Ocean-Based Climate Actions of the NEAMPAN sites in the Republic of Korea

ESCAP
Economic and Social Commission for Asia and the Pacific

NEASPEC
North-East Asian Subregional Programme for Environmental Cooperation

ACKNOWLEDGMENTS

This report was authored by Dr. Jungho Nam, Senior Research Fellow of Korea Maritime Institute, as a work of the North-East Asian Subregional Programme for Environmental Cooperation (NEASPEC). Under the overall direction and guidance of Ganbold Baasanjav, Head of the ESCAP ENEA office, and the supervision of Riccardo Mesiano, Deputy Head of the Office, Mi-Jin Lee, Research Associate, and Bosi Ding, Intern, worked closely with the author to refine and enhance the report, incorporating the suggested revisions provided by the NEASPEC secretariat to strengthen the original draft.

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Please cite this report as:

Jungho Nam (2025). "Ocean-Based Climate Actions of the NEAMPAN sites in the Republic of Korea", ESCAP / NEASPEC.

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EXECUTIVE SUMMARY

This report highlights the critical role of Marine Protected Areas (MPAs) in addressing the twin crises of biodiversity loss and climate change, with a particular focus on ocean-based climate actions (OBCAs). It provides a comprehensive analysis of the Republic of Korea's (ROK) marine biodiversity conservation strategies and their contributions to regional and global frameworks, including the North-East Asian Marine Protected Areas Network (NEAMPAN). NEAMPAN, established by the North-East Asian Subregional Programme for Environmental Cooperation (NEASPEC), serves as a collaborative platform to promote best practices and enhance MPA management capacity in the subregion, integrating climate action as a core element of marine ecosystem conservation.

The report is structured in six chapters:

1. **Introduction:** Introduces the significance of OBCAs and MPAs in mitigating climate risks and biodiversity loss, setting the stage for further analysis at national, regional, and global levels.
2. **Global Overview**: Reviews international frameworks, agreements, and trends such as the Global Biodiversity Framework (GBF), the 30x30 target, and the UNFCCC's emphasis on blue carbon, which collectively emphasizes the importance of MPAs in enhancing climate resilience and ecological restoration.
3. **Regional Overview**: Highlights cooperative efforts among North-East Asian countries, with a focus on NEAMPAN's role in promoting regional MPA networks, knowledge exchange, and capacity building to address climate change impacts in marine environments.
4. **Marine Biodiversity Conservation and OBCAs in the ROK**: Presents the ROK's robust legal and institutional frameworks, including the Framework Act on Carbon Neutrality (2021) and Wetlands Conservation Act (1999), and its efforts in MPA expansion, blue carbon initiatives, and habitat restoration.
5. **In-Depth Analysis of NEAMPAN Sites in the ROK**: Analyzes management plans for Muan, Suncheon, and Gochang MPAs, identifying progress and gaps in integrating climate actions, particularly in the areas of financing, governance, and alignment with international guidelines.
6. **Recommendations**: Proposes strategic guidance for the ROK, NEAMPAN member States, and the NEASPEC Secretariat to enhance the effectiveness of MPAs through climate-resilient approaches, capacity building, and regional cooperation.

Key Findings

- **Ecological and Socio-economic Contexts of Climate Change Impacts:** Climate change has led to a range of ecological disruptions, including changes in phytoplankton productivity, metabolic changes in marine fauna, and altered carbon sequestration processes in pelagic ecosystems. It also reduces habitat complexity, significantly affecting coral reefs, mangroves, seagrasses, and salt marshes. Additional impacts include the proliferation of invasive species

and the increased incidence of marine diseases, posing further threats to native biodiversity. These stressors, when combined with both local and global anthropogenic pressures, undermine ecosystem resilience and push marine systems toward ecological thresholds beyond which recovery is uncertain. The economic consequences are equally severe. Climate change adversely affects the economic services derived from marine systems, including fisheries, mariculture, marine tourism, and coastal hazard mitigation. These impacts result from changes in ocean temperature, chemistry, circulation, and sea level, all of which directly influence marine habitats and biological productivity. By 2050, the global cost of climate-related marine impacts is projected to reach USD 428 billion annually, escalating to nearly USD 2 trillion per year by 2100.

- **Global and Regional Alignment**: Marine Protected Areas (MPAs) play a vital role in protecting marine ecosystems against the adverse effects of climate change. By limiting activities such as fishing and industrial development, MPAs serve as safe zones where marine biodiversity can thrive, and ecosystems can function with reduced stress. MPAs also contribute to carbon sequestration through more effective biological processes within their ecosystems than unprotected areas. At the global level, international frameworks such as the Ramsar Convention, the Global Biodiversity Framework, and the High Seas Treaty underscore the importance of OBCAs. At the regional level, institutions are increasingly incorporating OBCAs into their policies and practices within their mandates. Among them, NEAMPAN is notable for its role in complementing global efforts, as a catalyst, by advancing regional collaboration on climate action and biodiversity conservation.

- **Republic of Korea's Legal Mechanism and Practices**: The Republic of Korea has established a comprehensive legal and policy framework to address climate change and biodiversity loss. Key legislation includes the Framework Act on Carbon Neutrality and Green Growth, the Marine Environment Conservation Act, the Marine Ecosystem Act, the Wetlands Conservation Act, the Getbol Act, and the Biodiversity Conservation Act. The Framework Act on Carbon Neutrality and Green Growth sets the national goal of achieving carbon neutrality by 2050, supported by detailed national and local plans for greenhouse gas reduction and climate adaptation. The Marine Environment Conservation Act, led by the Ministry of Oceans and Fisheries (MOF), covers marine spatial planning, environmental assessments, and climate responses. The Marine Ecosystem Act outlines conservation frameworks, ecological axes, and biodiversity management. Based on these laws, the ROK has designated and managed various MPAs, governed by different ministries under laws such as the Marine Ecosystem Act and Wