, climbing, kayaking, diving, and biking.

Part of MPA Network

- The Gulf of Orosei and its reserves (e.g., Biderosa, Supramonte) are part of Sardinia's regional network of protected natural areas.
- Part of Natura 2000 network.

Managing Authority

- Regional Government: Regione Autonoma della Sardegna.
- Local Government: Comune di Dorgali, Comune di Orosei.
- Nature Reserve Authorities: Biderosa Reserve administration.
- Private/Community: S'Abba Frisca Park Museum (private ethnographic and naturalistic museum).
- Collaboration: Local cooperatives, tourism operators, environmental NGOs.

Managing Performance

- Visitor Management:
 - Biderosa: daily visitor cap (max ~100 cars/day), entrance fee, online booking.
 - Caves: guided tours only, limited group sizes.
 - Some beaches only accessible by boat or long hike, naturally limiting numbers.
- Conservation Successes:
 - High water quality and preserved landscapes.
 - Archaeological sites maintained and interpreted for visitors.
- Challenges:
 - High seasonal tourism pressure (especially July–August).

- Need for more integrated marine monitoring and enforcement.

Types of Measures Implemented

- Technical Measures:
 - Visitor quotas and ticketing systems in Biderosa and caves.
 - Marked hiking trails, interpretive signage, and maintained paths.
 - Mooring buoys to prevent anchor damage to seagrass beds.
- Legal Measures:
 - Regional conservation laws, regulated access to reserves and caves.
 - Archaeological heritage protection by national law.
 - Fishing restrictions in some zones.
- Economic Measures:
 - Entrance fees support management and restoration.
 - Support for local agritourism, crafts, and food production.
- Literacy, Awareness, and Education Measures:
 - S'Abba Frisca Park Museum: over 400 ethnographic and naturalistic exhibits; guided tours for schools and tourists.
 - Educational panels at archaeological and natural sites.
 - Community events and festivals promote local culture and environmental awareness.

Balance between Restrictions and Support for Local Stakeholders

- Restrictions (visitor limits, protected zones) are designed to protect sensitive areas, but also create opportunities for sustainable tourism and local enterprise.
- Local products and traditions are promoted as part of the visitor experience, supporting the rural economy.

Stakeholder Involvement

- Active Engagement: Local families and cooperatives manage many tourism and conservation services; community festivals and events are organized by local associations.
- Decision-making involves collaboration between authorities, businesses, and residents.

Dedicated Resources Available

- Human Resources:
 - Park rangers, museum staff, local guides, cooperative workers.
- Financial Resources:
 - Entrance fees, tourism revenue, regional and municipal funding, private investment.
- Equipment Resources:
 - Visitor infrastructure (trails, signage, rest areas), boats for excursions, museum collections, educational materials.

Effects of Management

- Ecological Effects:
 - High biodiversity, preserved habitats for key species (e.g., *Caretta caretta*, *Epinephelus marginatus*).
 - Recovery of some habitats (e.g., Posidonia meadows, forests).
 - Continued presence of rare birds and increased sightings of dolphins.
- Economic Effects:
 - Tourism is the main economic driver, with significant benefits for local businesses and employment.
 - Value-added for local products (wine, cheese, crafts) through branding and direct sales to tourists.
 - Diversification of rural economy, reducing dependence on traditional agriculture and livestock.

Summary

The Gulf of Orosei is one of Sardinia's most valuable natural and ecological areas: a formally protected Natura 2000 site and part of a national park, covering a wide array of habitats and species. However, despite this legal framework, evidence for effective marine-zone management remains limited. For full conservation benefit the area would require more active, consistent governance, monitoring, and sustainable-use planning, especially given tourism and recreational pressures.

Asinara National Park, Sardinia, Italy

<https://www.parcoasinara.org>

Establishment Year

- Provisional designation and measures to protect the Asinara National Park, 1997
- Decree of the President of the Republic, 2002

Characteristics

- Type: Coastal and open-water reserve around the island; 1–2 km offshore, perimeter of 79 km, total area of 10,732 ha, half of it marine
- Geomorphology:
 - *West side*: steep rocky slopes to ~50 m; strong seasonal currents
 - *East side*: gentle sandy slopes to ~50 m; sheltered currents
- Habitats:
 - Extensive *Posidonia oceanica* meadows (~3,600 ha)
 - Rocky reefs with brown and red algae (e.g., *Cystoseira*, *Lithophyllum*, *Laminaria*)

Objectives

- Conservation of marine biodiversity: *Posidonia*, *Pinna nobilis*, *Patella ferruginea*, red algae
- Protection of commercial & sensitive species: grouper, snapper, sea bream, lobster, dolphins, sea turtles, cetaceans
- Part of Cetacean Sanctuary, safeguarding whales and dolphins
- Support ecological research, monitoring, and environmental education

Local Context

- Remote island formerly a penal colony/prison; low human disturbance leading to highly intact habitat
- Accessible only by authorized ferry and guided visits; private boats prohibited

Part of MPA Network

- Integrated in the Sardinian marine protected areas and Natura 2000 networks, part of national Cetacean Sanctuary

Managing Authority

- Managed by Parco Nazionale dell'Asinara and Region of Sardinia; surveillance by regional Forest & Environmental Corps from Cala d'Oliva

Managing Performance

- Proposal for expansion from 10,700 ha to over 66,000 ha of marine protection by 2024 in collaboration with Blue Marine Foundation and EU LIFE projects
- Active projects like Clean Sea LIFE for marine litter removal and outreach
- Strategic Sea Forest LIFE project to protect *Posidonia*, ban anchoring, install moorings, and launch app guidance
- European Charter for Sustainable Tourism (CETS), Park Quality Label, Europark

Types of Measures

- Technical
 - Zoning with strict no-take/no-access Zones A, B, C
 - Monitoring via diving surveys, tagging (e.g., lobster), marine litter surveys, GIS mapping
 - Mooring ban and mooring-system replacement via Sea Forest LIFE
- Legal
 - Decrees from 2002 govern zoning and permitted activities
 - Surveillance enforced by regional environmental police
- Economic
 - Funding from national/regional budget, EU LIFE grants, private foundations (Blue Marine, Capellino)
 - Certification of sustainable fishing (lobster tagging, quality mark) supports local fisheries
- Literacy / Awareness / Education
 - Outreach: >1,000 public meetings, engagement with fishermen, divers, schools (>170,000 participants via Clean Sea LIFE)
 - Visitor centres at Cala Reale and Cala d'Oliva; guided visits, info boards, sustainable tourism rules

Balance between Restrictions & Stakeholder Support

- Zoning provides strong core protection while allowing regulated activities in Buffer/General zones
- Fishery restrictions paired with support: tagging, quality schemes, data-driven sustainable harvesting
- Public engagement via awareness campaigns and participatory projects (e.g., litter cleanup)

Stakeholder Involvement

- Collaboration with fishermen, diving centres, tour operators, schools through EU-funded projects
- Multi-tier governance: Park Authority, regional bodies, national ministries, local coastal communities

Dedicated Resources

- Human: Park rangers, forest corps officers, project scientists, educators
- Financial: Regional/national budgets, EU LIFE funding, private foundations
- Equipment: Patrol boats, mooring systems, tagging gear, data/GIS tools, visitor infrastructure

Effects

- Ecological
 - Healthy, extensive Posidonia meadows; robust *Pinna nobilis* and *Patella ferruginea* populations

- Abundant fish communities: grouper, snapper, bream, lobster; frequent sightings of cetaceans (dolphins, whales, sperm whales) and turtles
- Economic / Social
 - Tourism: regulated visits via ferries and tours; sustainable travel model
 - Fisheries benefit from spill-over and quality certification; locals engaged in conservation-tourism synergy

Summary

The marine part of Asinara National Park is a well-managed, zoning-based coastal MPA established in 2002. Its combination of strong conservation measures, extensive stakeholder engagement, technical innovation, and substantial funding from EU and private sources has yielded robust ecological recovery and sustainable local economies.

National Nature Reserve Cerbère-Banyuls, France

<https://reserves-naturelles.org/reserves/cerbere-banyuls>

<https://www.reserves-naturelles-catalanes.org/les-reserves/reserve-naturelle-de-cerbere-banyuls>

Establishment Year

- 1974 (by ministerial decree, first strictly marine reserve in France); designated a national nature reserve in 1990

Characteristics

- Type: Coastal marine reserve (no estuarine or island zones; entirely open-water, rocky coastline with depth gradients up to ~150 m)

Objectives

- Primary aim: Preservation of marine biodiversity, including habitats (Posidonia seagrass, coralligène reefs, Lithophyllum pavement)
- Species conservation: Protection and restoration of emblematic species like grouper, dusky grouper, wrasse, red coral, Posidonia oceanica, great conch, loggerhead turtle, monk seal, ocean sunfish, etc.
- Nursery protection: Seagrass meadows act as spawning grounds and juvenile habitats for fish and cephalopods
- Scientific research & monitoring: Serve as a living laboratory under the Arago oceanographic observatory
- Education & recreation: Promote public awareness, environmental education (underwater trail, school visits)

Local Context

- Located in the Occitanie region, Pyrénées-Orientales, along 7 km of Côte Vermeille coastline between Banyuls-sur-Mer and Cerbère, with steep slopes and strong currents contributing to biodiversity
- Adjacent to the Arago Observatory, supporting 50 years of scientific monitoring

Part of MPA Network

- Yes – it's part of regional marine conservation efforts, including the Parc naturel marin du Golfe du Lion and Natura 2000 network

Managing Authority

- Managed by the Conseil Départemental des Pyrénées-Orientales (Category B IUCN reserve), in partnership with national agencies & local stakeholders

Managing Performance

- Awarded the IUCN Green List of Protected and Conserved Areas label (2024), reflecting high governance and conservation success
- Significant “reserve effect”: grouper population rose from a dozen in the 1980s to over 700 individuals; fish are significantly larger and spill-over benefits are observed beyond the boundaries of the reserve

- Multi-decadal monitoring confirms strong ecological recovery

Types of Measures

- Technical
 - Infrastructure: underwater trail with signage, ecological mooring buoys (29 seasonal)
 - Scientific monitoring: data collection via Arago Observatory and local patrol teams
- Legal
 - Regulations set by decrees (1974/1990)
 - Zoning:
 - *Zone de Protection Renforcée (10%)*: no fishing, diving, anchoring except for science
 - *Partial Protection Zone*: regulated fishing, diving, mooring
- Economic
 - Funded by the department, national funds, EU and private grants
 - Tourism revenues via guided snorkeling, trail fees, visitor permits
 - Support for local fisheries through spill-over enhancement
- Literacy / Awareness / Education
 - Underwater educational trail, summer environmental outreach (~5 000 beach visitors annually)
 - School programs, public exhibitions, interpretive signage

Balance: Restrictions vs Local Support

- Strict zoning (10%) provides strong conservation; Partial zone enables regulated, sustainable use
- Management emphasizes participatory governance—regular stakeholder dialogue, inclusion of fishers and dive operators
- Ongoing extension process (up to 1 680 ha) uses engaged consultation to avoid alienating stakeholders

Stakeholder Involvement

- Formal governance includes management board with local fishers, NGOs, scientists, municipal authorities
- Regular consultation workshops and co-designed extension planning
- Local fishers serve as voluntary rangers/monitors, contributing real-time intelligence

Dedicated Resources

- Human: ~6 permanent staff plus seasonal educators and patrols
- Financial: Departmental budget, external grants, tourism revenues
- Equipment: Patrol boats, mooring buoys, scientific instruments, audio guidance systems, signage, mask-tuba kits

Effects

- Ecological
 - Grouper population increase from ~12 to 700+; fish 30× larger, juvenile recruitment observed
 - General biodiversity rebound: coral populations, wrasse, dusky grouper, conch, sponges, gorgonians
 - Robust habitats: seagrass nurseries, coralligenous reefs, Lithophyllum pavement are restored
- Economic
 - Boost in eco-tourism: ~30 000 divers annually; snorkelling trail attracts family visitors
 - Positive spill-over to local artisanal fishers; enhancing catches and yields
 - Educational tourism supports local economy

Summary

Cerbère-Banyuls MPA balances strong conservation protection with sustainable use, underpinned by adequate zoning, inclusive governance, active monitoring, and vibrant education. It is a model of ecological success, stakeholder acceptance, and international recognition proving that nature protection can support economic and social vitality.

Wadden Sea National Park, Denmark

<https://eng.nationalparkvadehavet.dk>

Wadden Sea National Park (Nationalpark Vadehavet)

The Wadden Sea is not a single marine park but a transboundary protected area comprising multiple national parks, nature reserves, and protected areas across three countries: Netherlands, Germany, and Denmark. It is often referred to as the Wadden Sea World Heritage Site or the Trilateral Wadden Sea Cooperation.

The specific national parks include:

- Netherlands:
 - Wadden Sea National Park (Nationaal Park Waddenzee)
- Germany:
 - Lower Saxony Wadden Sea National Park (Nationalpark Niedersächsisches Wattenmeer)
 - Schleswig-Holstein Wadden Sea National Park (Nationalpark Schleswig-Holsteinisches Wattenmeer)
 - Hamburg Wadden Sea National Park (Hamburgisches Wattenmeer Nationalpark) - smaller area around the island of Neuwerk
- Denmark:
 - Wadden Sea National Park (Nationalpark Vadehavet)

For the purpose of this case study, "Wadden Sea Marine Park" will refer to the entire Wadden Sea area under protection across these three countries.

The establishment years vary for the different national parks and protected areas:

- Lower Saxony (Germany): 1986 (initially), significantly enlarged in 2008
- Schleswig-Holstein (Germany): 1985
- Hamburg (Germany): 1990
- Netherlands: 2002
- Denmark: 2010
- The Trilateral Wadden Sea Cooperation, which coordinates management across the entire area, was established in 1978. The Wadden Sea was designated a UNESCO World Heritage Site in 2009, (2014 - Danish part included).

Characteristics

- Type of Environment:
 - Estuarine: Large estuarine system with tidal channels and river mouths (e.g., Varde Å valley)
 - Island: Includes Fanø, Mandø, and Rømø islands
 - Coastal: Extensive low-lying flat coast, beach meadows, sandplains, dunes
 - Open Water: Shallow tidal flats and intertidal zones

- Marshlands: Tjæreborgmarsken, Ribemarsken, Margrethekogen, De Ydre Diger
- Physical Extent:
 - Area: Largest national park in Denmark (excluding Greenland)
 - Coverage: Danish Wadden Sea from Ho Bugt to the German border

Characteristics

- The Wadden Sea is a unique intertidal ecosystem, characterized as an estuarine, coastal environment with extensive tidal flats, salt marshes, barrier islands, and tidal channels. It is the largest unbroken system of intertidal sand and mud flats in the world. The area is a dynamic environment shaped by tidal currents, wind, and sediment deposition.

Objectives

- Biodiversity protection: To protect the rich biodiversity of the Wadden Sea, including its diverse flora and fauna, such as marine mammals, fish, shellfish, birds, and plants. Habitat for over 500 species of plants and animals.
- Species conservation: To conserve populations of key species, including migratory birds (a crucial stopover site for millions of birds annually), harbor seals, grey seals, harbor porpoises, and various fish species. Key site for migratory and breeding birds, including European starlings (notable for "sort sol"/black sun phenomenon), sea eagles, oystercatchers, and many others.
- Geological formation preservation: To preserve the unique geological formations of the Wadden Sea, including its tidal flats, salt marshes, barrier islands, and dynamic coastal landscapes.
- Fishery spawning area designation: To protect critical spawning and nursery areas for various fish species (starfish, blue mussels, Pacific oysters, mudsnails, lugworms, crabs, clams, etc.), contributing to the health of both the Wadden Sea ecosystem and adjacent North Sea fisheries.

Local Context

- The Wadden Sea is located along the coasts of the Netherlands, Germany, and Denmark. The region has a long history of human settlement and use, with traditional livelihoods including fishing, agriculture, and shipping. Today, the area is also important for tourism and recreation. The Wadden Sea is a dynamic environment influenced by both natural processes and human activities.

Part of MPA Network:

- The Wadden Sea is a key component of the Natura 2000 network, a European Union-wide network of protected areas. It is also a UNESCO World Heritage Site, recognizing its outstanding universal value. The various national parks and protected areas within the Wadden Sea contribute to national and international MPA networks. Includes Ramsar wetlands, bird and wildlife sanctuaries.

Managing Authority

The Wadden Sea is managed through a multi-level, transboundary governance system involving:

- National governments: The Netherlands, Germany, and Denmark each have their own national park administrations and environmental agencies responsible for managing their respective parts of the Wadden Sea.
- Trilateral Wadden Sea Cooperation (TWSC): This intergovernmental body coordinates management across the entire Wadden Sea area. The TWSC is guided by the Wadden Sea Plan, a joint management plan that sets out common objectives and strategies.
- Local municipalities and authorities: Local governments play a role in spatial planning, permitting, and environmental management within their jurisdictions.

Managing Performance

- Regular monitoring programs: To track ecological conditions, species populations, and water quality.
- Joint monitoring and assessment: Coordinated by the TWSC to evaluate the overall health of the Wadden Sea ecosystem.
- Adaptive management strategies: Incorporating new scientific information and adjusting management actions as needed.
- Periodic reviews and evaluations: Of the Wadden Sea Plan and management effectiveness.
- Compliance with international agreements: Including the UNESCO World Heritage Convention and EU directives.
- Challenges:
 - Invasive species (Pacific oysters outcompeting native mussels)
 - Balancing tourism with wildlife protection
 - Climate change impacts (sea level rise, storm surges)

Types of Measures Implemented

- Technical Measures
 - Zoning and spatial planning: To separate sensitive habitats from intensive use.
 - Habitat restoration: Projects to restore tidal flats, salt marshes, and other key habitats.
 - Water quality management: Measures to reduce pollution from agricultural runoff, industrial discharges, and shipping.
 - Fisheries management: Regulations on fishing gear, quotas, and closed areas to protect fish stocks and sensitive habitats.
 - Monitoring programs: To track ecological conditions, species populations, and human activities.
- Legal Measures

- National park laws and regulations: Establishing protected areas and setting out management rules.
- Nature conservation laws: Protecting habitats and species.
- Water quality regulations: Controlling pollution sources.
- Fisheries regulations: Managing fishing activities.
- Spatial planning laws: Guiding development and land use.
- International agreements: Including the UNESCO World Heritage Convention, the Bonn Convention (Convention on Migratory Species), and EU directives (e.g., the Birds Directive and Habitats Directive).
- Economic Measures
 - Sustainable tourism initiatives: Promoting eco-friendly tourism practices and infrastructure.
 - Subsidies for sustainable agriculture: Supporting farmers who adopt environmentally friendly farming methods.
 - Compensation for fishing restrictions: Providing financial assistance to fishers affected by conservation measures.
 - Investment in green infrastructure: Such as wastewater treatment plants and renewable energy projects.
 - Payment for ecosystem services: Exploring opportunities to compensate landowners for providing ecosystem services, such as carbon sequestration and flood protection.
- Literacy, Awareness, and Education Measures
 - Visitor centres and educational programs: Providing information about the Wadden Sea ecosystem and its conservation. Black Sun tours, oyster safaris, seal safaris, educational walks.
 - Public awareness campaigns: To promote responsible behaviour and support for conservation efforts. Codes of conduct for visitors (“How to be the best guest”).
 - Training programs: For tourism operators, fishers, and other stakeholders.
 - School programs: To educate children about the Wadden Sea and its importance.
 - Citizen science initiatives: Engaging the public in monitoring and research activities.

Balance between Restrictions and Support for Local Stakeholders

- The management of the Wadden Sea seeks to balance restrictions on certain activities (e.g., fishing, development) with support for local stakeholders through:
 - Stakeholder participation: Engaging local communities in decision-making processes.
 - Compensation programs: Providing financial assistance to those affected by conservation measures.

- Sustainable tourism initiatives: Promoting economic opportunities that are compatible with conservation goals.
- Support for traditional livelihoods: Recognizing and supporting sustainable practices in fishing and agriculture.
- Education and awareness programs: Fostering a sense of stewardship and promoting responsible behaviour.
- Balancing these competing interests is an ongoing challenge, requiring adaptive management and continuous dialogue among stakeholders.

Stakeholder Involvement

- The Wadden Sea Forum: A multi-stakeholder platform that brings together representatives from government, NGOs, business, and research.
- International Cooperation: Trilateral Wadden Sea Cooperation (Denmark, Germany, Netherlands) for joint management and research.
- Working groups and expert groups: Involving stakeholders in specific management issues.
- Public consultation processes: For major policy decisions.
- Local advisory committees: Providing input on local management issues.

Dedicated Resources Available

- Human Resources
 - Staff from national park administrations, environmental agencies, and research institutions.
 - Park rangers and enforcement officers.
 - Educators and interpreters.
 - Volunteers.
- Financial Resources
 - Government funding for national park management and conservation programs.
 - EU funding through programs like LIFE and INTERREG.
 - Private donations and grants.
 - Revenue from tourism.
- Equipment Resources
 - Research vessels and monitoring equipment.
 - Patrol boats and enforcement equipment.
 - Visitor centres and educational facilities.
 - GIS and data management systems.

Effects of Management

- Ecological Effects
 - Habitat protection: Conservation measures have helped to protect and restore key habitats, such as tidal flats and salt marshes.

- Species conservation: Populations of some key species, such as harbor seals and certain bird species, have increased.
- Water quality improvement: Efforts to reduce pollution have led to improvements in water quality.
- Ecosystem resilience: The Wadden Sea ecosystem remains vulnerable to various threats, including climate change, invasive species, and pollution.
- Economic Effects
 - Sustainable tourism: The Wadden Sea is a popular tourist destination, generating significant economic benefits for local communities.
 - Sustainable fisheries: Managed fisheries provide economic opportunities while minimizing impacts on the ecosystem.
 - Ecosystem services: The Wadden Sea provides valuable ecosystem services, such as flood protection and carbon sequestration.
 - Costs of conservation: Conservation measures can impose costs on certain stakeholders, such as fishers and landowners.

Summary

The Wadden Sea Marine Park, as a transboundary protected area, represents a significant effort to conserve a unique and valuable ecosystem. Its multi-level governance system, emphasis on stakeholder involvement, and adaptive management approach provide a model for other transboundary conservation initiatives. While challenges remain in balancing ecological protection with human activities and addressing emerging threats, the Wadden Sea stands as a testament to the power of international cooperation and long-term commitment to conservation.

Selvagens Islands Nature Reserve, Portugal

<https://ifcn.madeira.gov.pt/en/areas-protegidas/ilhas-selvagens.html>

Selvagens Islands Nature Reserve / Reserva Natural das Ilhas Selvagens
Portugal, Autonomous Region of Madeira,

Establishment year:

- 1971 (marine and terrestrial protections expanded in subsequent years, with full no-take marine reserve status strengthened in 2021)

Characteristics

- Remote, uninhabited archipelago in the North Atlantic, located between Madeira and the Canary Islands. Primarily coastal and open-water habitats with rocky shores, steep submarine slopes, and highly productive pelagic zones. Terrestrial area dominated by cliffs and low vegetation; marine area includes deep benthic habitats, macroalgae, and significant pelagic communities.

Objectives

- Strict protection of marine and terrestrial biodiversity
- Preservation of globally important seabird colonies (e.g., Cory's shearwater, Bulwer's petrel)
- Conservation of endemic species and fragile island ecosystems
- Protection of fish populations, pelagic predators, and benthic communities
- Prevention of human disturbance and invasive species introduction
- Support of long-term ecological research in an undisturbed environment

Local Context

- The Selvagens Islands are among the most pristine and least disturbed ecosystems in Europe. The islands are uninhabited aside from a small, rotating ranger and maritime surveillance presence.
- The declaration of this marine area of total protection in 2021 covers a territory of 2,677 sq. km, within a 12-nautical-mile area surrounding the Selvagens Islands. Within this area, all species living there are now fully protected from extractive activities, such as fishing or mineral extraction.

Part of MPA Network

- They are part of the Natura 2000 network, the OSPAR network of Marine Protected Areas, and form part of the Madeira Natural Park system.

Managing Authority

- Instituto das Florestas e Conservação da Natureza (IFCN), Autonomous Region of Madeira, with support from maritime authorities and international conservation partners.

Managing Performance

- The reserve is recognized as one of the most strictly protected MPAs in the Atlantic. Enforcement performance is high due to continuous ranger presence and robust surveillance. Scientific assessments indicate excellent conservation outcomes and minimal anthropogenic pressures.

Types of Measures

- Technical measures:
 - Continuous ranger presence, vessel and aerial surveillance
 - Strict access protocols
 - Invasive species prevention
 - Scientific monitoring of marine and seabird populations
- Legal measures:
 - Total no-take marine reserve
 - Strict landing permits; prohibition of fishing, anchoring, and unsupervised visitation
 - Full wildlife and habitat protection under regional and national law
- Economic measures:
 - Limited; the area is not used for extractive or tourism-based revenue. Funding comes from regional government resources and EU conservation programs.
- Literacy / awareness / education:
 - Outreach conducted mainly through Madeira-based educational programs, scientific publications, and controlled visits for educational institutions.

Balance Between Restrictions and Support for Local Stakeholders

- Because the islands are remote and uninhabited, restrictions primarily affect offshore fishers. These restrictions are justified by the ecological significance of the area and are supported by the broader Madeiran conservation framework. Benefits accrue indirectly through regional ecosystem services, fisheries spillover, and scientific prestige.

Stakeholder Involvement

- Stakeholder involvement occurs mainly through scientific institutions, conservation NGOs, the Madeira government, and maritime authorities. Limited involvement from local communities due to lack of settlement, but regional fishers and tourism operators participate in wider conservation planning.

Dedicated Resources

- Permanent ranger station with rotating staff; maritime patrol boats; funding from the Madeira regional government and EU projects; technical equipment for monitoring seabirds, marine mammals, fish, and habitats.

Effects

- Ecological effects:
 - Exceptional seabird colony conservation

- High fish biomass
- Intact pelagic predator populations
- Pristine benthic and coastal ecosystems
- Minimal invasive species
- Optimal conditions for long-term ecological stability.
- Economic effects:
 - Indirect benefits through fisheries spillover to Madeira and the broader region; enhanced scientific and conservation reputation; limited direct economic activity due to strict protection.

Summary

The Selvagens Islands Nature Reserve is one of Europe's most strictly protected and pristine MPAs, safeguarding seabird colonies, endemic species, and undisturbed marine ecosystems. Its fully enforced no-take status, continuous surveillance, and rigorous access controls ensure exceptional ecological conditions and high fish biomass. Although remote and economically non-extractive, the reserve provides regional benefits through ecosystem integrity, fisheries spillover, and scientific value.

Belize Barrier Reef Reserve System (BBRRS)

<https://belizeworldheritagesite.org>

Belize Barrier Reef Reserve System (BBRRS)

- Includes: Bacalar Chico National Park & Marine Reserve, Blue Hole Natural Monument, Half Moon Caye Natural Monument, South Water Caye Marine Reserve, Glover's Reef Marine Reserve, Laughing Bird Caye National Park, Sapodilla Cayes Marine Reserve

Establishment Year

- The Belize Barrier Reef Reserve System was inscribed as a UNESCO World Heritage Site in 1996. The individual protected areas within the system were established at various times:
 - Hol Chan Marine Reserve: 1987
 - Bacalar Chico National Park and Marine Reserve: 1996
 - Glover's Reef Marine Reserve: 1993
 - South Water Caye Marine Reserve: 1996
 - Laughing Bird Caye National Park: 1991
 - Sapodilla Cayes Marine Reserve: 1996

Characteristics

- Type of Environment:
 - Island: Over 450 sand and mangrove cayes
 - Coastal: Mangrove forests, littoral forests, lagoons, estuaries
 - Open Water: Barrier reefs, atolls (Turneffe, Lighthouse, Glover's), Blue Hole
 - Estuarine: Coastal lagoons and estuaries
- Physical Extent:
 - Reef length: 300 km (second largest in the world)
 - Protected area: 960 km² (about 12% of the entire reef complex)

Objectives

- Biodiversity Protection:
 - Preserve one of the world's most pristine and diverse coral reef ecosystems
 - Protect more than 500 fish species, 70 hard coral species, 36 soft coral species, hundreds of invertebrates, and 247 marine flora taxa
- Species Conservation:
 - Safeguard threatened species: West Indian manatee, green, hawksbill, and loggerhead turtles, American crocodile, red-footed booby, endemic and migratory birds, groupers
- Geological Formation Preservation:
 - Protect unique geological features such as the Blue Hole, atolls, patch reefs, pinnacle reefs, and faros
- Fishery Spawning Area Designation:

- Maintain critical spawning, nesting, foraging, and nursery habitats (e.g., for groupers, turtles, manatees)

Local Context

The Belize Barrier Reef is located off the coast of Belize in Central America. The reef is an integral part of Belizean culture and economy, supporting tourism and fishing industries. Local communities have a strong connection to the reef and rely on it for their livelihoods.

- Population:
 - Low human density compared to other major reef systems
 - Coastal and island communities rely on fishing and tourism
- Economy:
 - Tourism is Belize's top industry, with the reef attracting nearly half of all visitors (~130,000/year)
 - Fishing is vital for livelihoods and food security
- Cultural and Historical Value:
 - The reef system is central to Belizean identity and heritage
 - Some cayes have archaeological significance (e.g., Mayan sites on Bacalar Chico)

Part of MPA Network: Yes/No

- BBRRS is a World Heritage Site and part of Belize's national protected areas network
- Linked to the Mesoamerican Barrier Reef System (regional network)

Managing Authority

- Government of Belize:
 - Fisheries Department (Ministry of Blue Economy and Civil Aviation)
 - Forest Department (Ministry of Sustainable Development, Climate Change and Disaster Risk Management)
 - Coastal Zone Management Authority and Institute (CZMAI)
- Co-management:
 - Partnerships with NGOs (e.g., Belize Audubon Society, Southern Environmental Association, Toledo Institute for Development and Environment)

Managing Performance

- Strengths:
 - Legal protection under the National Parks Act and Fisheries Act
 - Site-specific management plans (resource protection, surveillance, monitoring, outreach, financial sustainability)
 - Regular monitoring of coral health, fish populations, and endangered species
- Challenges:

- Overharvesting, coastal development, pollution, unsustainable tourism, hurricanes, coral bleaching, climate change
- Need for improved institutional coordination and enforcement
- Innovations:
 - Belize was the first country to ban bottom trawling (2010)
 - Ban on offshore oil drilling within 1 km of the reef (2015)

Types of Measures Implemented

- Technical Measures
 - Zoning: Designating different zones within the BBRRS with varying levels of protection.
 - Fishing gear restrictions: Limiting the types of fishing gear allowed in certain areas.
 - Closed seasons: Temporarily closing certain areas to fishing during spawning seasons.
 - Artificial reefs: Deploying artificial reefs to enhance fish habitat.
 - Coral nursery programs: Growing corals in nurseries for transplantation onto degraded reefs.
- Legal Measures
 - Fisheries Act: Regulates fishing activities.
 - National Parks System Act: Provides the legal framework for establishing and managing national parks and marine reserves.
 - Environmental Protection Act: Provides for environmental impact assessments and pollution control.
 - World Heritage Convention: Provides international recognition and support for the BBRRS.
 - Regulations for specific protected areas: Setting out rules for activities within each protected area.
- Economic Measures
 - Entrance fees: Charging visitors fees to enter marine reserves.
 - Sustainable tourism initiatives: Promoting eco-friendly tourism practices.
 - Compensation for fishers: Providing financial assistance to fishers affected by MPA regulations.
 - Payment for ecosystem services: Exploring opportunities to compensate landowners for providing ecosystem services, such as carbon sequestration and watershed protection.
 - Funding from the Protected Areas Conservation Trust (PACT), COMPACT, and international donors.
- Literacy, Awareness, and Education Measures
 - Environmental education programs: In schools and communities.

- Public awareness campaigns: To promote responsible behavior and support for conservation efforts.
- Training programs: For tourism operators, fishers, and other stakeholders.
- Visitor centers: Providing information about the marine environment.
- Citizen science initiatives: Engaging the public in monitoring and research activities.

Balance between Restrictions and Support for Local Stakeholders

- Stakeholder participation: Engaging local communities in decision-making processes.
- Compensation programs: Providing financial assistance to those affected by conservation measures. Revenue-sharing from tourism fees.
- Alternative livelihood programs: Supporting fishers in diversifying their income sources.
- Sustainable tourism initiatives: Promoting economic opportunities that are compatible with conservation goals.
- Education and awareness programs: Fostering a sense of stewardship and promoting responsible behavior.
- Restrictions: No-take zones, gear/type limits, closed seasons, exclusion of destructive activities (trawling, oil drilling).

Stakeholder Involvement

Stakeholder involvement is a key principle of BBRRS management. Key stakeholders include:

- Local communities: Fishers, tourism operators, and other residents. Key partners in co-management, monitoring, and enforcement.
- Government agencies: Fisheries Department, Forest Department, CZMAI, and others.
- Non-governmental organizations (NGOs): Involved in research, monitoring, and community engagement.
- Private sector: Tourism businesses and other companies operating in the marine environment.
- Research institutions: Conducting scientific research on marine ecosystems.
- International partners: UNESCO, regional conservation initiatives (Mesoamerican Reef Fund), donor agencies.

Dedicated Resources Available

- Human Resources
 - Government staff (rangers, fisheries officers, CZMAI personnel)
 - NGO staff and community rangers
 - Volunteer and research partners
- Financial Resources
 - National budget allocations

- Protected Areas Conservation Trust (PACT) grants
- International donor funding (e.g., GEF, World Bank, WWF)
- Tourism and entry fees
- Equipment Resources
 - Patrol boats, monitoring equipment, mooring buoys, vehicles
 - Research and visitor facilities (e.g., field stations, interpretation centres)

Effects of Management

- Ecological Effects
 - Increased fish biomass: Studies have shown increased fish biomass and diversity within MPAs.
 - Coral reef health: Some coral reefs have shown signs of recovery from bleaching events.
 - Protection of threatened species: MPAs provide important habitat for threatened species, such as the West Indian manatee and hawksbill sea turtle.
- Economic Effects
 - Sustainable tourism: The BBRRS supports a thriving tourism industry, generating revenue and employment. Reef is Belize's #1 tourist attraction, supporting thousands of jobs and local businesses.
 - Sustainable fisheries: Managed fisheries provide economic opportunities while minimizing impacts on the ecosystem. Spillover effects from no-take zones benefit adjacent fishing areas.
 - Ecosystem services: The BBRRS provides valuable ecosystem services, such as coastal protection and carbon sequestration.
 - Improved livelihoods: Sustainable management of marine resources can improve the livelihoods of local communities.

Summary

- The Belize Barrier Reef Reserve System represents a significant effort to conserve a unique and valuable ecosystem. Its multi-faceted approach, emphasis on stakeholder involvement, and adaptive management strategies provide a model for other marine protected areas. While challenges remain in balancing ecological protection with human activities and addressing emerging threats, the BBRRS demonstrates the importance of integrated management for the long-term sustainability of marine resources. The New Fisheries Resource Act in 2020 is a crucial step forward in strengthening the governance framework.

Galápagos Marine Reserve (GMR), Ecuador

<https://galapagos.gob.ec>

<https://www.galapagos.org>

Galápagos Marine Reserve / Reserva Marina de Galápagos, Ecuador

Establishment Year

- 1998: Officially established by the Ecuadorian government.

Characteristics

- Type of Environment:
 - Island: Surrounds the Galápagos Archipelago (19 main islands and many islets).
 - Coastal: Includes extensive coastal habitats, mangroves, and rocky shores.
 - Open Water: Encompasses deep pelagic zones, upwelling areas, and oceanic habitats.
 - Estuarine: Includes estuaries and brackish lagoons, though less extensive than other types.
- Physical Extent:
 - Area: 133,000 km², expanded in 2022 with the creation of the Hermandad Marine Reserve (+60,000 km²).
 - Biodiversity: Home to nearly 3,000 marine species.

Objectives

- Biodiversity Protection:
 - Protects one of the world's most biodiverse marine ecosystems, including endemic species and unique evolutionary lineages.
- Species Conservation:
 - Safeguards threatened and iconic species such as:
 - Sharks: Scalloped hammerhead (*Sphyrna lewini*), whale shark (*Rhincodon typus*), Galápagos shark (*Carcharhinus galapagensis*).
 - Marine mammals: Galápagos sea lion (*Zalophus wollebaeki*), Galápagos fur seal (*Arctocephalus galapagoensis*).
 - Birds: Galápagos penguin (*Spheniscus mendiculus*), flightless cormorant (*Phalacrocorax harrisi*), blue-footed booby (*Sula nebouxii*).
 - Reptiles: Marine iguana (*Amblyrhynchus cristatus*), green sea turtle (*Chelonia mydas*).
 - Corals: Multiple coral species, although 95–99% of reefs were lost in 1983–85 due to El Niño.
- Geological Formation Preservation:
 - Protects unique volcanic and oceanic geological features, hydrothermal vents, and submarine mountains.

- Fishery Spawning Area Designation:
 - Protects critical spawning and nursery areas for sharks, rays, groupers, and other commercial and ecological keystone species.
 - 2017: First hammerhead nursery discovered near Santa Cruz Island.

Local Context

- Population: ~30,000 residents (2023), mostly on Santa Cruz, San Cristóbal, Isabela, and Floreana.
- Economy:
 - Ecotourism: Primary economic driver; over 200,000 visitors/year pre-pandemic.
 - Fisheries: Small-scale, artisanal fishing allowed under strict regulation.
 - Conservation: Major employer (Galápagos National Park, NGOs, research).
- Cultural Heritage:
 - Unique blend of indigenous, mestizo, and international conservation communities.
 - Traditional fishing communities with strong ties to marine resources.

Part of MPA Network

- The GMR is part of Ecuador's National System of Protected Areas and is integrated into regional MPA networks in the Eastern Tropical Pacific. It is connected through migratory corridors with other MPAs including Cocos Island (Costa Rica), Malpelo (Colombia), and Coiba (Panama) as part of the Eastern Tropical Pacific Marine Corridor.

Managing Authority

The GMR is managed through a multi-institutional framework:

- The Galápagos National Park Directorate (GNPD) serves as the primary managing authority
- The Participatory Management Group (Junta de Manejo Participativo or JMP) provides a platform for stakeholder involvement in decision-making
- The Interinstitutional Management Authority (Autoridad Interinstitucional de Manejo or AIM) has final decision-making authority, comprising representatives from ministries, local government, and other sectors

This structure reflects the GMR's innovative participatory management regime established under the Galápagos Special Law.

- Collaborators:
 - Galápagos Conservancy, Charles Darwin Foundation, international NGOs, Ecuadorian Navy, local communities, and research institutions.

Managing Performance

- Patrols and Enforcement:
 - Regular patrols with navy and park rangers; use of satellite monitoring (VMS/AIS) to detect illegal fishing.

- Notable successes in intercepting illegal fishing fleets (e.g., 300+ vessels near/inside GMR in recent years).
- Adaptive Management:
 - Research-driven policies (e.g., coral reef restoration, shark nursery protection).
 - Annual and multi-year monitoring of key species and habitats.
- Challenges:
 - Industrial fishing pressure at the reserve's edge, illegal fishing, invasive species, climate change impacts (El Niño, coral bleaching), and limited resources for enforcement.

Types of Measures Implemented

- Technical Measures
 - Zoning system: Divides the reserve into different use zones including conservation zones (no-take), tourism sites, multiple-use zones, and fishing areas
 - Vessel monitoring systems: Satellite-based tracking of fishing vessels to ensure compliance with zoning and regulations
 - Scientific monitoring programs: Regular monitoring of key indicator species, ecosystems, and environmental parameters.
 - Species Monitoring: Tagging and tracking sharks, turtles, and whale sharks; population surveys of marine mammals and seabirds.
 - Biosecurity protocols: Technical measures to prevent invasive species introductions
 - Geographic Information Systems (GIS): For spatial planning and monitoring
- Legal Measures
 - Galápagos Special Law (GSL): Primary legislation providing legal framework for the GMR
 - Fishing regulations: Including gear restrictions, quotas, size limits, and seasonal closures
 - Tourism regulations: Limiting visitor numbers, controlling access to sensitive sites, and establishing operator requirements
 - Enforcement mechanisms: Including fines, vessel seizures, and prosecution for violations
 - International agreements: Including UNESCO World Heritage status (designated in 1978, extended to include marine areas in 2001)
 - Expansion: 2022 expansion (Hermandad Marine Reserve) adds new protected corridors for migratory species.
- Economic Measures
 - Entrance fees: Visitor fees contributing to conservation funding (approximately \$100 USD per foreign visitor)

- Fishing licenses and permits: Regulated access to commercial fisheries
- Alternative livelihood programs: Supporting transition from extractive to sustainable activities
- Certification schemes: For sustainable fisheries and tourism operations
- Payment for ecosystem services: Including carbon sequestration initiatives
- Grant Funding: Conservation grants (e.g., Galápagos Conservancy, international donors).
- Literacy, Awareness, and Education Measures
 - Environmental education programs: In local schools and communities
 - Visitor interpretation centers: Providing information on marine conservation
 - Training programs: For fishers, tour guides, and other stakeholders
 - Public awareness campaigns: About conservation issues and regulations
 - Capacity building: For local stakeholders to participate effectively in management processes

Balance between Restrictions and Support for Local Stakeholders

The GMR management model attempts to balance restrictions with support through:

- Exclusive fishing rights for local fishers, prohibiting industrial fishing and limiting entry of new fishers
- Compensation and transition programs for those affected by fishing restrictions
- Preferential access to tourism opportunities for local residents
- Technical and financial support for sustainable business development
- Grandfathering provisions that respect historical use patterns

Despite these efforts, tensions remain between conservation objectives and local economic needs, particularly in the fishing sector where restrictions have impacted traditional livelihoods. The balance between restrictions and support requires ongoing negotiation and adaptation.

Stakeholder Involvement

Stakeholder participation is formalized through the Participatory Management Group (JMP), which includes representatives from:

- Local fishing cooperatives
- Tourism sector
- Conservation organizations
- Scientific community
- Local government
- Galápagos National Park Directorate

This participatory model aims to:

- Resolve conflicts through dialogue and negotiation
- Incorporate diverse knowledge systems (including traditional and scientific knowledge)

- Build ownership of management decisions
 - Improve compliance through stakeholder buy-in
- While this model has improved inclusivity, challenges remain in ensuring equitable representation and addressing power imbalances among stakeholders.

- NGO Partnerships:
 - Charles Darwin Foundation, Galápagos Conservancy, and others provide research, funding, and capacity-building.

Dedicated Resources Available

- Human Resources
 - 300+ park rangers and technical staff.
 - Navy and law enforcement partners.
 - Scientists, local guides, and community monitors.
- Financial Resources
 - Government funding (national and provincial budgets).
 - International grants (e.g., Galápagos Conservancy, WWF, UNESCO).
 - Tourism revenues (park entry fees, permits).
- Equipment Resources
 - Patrol boats, surveillance technology, research labs, coral nurseries, satellite tracking equipment.

Effects of Management

- Ecological Effects
 - Species Recovery:
 - Giant tortoise populations increased from a few dozen to thousands (e.g., Española tortoise from 15 to 2,300+).
 - Pinzón tortoise hatchlings returned after 100+ years.
 - Identification and protection of hammerhead shark nurseries.
 - Coral reef recovery efforts underway (pilot coral farming projects).
 - Population Trends:
 - Some species in recovery (giant tortoises, penguins in some years).
 - Others remain threatened or declining (e.g., Galápagos sea lion and fur seal populations down >50% since 1980; scalloped hammerhead shark population down >80% in 75 years).
 - Habitat Integrity:
 - Large areas remain pristine; invasive species and climate change are ongoing threats.
- Economic Effects
 - Tourism:
 - Pre-pandemic, over 200,000 visitors/year; tourism is the main economic driver, generating millions in revenue and supporting thousands of jobs.
 - Giant tortoises, marine iguanas, and sharks are key attractions.

- Fisheries:
 - Artisanal fishing continues under strict regulation, providing local livelihoods but with reduced pressure on stocks.
- Research and Innovation:
 - The islands serve as a global model and laboratory for conservation science, attracting international investment and expertise.

Summary

- The Galápagos Marine Reserve is a global model for large-scale marine protection, balancing strict conservation with community engagement and sustainable development. Its success relies on adaptive management, strong enforcement, multi-stakeholder governance, and innovative science. While facing significant threats from climate change, invasive species, and illegal fishing, the GMR's integrated approach offers vital lessons for effective MPA governance worldwide.

Papahānaumokuākea Marine National Monument, USA

<https://www.papahanaumokuakea.gov>

Hawaii, United States of America

Establishment Year

- 2006: Designated as Marine National Monument (June 15, 2006)
- 2016: Expanded (August 26, 2016)
- 2025: Designated as National Marine Sanctuary (January 16, 2025)

Characteristics

- Type of Environment:
 - Open Water: Vast pelagic oceanic environment covering approximately 582,570 square miles (1,508,870 km²)
 - Island: Small islands, islets, and atolls scattered throughout the northwestern Hawaiian archipelago
 - Coastal: Fringing reefs, lagoons, and shallow coastal waters around atolls
 - Coral Reef: Extensive coral reef systems extending from subtropical to near-northern limits of coral development
- Physical Extent:
 - Area: 582,570 mi² (1,508,870 km²) - nearly the size of the Gulf of Mexico
 - Location: Northwestern Hawaiian Islands, extending northwest of Kaua'i
 - Features: Small islands, islets, reefs, shoals, submerged banks, and atolls
 - Notable Sites: Midway Atoll, Hōlanikū (Kure Atoll), French Frigate Shoals

Objectives

- Biodiversity Protection:
 - Protects one of the last pristine ocean environments in the world
 - Home to over 7,000 marine species, many endemic to the region
 - Extensive coral reef ecosystems supporting unique biodiversity
- Species Conservation:
 - Endangered Hawaiian monk seals (*Neomonachus schauinslandi*) - critical habitat
 - Sea turtles: Green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*)
 - Seabirds: 14 million seabirds representing multiple species
 - Marine mammals: Whales and dolphins
 - Fish: Sharks, billfish, tuna, and four endemic duck species
 - Endemic species: Many species found nowhere else in the world
- Geological Formation Preservation:
 - Protects unique geological features including atolls, submerged banks, and volcanic formations
 - Preserves natural processes of atoll formation and coral reef development

- Cultural and Maritime Heritage:
 - Native Hawaiian Cultural Sites: Sacred places with deep spiritual significance
 - World War II Heritage: Battle of Midway site and associated military remains
 - Shipwrecks: Over 60 known shipwreck sites representing centuries of maritime history
 - Traditional Voyaging Routes: Ancient pathways for Hawaiian navigation and wayfinding

Local Context

- Cultural Significance:
 - Sacred to Native Hawaiians as the place "from which all life springs and ancestral spirits return after death"
 - Traditional voyaging and wayfinding heritage continues to be culturally important
 - Deep biocultural significance recognized in management approaches
- Historical Importance:
 - Site of the pivotal WWII Battle of Midway (1942)
 - Century-long history of conservation efforts beginning in 1903 with President Theodore Roosevelt
 - Progressive protection by six U.S. Presidents over 100+ years
- Geographic Context:
 - Remote and largely uninhabited marine region
 - Strategic location in the North Pacific
 - Critical stopover for migratory species

Part of MPA Network

- Part of the U.S. National Marine Sanctuary System (15 sanctuaries and 2 monuments covering 620,000 square miles)
- Integrated into broader Pacific marine conservation networks
- Connected to Hawaiian Islands Humpback Whale National Marine Sanctuary

Managing Authority

- Co-Trustee Management Structure:
 - State of Hawai'i (Department of Land and Natural Resources)
 - Division of Aquatic Resources (DAR)
 - Division of Forestry and Wildlife (DOFAW)
 - U.S. Department of the Interior (Fish and Wildlife Service - FWS)
 - U.S. Department of Commerce (National Oceanic and Atmospheric Administration - NOAA)
 - Office of Hawaiian Affairs (OHA)
- Sanctuary Designation Leadership:
 - NOAA Office of National Marine Sanctuaries (ONMS)

- State Division of Aquatic Resources (DAR)

Managing Performance

- Adaptive Management:
 - Science-based management decisions informed by ongoing research
 - Regular monitoring of key species and ecosystems
 - Integrated approach combining federal, state, and Native Hawaiian perspectives
- Conservation Successes:
 - Maintained pristine ocean environment status
 - Successful protection of endangered species habitats
 - Effective marine debris removal programs
 - Cultural resource preservation and interpretation
- Challenges:
 - Marine debris accumulation from Pacific-wide sources
 - Climate change impacts on coral reefs and marine ecosystems
 - Remote location complicating management and enforcement
 - Balancing access for research, education, and cultural practices

Types of Measures Implemented

- Technical Measures
 - Vessel monitoring systems (VMS): Required for all vessels transiting or operating within the monument.
 - Advanced surveillance technologies: Including satellite imagery and aerial patrols to monitor for illegal activities.
 - Strict biosecurity protocols: To prevent the introduction of invasive species.
 - Scientific research and monitoring programs: To assess ecosystem health and inform management decisions.
 - GIS and spatial planning tools: For managing access and activities within the monument.
- Legal Measures
 - Presidential Proclamations 8031 and 9478: Establishing and expanding the monument and its protections.
 - Federal laws: Including the National Marine Sanctuaries Act, Endangered Species Act, and Magnuson-Stevens Fishery Conservation and Management Act.
 - State of Hawai'i laws and regulations: Applicable in state waters within the monument.
 - Permitting system: Strict regulations governing all access and activities, with most extractive uses prohibited. Permits are generally limited to research, conservation, education, and Native Hawaiian cultural practices.
 - Enforcement: Joint enforcement efforts by federal and state agencies.

- Economic Measures
 - Prohibition of commercial fishing: And other extractive activities, significantly limiting direct economic exploitation.
 - Funding for research and conservation: Through federal and state budgets, grants, and partnerships.
 - Support for non-extractive uses: Such as limited ecotourism (primarily to Midway Atoll) and educational programs.
 - Investment in cultural heritage programs: Supporting Native Hawaiian cultural practitioners.
- Literacy, Awareness, and Education Measures
 - Extensive public outreach and education programs: Including visitor centers (e.g., Mokupāpapa Discovery Center in Hilo), educational materials, and online resources.
 - Integration of Native Hawaiian culture and knowledge: In educational and interpretive programs.
 - Professional development for educators: To incorporate monument themes into curricula.
 - Community engagement: With Native Hawaiian communities and the broader public in Hawai'i.
 - International outreach: Sharing lessons learned in large-scale MPA management.

Balance between Restrictions and Support for Local Stakeholders

- Strict Protection with Cultural Access:
 - Complete prohibition of extractive activities while maintaining Native Hawaiian cultural access rights
 - Permit system allows for legitimate research, education, and cultural activities
 - Co-management structure ensures Native Hawaiian voice in decision-making
- Community Engagement:
 - Sanctuary Advisory Council process for community input
 - Regular public meetings and consultation processes
 - Integration of traditional ecological knowledge

Stakeholder Involvement

Stakeholder involvement is a cornerstone of PMNM management, particularly:

- Office of Hawaiian Affairs (OHA): As a co-trustee, OHA ensures Native Hawaiian voices, values, and traditional knowledge are central to decision-making.
- Monument Management Board: Comprises representatives from the co-trustee agencies.

- Reserve Advisory Council: Provides advice and recommendations from a diverse group of stakeholders, including scientists, educators, conservationists, fishers (representing those fishing outside the monument), and Native Hawaiian representatives.
- Public consultation processes: For management plan revisions and significant policy decisions.
- Collaboration with academic and research institutions: Both in Hawai'i and internationally.

Dedicated Resources Available

- Human Resources
 - Staff from NOAA, USFWS, State of Hawai'i (DLNR), and OHA dedicated to monument management, research, enforcement, and education.
 - On-site personnel at Midway Atoll and French Frigate Shoals (seasonal).
 - Partnerships with university researchers and conservation organizations.
- Financial Resources
 - Primarily funded through federal appropriations to NOAA and USFWS, and state funding to DLNR and OHA.
 - Grants from foundations and other organizations for specific research and conservation projects.
 - Revenue from visitor fees at Midway Atoll contributes to operational costs.
 - Estimated annual operating budget is in the range of tens of millions of U.S. dollars.
- Equipment Resources
 - Research vessels and aircraft for monitoring and logistical support.
 - Field stations and research facilities (e.g., at Midway Atoll).
 - Advanced monitoring and surveillance equipment.
 - Educational facilities like the Mokupāpapa Discovery Center.

Effects of Management

- Ecological Effects
 - Protection of large, intact ecosystems: PMNM harbors some of the most pristine coral reefs and deep-sea environments on Earth.
 - High levels of endemism: Provides refuge for many species found nowhere else.
 - Recovery of depleted species: Populations of Hawaiian monk seals and green sea turtles have shown signs of stabilization or recovery in some areas, although they still face threats.
 - Resilience to climate change: While impacted by events like coral bleaching and hurricanes (e.g., Hurricane Walaka in 2018 significantly damaged East Island at French Frigate Shoals), the large scale and relative lack of direct

human stressors may confer greater resilience compared to more impacted reef systems.

- Scientific reference site: Serves as a crucial baseline for understanding relatively undisturbed marine ecosystems and the impacts of global change.
- Economic Effects
 - Cessation of commercial fishing: The establishment of the monument led to the buy-out of commercial fishing permits for the Northwestern Hawaiian Islands, ending this extractive activity within its boundaries. This had a direct economic impact on the displaced fishers, though it was intended to provide long-term ecological benefits that could support fisheries outside the monument.
 - Growth in research and conservation economy: Significant investment in scientific research, monitoring, and management creates jobs and economic activity.
 - Limited, high-value ecotourism: Carefully managed tourism at Midway Atoll provides some economic return and supports conservation.
 - Enhanced ecosystem services: Protection of these ecosystems contributes to broader ocean health, which has indirect economic benefits (e.g., for fisheries in adjacent areas, though this is hard to quantify).
 - Cultural revitalization: Investment in cultural programs has economic and social benefits for Native Hawaiian communities.

Summary

- Papahānaumokuākea Marine National Monument represents a world-class example of large-scale marine protection that successfully integrates biodiversity conservation, cultural preservation, and scientific research. As the largest marine protected area in the Northern Hemisphere, it demonstrates how co-management between federal, state, and Native Hawaiian authorities can effectively protect both natural and cultural resources. The 2025 sanctuary designation further strengthens protections while maintaining the monument's status, providing a model for comprehensive marine conservation that respects indigenous rights and cultural values while achieving significant conservation outcomes.

Palau National Marine Sanctuary (PNMS)

<https://picrc.org>

Palau National Marine Sanctuary (PNMS) / Palauan: *Euotelel a Klingil a Debel Belau*
Republic of Palau

Establishment Year

- Law enacted: 2015 (RPPL 9-49)
- Came into full effect: January 1, 2020

Characteristics

- Type of Environment:
 - Open water: 80% of Palau's Exclusive Economic Zone (EEZ), including pelagic and abyssal environments
 - Island and coastal: Adjacent to Palau's archipelago; includes nearshore reefs and islands (not directly within PNMS, but connected through the national network)
 - Geological features: 400+ seamounts and knolls, Palau Trench (up to 8,000m deep), unique deep-sea habitats
- Physical Extent:
 - Total area: 475,077 km² (among the world's largest MPAs)
 - Protection zones:
 - 80% (380,000+ km²): No-take zone (all extractive activities banned)
 - 20%: Domestic Fishing Zone (DFZ) for local fisheries and food security

Objectives

- Biodiversity Protection: Safeguard a vast array of marine life, including over 800 marine vertebrate species, at least 30 marine mammals, and 60 shark and ray species
- Species Conservation: Protect threatened and endangered species: hawksbill and leatherback turtles (critically endangered), blue whales, white sharks, great hammerhead sharks (endangered), dugongs, napoleon wrasse, bumphead parrotfish, and many others
- Geological Formation Preservation: Conserve unique geological features (seamounts, deep-sea trenches, abyssal habitats) that may harbor undiscovered species
- Fishery Spawning Area Designation: Protect pelagic fish spawning grounds (notably for tuna) and support ecosystem-based management to ensure long-term fishery health

Local Context

Palau is an island nation in the western Pacific Ocean. The country's economy is heavily reliant on tourism and fishing. The local communities have a strong connection to the ocean, and sustainable management of marine resources is crucial for their livelihoods and cultural identity.

- Population: Small island nation (~18,000 people), highly dependent on marine resources and tourism
- Economy:
 - Tourism contributed ~38% of GDP in 2020 (pre-pandemic); main economic driver alongside fisheries
 - COVID-19 pandemic caused a 39% decline in private sector output and 21% drop in government tax revenue
- Culture:
 - Strong tradition of ocean stewardship (“bul” – customary conservation practice)
 - PNMS is central to Palau’s national identity and international reputation for conservation leadership

Part of MPA Network

- PNMS is part of a national network of 29+ MPAs managed by the Palau Conservation Society and other partners
- Contributes to regional Pacific conservation initiatives

Managing Authority

The management of the PNMS involves multiple agencies:

- Palau International Coral Reef Center (PICRC) – mandated for administration, research, outreach, and education
- Palau National Government (Congress, President).
- Palau Ministry of Natural Resources, Environment & Tourism: Has overall responsibility for environmental policy and MPA management.
- Bureau of Marine Resources: Responsible for fisheries management and enforcement.
- PNMS Office: Oversees the day-to-day management of the sanctuary.
- Environmental Quality Protection Board: Plays a role in regulating activities that may impact the marine environment.
- Local communities: Traditional leaders and community members are involved in management decisions.
- NGOs (e.g., Ebiil Society, The Nature Conservancy, Conservation International).

Managing Performance

- Strengths:
 - Among the world’s largest no-take MPAs
 - Strong legal framework (RPPL 9-49 and amendments)
 - Innovative funding via Pristine Paradise Environmental Fee (PPEF)

- Robust baseline studies and 10-year science/monitoring plan
- Challenges:
 - Economic pressure due to loss of fishing license revenue and COVID-19 tourism collapse
 - Political controversy over potential re-opening to commercial fishing
 - Need for improved science-based zone design and more effective outreach
- Achievements:
 - International recognition as a model for large-scale, fully protected MPAs
 - Grant support from NGOs to maintain no-take status during economic crisis

Types of Measures Implemented

- Technical Measures
 - Vessel monitoring systems (VMS): Required for all vessels operating within Palau's EEZ.
 - eDNA, histological, and larval research: Monitoring species presence, spawning, and larval dispersal
 - BRUVs and deep-sea cameras: Study pelagic and deep-sea fauna.
 - Satellite surveillance: To detect illegal fishing activities.
 - Marine patrols: By patrol boats and aircraft.
 - Coral reef monitoring: To assess reef health and identify threats.
 - Fish stock assessments: To monitor the abundance of commercially important fish species.
- Legal Measures
 - Palau National Marine Sanctuary Act: Establishing the PNMS and its regulations.
 - Protected Areas Network Act: Provides a framework for establishing and managing protected areas.
 - Environmental Quality Protection Act: Provides for environmental impact assessments and pollution control.
 - Fisheries Management Act: Regulates fishing activities.
 - Traditional Leader's Law: Recognizes the role of traditional leaders in resource management.
 - Palau Legacy Pledge: A pledge that all visitors must sign, committing to responsible behaviour and environmental stewardship.
- Economic Measures
 - Green fee: A fee charged to all tourists visiting Palau, with a portion of the revenue dedicated to conservation efforts.
 - Sustainable tourism initiatives: Promoting eco-friendly tourism practices.
 - Support for local fisheries: Providing assistance to local fishers to transition to sustainable fishing practices.

- Grants and funding: From international organizations and donors to support conservation efforts.
- Literacy, Awareness, and Education Measures
 - Environmental education programs: In schools and communities.
 - Public awareness campaigns: Promotion of responsible behaviour and support for conservation efforts. Engaging local communities in conservation activities.
 - Training programs: For tourism operators, fishers, and other stakeholders.
 - Visitor information centres: Providing information about the PNMS and its importance.

Balance between Restrictions and Support for Local Stakeholders

The management of the PNMS seeks to balance restrictions on certain activities (primarily commercial fishing) with support for local stakeholders through:

- Domestic fishing zone: Designating an area within Palau's EEZ for local fishers.
- Transition assistance: Providing support to local fishers to transition to alternative livelihoods.
- Stakeholder participation: Engaging local communities in decision-making processes.
- Sustainable tourism initiatives: Promoting economic opportunities that are compatible with conservation goals.
- Education and awareness programs: Fostering a sense of stewardship and promoting responsible behavior.
- Revenue-sharing from PPEF and grants.

Stakeholder Involvement

Stakeholder involvement is a key principle of PNMS management. Key stakeholders include:

- Local communities: Fishers, tourism operators, and other residents.
- Traditional leaders: Customary leaders (Council of Chiefs), state governments. Play a key role in decision-making.
- Government agencies: Ministry of Natural Resources, Environment & Tourism, Bureau of Marine Resources, and others.
- Non-governmental organizations (NGOs): NGOs, Ebiil Society, Friends of the PNMS. Involved in research, monitoring, and community engagement.
- Private sector: Tourism businesses and other companies operating in the marine environment.
- Research institutions: PICRC, international research collaborations. Conducting scientific research on marine ecosystems.
- International partners: The Nature Conservancy, Conservation International, Nia Tero, UNDP, Stanford Center for Ocean Solutions. Providing technical and financial assistance.

Dedicated Resources Available

- Human Resources: PICRC staff (researchers, educators), government officers, community rangers
- Financial Resources
 - PPEF tourism fee (~\$100 per visitor, variable with tourism volume)
 - International grants (\$2.6 million/year for 3 years, plus project-based support)
 - Government funding for PNMS management and conservation programs.
- Equipment Resources: Research vessels, BRUVs, deep-sea cameras, laboratory facilities, outreach materials

Effects of Management

- Ecological Effects
 - Biodiversity:
 - Early evidence of increased abundance of pelagic fish (e.g., yellowfin, bigeye tuna) in adjacent DFZ
 - Protection of critical habitats for endangered species (turtles, sharks, whales)
 - Large-scale connectivity supports resilience to climate change
 - Population Dynamics:
 - Anticipated “spillover” of fish biomass from no-take to fishing zones
 - Ongoing monitoring will clarify long-term trends
- Economic Effects
 - Tourism: Pre-pandemic, tourism provided ~38% of GDP; PPEF supports conservation and state budgets; COVID-19 highlighted vulnerability of tourism-dependent funding
 - Fisheries:
 - Domestic fishers report higher catches of pelagic species near artisanal zones
 - Export-oriented DFZ supports local economic activity
 - Long-term sustainability prioritized over short-term gains from foreign fleets

Summary

- The Palau National Marine Sanctuary is a pioneering large-scale MPA, balancing ambitious conservation goals with local livelihoods and national development. Despite economic and political challenges, the PNMS demonstrates strong governance through legal innovation, broad stakeholder engagement, and adaptive, science-based management. Early signs show ecological and economic benefits, but continued monitoring, funding diversification, and community involvement remain critical to its long-term success.

Seychelles Marine Protected Areas

<https://www.spga.gov.sc/parks>

Seychelles

Establishment Year

The establishment of MPAs in Seychelles has been an ongoing process:

- Aldabra Atoll: Designated as a Special Reserve in 1981 and a UNESCO World Heritage Site in 1982.
- Curieuse Marine National Park: Established in 1979.
- Sainte Anne Marine National Park: Established in 1973.
- Expanded MPA Network: Significant expansion occurred in 2020 with the implementation of the Marine Spatial Plan, designating 30% of Seychelles' Exclusive Economic Zone (EEZ) as MPAs.

Characteristics

- Type of environment: The Seychelles MPAs encompass a diverse range of marine environments, including:
 - Estuarine: Mangrove ecosystems, especially around islands like Aldabra.
 - Island: Numerous islands, both granitic and coralline, surrounded by coral reefs.
 - Coastal: Fringing reefs, sandy beaches, and rocky shores.
 - Open water: Pelagic habitats supporting diverse marine life.
 - Wetlands: High-altitude marshes, Ramsar sites.
 - Deep sea: Including seamounts and abyssal plains.

Objectives

- Biodiversity protection: To conserve the rich marine biodiversity of Seychelles, including coral reefs, seagrass beds, mangroves, fish populations, marine mammals, sea turtles, and seabirds.
- Species conservation: To protect threatened and endangered species, such as the dugong, whale shark, giant tortoises, sea turtles (hawksbill, green), rare birds (e.g., Seychelles Black Paradise Flycatcher, Seychelles Scops-owl), corals, and endemic plants, and various seabird species.
- Geological formation preservation: To preserve the unique geological formations of Seychelles, including its granitic islands, coralline atolls, and underwater features.
- Fishery spawning area designation: To protect critical spawning and nursery areas for commercially important fish species, supporting sustainable fisheries.
- Climate change mitigation: To enhance carbon sequestration by protecting blue carbon ecosystems (mangroves and seagrass beds).

Local Context

Seychelles is an archipelago of 115 islands in the western Indian Ocean. The country's economy is heavily reliant on tourism and fisheries. The local communities have a strong connection to the ocean, and sustainable management of marine resources is crucial for their livelihoods and cultural identity.

- Human Population:
 - Small, island-based communities with livelihoods tied to fishing, tourism, and agriculture
 - Cultural and historical sites within several parks (e.g., cinnamon distilleries, plantation ruins)
- Tourism:
 - Major economic driver; MPAs are key attractions for eco-tourism, diving, snorkelling, and wildlife watching
- Traditional Use:
 - Historical fishing, harvesting, and cultural practices integrated into management where sustainable

Part of MPA Network

- Integrated national network of protected areas
- Includes UNESCO World Heritage Sites, Ramsar Wetlands, and Important Bird Areas
- Part of the Seychelles Marine Spatial Plan (MSP)

Managing Authority

The management of MPAs in Seychelles involves multiple agencies:

- Ministry of Environment, Energy and Climate Change (MEECC): Overall responsibility for environmental policy and MPA management.
- Seychelles National Parks Authority (SNPA): Manages specific national parks and marine parks, such as Sainte Anne and Curieuse.
- Seychelles Fishing Authority (SFA): Manages fisheries resources within and outside MPAs.
- Non-governmental organizations (NGOs): Play a key role in research, monitoring, and community engagement.

The Marine Spatial Planning (MSP) initiative has strengthened coordination among these agencies.

Managing Performance

- Regular ecological monitoring: Of coral reefs, fish populations, seagrass beds, and other key indicators.
- Socio-economic monitoring: Assessing the impacts of MPAs on local communities and the tourism sector.
- Enforcement patrols: To deter illegal fishing and other activities.

- Adaptive management: Adjusting management strategies based on monitoring results and stakeholder feedback.
- Marine Spatial Planning (MSP): Provides a framework for integrated management and adaptive planning.
- Challenges:
 - Enforcement in remote areas
 - Balancing tourism growth with ecosystem protection
 - Climate change impacts (coral bleaching, sea level rise)

Types of Measures Implemented

- Technical Measures
 - Zoning: Designating different zones within MPAs with varying levels of protection.
 - Fishing gear restrictions: Limiting the types of fishing gear allowed in certain areas.
 - Closed seasons: Temporarily closing certain areas to fishing during spawning seasons.
 - Marine Spatial Planning (MSP): Using GIS-based tools to map and manage marine resources.
 - Coral reef restoration: Projects to restore damaged coral reefs.
 - Biodiversity and population monitoring (e.g., turtles, tortoises, birds, corals).
 - Invasive species control and habitat restoration.
- Legal Measures
 - National Parks and Nature Conservancy Act: Provides the legal framework for establishing and managing national parks and marine parks.
 - Fisheries Act: Regulates fishing activities.
 - Environment Protection Act: Provides for environmental impact assessments and pollution control.
 - Maritime Zones Act: Establishes Seychelles' EEZ and territorial waters.
 - Regulations for specific MPAs: Setting out rules for activities within each MPA.
- Economic Measures
 - Entrance fees: Charging visitors fees to enter marine parks.
 - Sustainable tourism initiatives: Promoting eco-friendly tourism practices.
 - Compensation for fishers: Providing financial assistance to fishers affected by MPA regulations.
 - Blue carbon initiatives: Leveraging carbon finance to support mangrove and seagrass conservation.
 - Debt-for-nature swaps: Reducing Seychelles' national debt in exchange for commitments to marine conservation.
- Literacy, Awareness, and Education Measures
 - Environmental education programs: In schools and communities.

- Public awareness campaigns: To promote responsible behaviour and support for conservation efforts.
- Training programs: For tourism operators, fishers, and other stakeholders.
- Visitor centres: Providing information about the marine environment.
- Citizen science initiatives: Engaging the public in monitoring and research activities.

Balance between Restrictions and Support for Local Stakeholders

- Strict protection in sensitive or unique habitats (e.g., Aldabra, Veuve Reserve)
- Stakeholder participation: Engaging local communities in decision-making processes.
- Compensation programs: Providing financial assistance to those affected by conservation measures.
- Alternative livelihood programs: Supporting fishers in diversifying their income sources.
- Sustainable tourism initiatives: Promoting economic opportunities that are compatible with conservation goals.
- Education and awareness programs: Fostering a sense of stewardship and promoting responsible behaviour.
- Locally Managed Marine Areas (LMMAs): Empowering local communities to manage their marine resources.

Stakeholder Involvement

Stakeholder involvement is a key principle of MPA management in Seychelles. The MSP process has provided a structured framework for engaging stakeholders. Key stakeholders include:

- Local communities: Fishers, tourism operators, and other residents.
- Government agencies: MEECC, SNPA, SFA, and others.
- Non-governmental organizations (NGOs): Involved in research, monitoring, and community engagement.
- Private sector: Tourism businesses and other companies operating in the marine environment. Tour operators, dive centers, hospitality industry.
- Research institutions: Conducting scientific research on marine ecosystems.
- International organizations: UNESCO, Ramsar, BirdLife International, and others.

Dedicated Resources Available

- Human Resources
 - Staff from government agencies, NGOs, and research institutions.
 - Park rangers and enforcement officers.
 - Educators and interpreters.
 - Volunteers.
- Financial Resources
 - Government funding for MPA management and conservation programs.

- External funding from international organizations and donors.
- Revenue from tourism.
- Blue carbon finance.
- Debt-for-nature swaps.
- Equipment Resources
 - Research vessels and monitoring equipment.
 - Patrol boats and enforcement equipment.
 - Visitor centers and educational facilities.
 - GIS and data management systems.

Effects of Management

- Ecological Effects
 - Increased fish biomass: Studies have shown increased fish biomass and diversity within MPAs.
 - Coral reef recovery: Some coral reefs have shown signs of recovery from bleaching events.
 - Protection of threatened species: MPAs provide important habitat for threatened species, such as sea turtles and seabirds.
 - Improved or stable populations of flagship species (e.g., Aldabra giant tortoise, nesting turtles, endemic birds).
 - Climate change resilience: Blue carbon ecosystems within MPAs contribute to climate change mitigation.
 - Reduced pressures from invasive species and unsustainable use in many areas.
- Economic Effects
 - Sustainable tourism: MPAs support a thriving tourism industry, generating revenue and employment.
 - Sustainable fisheries: Managed fisheries provide economic opportunities while minimizing impacts on the ecosystem.
 - Ecosystem services: MPAs provide valuable ecosystem services, such as coastal protection and carbon sequestration.
 - Improved livelihoods: Sustainable management of marine resources can improve the livelihoods of local communities.

Summary

- Seychelles' Marine Protected Areas represent a holistic, adaptive, and participatory approach to conservation. By integrating strict protection with sustainable use, robust legal frameworks, stakeholder engagement, and education, Seychelles has set a global benchmark for MPA governance. This network contributes to ecological resilience, economic sustainability, and the preservation of unique natural and cultural heritage for present and future generations.

Great Barrier Reef Marine Park, Australia

<https://www2.gbrmpa.gov.au>

Queensland, Australia

Establishment Year

- 1975: The Great Barrier Reef Marine Park was established under the Great Barrier Reef Marine Park Act 1975.
- 1981: Inscribed as a UNESCO World Heritage Site.

Characteristics

- Type of Environment:
 - Open water: Encompasses a vast expanse of the Coral Sea.
 - Coastal: Includes inshore reefs, mangroves, and seagrass beds along mainland Queensland.
 - Island: Over 900 islands, including sandy cays, vegetated cays, and continental islands.
 - Estuarine: Includes estuarine wetlands and river mouths.
- Physical Extent:
 - Area: Approximately 348,000 km² (almost the size of Japan or Italy).
 - Length: Extends 2,000 km along the northeast coast of Australia (from 10°S to 24°S latitude).
 - Contains about 2,500 individual reefs and 900 islands.
 - Depth range: From shallow inshore areas to over 2,000 meters deep beyond the continental shelf.

Objectives

- Biodiversity Protection:
 - Home to the world's largest collection of coral reefs, with 400+ coral species (60 genera).
 - Supports 1,500+ fish species, 4,000+ mollusc species, 240+ bird species, and a rich array of sponges, anemones, marine worms, and crustaceans.
 - Contains half the world's diversity of mangroves and many seagrass species.
- Species Conservation:
 - Key threatened species:
 - Dugong (*Dugong dugon*): GBR is a major feeding ground for one of the world's largest populations.
 - Green turtle (*Chelonia mydas*): Raine Island is the world's largest green turtle rookery.
 - Other marine turtles: Six of the world's seven marine turtle species occur here, including the loggerhead (*Caretta caretta*), hawksbill

(*Eretmochelys imbricata*), flatback (*Natator depressus*), leatherback (*Dermochelys coriacea*), and olive ridley (*Lepidochelys olivacea*).

- Cetaceans: At least 30 species of whales and dolphins, including the humpback whale (*Megaptera novaeangliae*), which calves in GBR waters.
- Seabirds: 22 seabird species breed on cays and islands.
- Endemic and rare fish: e.g., Queensland grouper (*Epinephelus lanceolatus*), potato cod (*Epinephelus tukula*).
- Geological Formation Preservation:
 - Represents all stages of reef development, shaped by glacial and interglacial cycles over 15,000 years.
 - Features continental islands, coral cays, sand banks, and deep oceanic plains.
- Fishery Spawning Area Designation:
 - Critical spawning and nursery habitats for many commercial and non-commercial fish species.
 - Temporal closures protect spawning aggregations (e.g., coral trout, *Plectropomus leopardus*).

Local Context

- Cultural Heritage:
 - The Reef is of spiritual and cultural significance to 70+ Aboriginal and Torres Strait Islander Traditional Owner groups who have lived in the region for thousands of years.
 - Traditional uses include fishing, hunting, and cultural practices, with many shell middens and fish traps present.
- Economic Importance:
 - Supports tourism, commercial and recreational fishing, and scientific research.
 - Tourism: Over 2 million visitors per year; contributes about AUD 6.4 billion annually and supports ~64,000 jobs.
- Threats:
 - Climate change (coral bleaching), declining water quality (land runoff), coastal development, shipping, fishing pressures, invasive species (e.g., crown-of-thorns starfish outbreaks), and extreme weather events.

Part of MPA Network

- The GBRMP is one of the world's largest and best-known MPAs, forming the core of Australia's national and international MPA network.
- Also a World Heritage Site and part of the National Representative System of Marine Protected Areas (NRSMPA).

Managing Authority

- Great Barrier Reef Marine Park Authority (GBRMPA): Independent Australian Government agency responsible for protection and management of the marine park.
- Queensland Government: Manages the contiguous Great Barrier Reef Coast Marine Park (between low and high water marks) and most islands.
- Collaborative Management: Federal and State governments, Traditional Owners, commercial and recreational stakeholders.

Managing Performance

- Zoning Plan:
 - Zoning provides spatial management: ~33% (115,000 km²) is 'no-take' or 'no-entry' zone.
 - Multiple-use zoning allows for conservation and sustainable use.
- Adaptive Management:
 - GBRMPA implements adaptive management, regular monitoring, and 5-yearly Outlook Reports.
- Conservation Programs:
 - Includes the Reef Water Quality Protection Plan, Climate Change Action Plan, and Reef Guardians Stewardship Programs.
- Challenges:
 - Ongoing coral bleaching events (notably in 1998, 2002, 2016, 2017, and 2020).
 - Cumulative impacts from climate change, water quality decline, and coastal development.
 - Management complexity due to overlapping jurisdictions and scale.

Types of Measures Implemented

- Technical Measures
 - Comprehensive zoning plan: Divides the park into different use zones (from no-entry to general use)
 - Monitoring systems: Advanced monitoring technologies including remote sensing, underwater monitoring stations, and drone surveillance
 - Vessel tracking systems: For monitoring commercial fishing and tourism vessels
 - Reef health early warning systems: For detecting coral bleaching events and crown-of-thorns starfish outbreaks
- Legal Measures
 - Great Barrier Reef Marine Park Act 1975: Primary legislation establishing the park and management framework
 - Environment Protection and Biodiversity Conservation Act 1999: Provides additional protection as a World Heritage site

- Zoning regulations: Legally enforceable rules for different use zones (significantly expanded in 2004, increasing no-take zones from 4.5% to over 33% of the park)
- Permits system: For regulating tourism, research, and other activities
- Enforcement mechanisms: Including fines and prosecutions for non-compliance
- Economic Measures
 - Environmental Management Charge: Collected from tourism operators
 - Sustainable fishing incentives: Programs promoting sustainable practices
 - Reef Trust: Funding mechanism for conservation projects
 - Public-private partnerships: For reef restoration and conservation initiatives
 - Economic valuation of ecosystem services: Used in decision-making processes
- Literacy, Awareness, and Education Measures
 - Reef Guardian programs: Educational initiatives for schools, local governments, and businesses
 - Interpretive programs: For visitors and tourists
 - Traditional Owner knowledge integration: Programs incorporating indigenous knowledge
 - Community awareness campaigns: About reef threats and conservation
 - Training programs: For tourism operators and other stakeholders

Balance between Restrictions and Support for Local Stakeholders

- Multiple-use zoning allows for a variety of activities while ensuring protection of key habitats.
- Consultative management: Involvement of Traditional Owners, fishers, tourism operators, and local communities in decision-making.
- Economic opportunities: Sustainable tourism and fishing support local livelihoods.
- Special Indigenous agreements (TUMRAs, ILUAs) allow for traditional use and stewardship.

Stakeholder Involvement

Stakeholder engagement in the GBRMP occurs through multiple mechanisms:

- Reef Advisory Committees: Provide expert advice on specific issues
- Local Marine Advisory Committees: Community-based committees providing local input
- Public consultations: During planning processes, including the major 2004 re-zoning
- Traditional Owner partnerships: Through Traditional Use of Marine Resources Agreements and Indigenous Land Use Agreements (Over 30% of inshore area covered by Traditional Use of Marine Resource Agreements (TUMRAs))

- Research institutions: Collaboration with universities and research centres.
- Industry partnerships: With tourism operators, fishers, and other commercial users

While consultation is extensive, the governance structure remains largely top-down, with ultimate decision-making authority residing with government agencies rather than being fully participatory.

Dedicated Resources Available

- Human Resources: GBRMPA staff, Queensland Parks and Wildlife Service rangers, Indigenous rangers, researchers, and volunteers.
- Financial Resources: Government funding (federal and state), permit and access fees, grants, and international support for conservation projects.
- Equipment Resources: Patrol vessels, research ships, monitoring buoys, remote sensing technology, visitor centres, and education materials.

Effects of Management

- Ecological Effects
 - Biodiversity:
 - GBR supports tens of thousands of species, including many globally significant or threatened species.
 - Some species and habitats show resilience and recovery after disturbances, but overall coral cover has declined in recent decades due to bleaching and other pressures.
 - Population dynamics:
 - Effective management of some fisheries and recovery of certain populations (e.g., green turtles at Raine Island).
 - Ongoing challenges with crown-of-thorns starfish outbreaks and coral health.
- Economic Effects
 - Tourism: Reef-related tourism generates approximately AUD 6.4 billion/year and supports ~64,000 jobs.
 - Fisheries: Sustainable fisheries provide economic value, but are closely regulated to prevent overexploitation.
 - Community benefits: Ongoing support for Indigenous livelihoods, local businesses, and educational opportunities.

Summary

- The Great Barrier Reef Marine Park is an example of good governance in MPA management through comprehensive legal frameworks, adaptive and collaborative management, robust stakeholder engagement, and a balance between conservation and sustainable use. While facing significant ecological challenges – especially from climate change – its management remains a global model for large-scale marine protection.

Recommendations

The case study overview clearly shows that effective MPA management relies on a combination of essential conditions. A stable legal and organisational framework is the first essential condition, providing the foundation for long-term governance and ensuring continuity, clear responsibilities, and the authority needed for implementation and enforcement. Well-defined objectives are equally important, as they guide decision-making and help evaluate progress over time.

A structured management plan further strengthens effectiveness by translating these objectives into concrete actions, timelines and monitoring systems. Successful MPAs demonstrate the importance of genuine stakeholder involvement, engaging communities, resource users, scientists, NGOs and local authorities, as this greatly improves compliance, legitimacy and shared ownership of conservation goals. Finally, adequate human and financial resources are indispensable. Without sufficient staff, funding, and operational capacity, even well-designed MPAs will struggle to achieve meaningful ecological or socio-economic outcomes.

The accumulated experience of managing protected areas and especially marine protected areas during this century points at several important directions for enhancing management effectiveness. A starting point for describing the place of an MPA could be the framework connecting the type of “protection” and likely MPA outcomes (Grorud-Colvert *et al.*, 2021). It describes MPAs through four interconnected components:

- 1) Stage of Establishment: MPAs progress through four stages – *Proposed/Committed*, *Designated* (formal legal recognition), *Implemented* (regulations in force), and *Actively Managed* (ongoing management and enforcement).
- 2) Level of Protection: Protection is categorised as *Fully Protected* (no extractive or destructive uses), *Highly Protected*, *Lightly Protected*, or *Minimally Protected* – depending on what human activities are permitted or curtailed within the MPA boundaries.
- 3) Enabling Conditions: The framework emphasises the necessary governance, funding, stakeholder involvement, ecological planning, and compliance capacity required to translate designation into real-world conservation outcomes.
- 4) Expected Outcomes: When higher protection levels are paired with advanced establishment stages and strong enabling conditions, MPAs can deliver tangible biodiversity benefits (e.g. increased abundance and size of marine species), ecological resilience, enhanced ecosystem function, and human well-being gains. Lesser protection or only nominal MPAs often fail to produce meaningful benefits.

By linking these elements in a unified structure, the MPA Guide (Grorud-Colvert *et al.*, 2021) offers a clearer way to assess existing MPAs and design new ones. It complements existing tools, such as IUCN protected area categories, and prioritizes quality over quantity, stressing that area-based targets (like protecting 30% of the seas) must also

emphasise effective management and genuine protection to deliver global biodiversity, climate, and socioeconomic benefits.

Several fields require the special attention of MPA managers. These can be summarised as follows:

1. Governance and Legal Framework

- Understand the legal basis for your MPA, including national regulations, international obligations and regional sea conventions (e.g. Bucharest Convention).
- Develop or update the MPA management plan every 3-5 years, based on scientific evidence and stakeholder consultation.
- Align your MPA goals with national biodiversity strategies, EU directives (if applicable), and climate adaptation plans.

2. Institutional Capacity and Staffing

- Establish a core management team with expertise in ecology, enforcement, education, community engagement, and administration.
- Maintain an annual training program for staff on topics such as monitoring methods, conflict resolution, environmental law, and communication.
- Secure long-term funding through government budgets, partnerships, and sustainable financing mechanisms (e.g., tourism fees, grants).

3. Monitoring and Evaluation

- Implement an ecological monitoring plan using standardized indicators (e.g., fish biomass, habitat cover, water quality).
- Track social and economic outcomes, such as local livelihood impacts, stakeholder satisfaction, and visitor trends.
- Use adaptive management cycles: assess progress annually, revise actions based on outcomes, and report results to stakeholders and authorities.

4. Zoning and Regulation

- Clearly define and map MPA zones, such as no-take areas, buffer zones, and sustainable use zones.
- Install visible signage and boundary markers, both on land and at sea.
- Regularly review permitted and prohibited activities based on ecological sensitivity, enforcement capacity, and stakeholder needs.

5. Enforcement and Compliance

- Coordinate with national enforcement agencies (e.g., coast guard, fisheries inspectors) to ensure presence and authority.
- Use low-cost surveillance tools like drones, AIS, and community reporting hotlines.
- Develop a tiered penalty system for infractions and ensure consistent, fair application.

6. Stakeholder Engagement

- Identify and map key stakeholders: fishers, residents, businesses, NGOs, scientists, and government bodies.
 - Establish a multi-stakeholder advisory committee to provide input on management decisions.
 - Hold regular community consultations, particularly when new rules or zoning changes are proposed.
7. Education, Outreach, and Communication
- Develop an MPA communication strategy to raise public awareness of conservation goals, benefits, and rules.
 - Organise educational activities for schools, tourists, and local communities.
 - Promote the MPA brand (e.g., via local seafood labelling or sustainable tourism campaigns) to build pride and support.
8. Climate Change and Pollution Resilience
- Identify vulnerable habitats and species likely to be impacted by climate change and incorporate them into zoning priorities.
 - Monitor for invasive species, hypoxia, and harmful algal blooms, and respond with contingency protocols.
 - Engage upstream actors (e.g., municipalities, farmers) to reduce land-based pollution entering the MPA.
9. Cross-Border and Regional Cooperation
- Exchange knowledge and best practices with managers from other MPAs in the Black Sea or neighbouring seas.
 - Participate in regional networks and forums, such as MedPAN.
 - Align monitoring methods and indicators to enable regional comparisons and ecosystem-level management.
10. Documentation and Reporting
- Maintain detailed records of patrols, infractions, monitoring results, stakeholder meetings, and funding.
 - Report annually to national authorities and funders, summarizing achievements, challenges, and budget execution.
 - Publish summary updates online or in community newsletters to keep the public informed.
 - Develop document templates
 - MPA zoning map template
 - Standard monitoring protocol (e.g., transects, species counts)
 - Stakeholder engagement checklist
 - Budget and finance planning template
 - Communication materials toolkit

The steps towards the designation of new MPAs in the Black Sea basin, as well as the expansion of existing protected areas and the necessary changes in their management, have been addressed from various perspectives by Goriup *et al.* (2017). The interplay between MPAs and broader European policies, such as the Marine Strategy Framework Directive, highlights their role as spatial protection measures within wider marine policy frameworks. The social and economic dimensions of MPA networks, and the influence of protected areas on fisheries, local economies and coastal communities are also considered. Tools for improving decision-making, such as multi-criteria evaluation, are presented alongside ecosystem-based management frameworks that emphasise integrated, science-driven planning. Collaboration emerges as a recurring theme, and the ways to strengthen cooperation among MPA managers to improve performance across entire networks are open for discussion. Coordinating management efforts, including those in the Black Sea, and adapting European MPA approaches to national contexts in countries such as Ukraine and Turkey, is not a new topic. Together, these viewpoints offer a multidimensional perspective on how MPA networks can be strengthened to protect biodiversity while supporting the sustainable use of marine environments.

Nevertheless, persistent challenges that hinder effective MPA management across Europe and neighbouring seas remain. One of the most significant issues is the uneven implementation of conservation policies, with countries applying legislation and management measures in highly variable ways (Fraschetti *et al.*, 2018). This inconsistency prevents the creation of coherent, connected MPA networks and limits opportunities for transboundary collaboration. Many MPAs were also designated without systematic ecological criteria, resulting in sites that do not always protect the habitats or species most in need. Added to this are frequent conflicts between conservation goals and economic interests—particularly fisheries, tourism, and coastal development—often exacerbated by fragmented governance and weak coordination among authorities.

Beyond designation challenges, Frascchetti *et al.* (2018) stress a widespread lack of capacity to deliver effective management on the ground. Many MPAs suffer from inadequate staffing, insufficient funding, and limited monitoring and enforcement, which leads to “paper parks” that exist legally but have little practical impact. Without routine ecological monitoring, adaptive management is difficult, and managers cannot track trends or adjust strategies. Moreover, weak stakeholder engagement can foster mistrust or resistance among resource users, making compliance more difficult and reducing the legitimacy of conservation measures.

To address these shortcomings, it is recommended that a holistic, ecosystem-based governance approach is adopted, integrating conservation with fisheries management, maritime spatial planning and other relevant sectors. Crucial steps for improving resilience and ensuring the protection of priority habitats and species include establishing scientifically grounded, standardised procedures for site selection and designing MPAs as connected ecological networks. Strong stakeholder participation, from planning to

implementation, is a key factor for success, helping to align conservation measures with local realities and promote shared ownership of decisions.

Long-term investment in human and financial resources, including surveillance capacity, monitoring programmes and equipment, is essential. Effective MPAs require sustained commitment rather than one-off political declarations. Finally, the report calls for improved regional cooperation, particularly in semi-enclosed seas where ecological processes and human activities transcend national borders. Combining scientific evidence, participatory governance, sufficient capacity and coordinated planning can transform MPAs from isolated efforts into robust, effective instruments for marine conservation.

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Useful links:

[MedPAN](#)

[MPA Community Network](#)

[Panorama](#)

[Marine Protection Atlas](#)

[Blue Parks by Marine Conservation Institute](#)

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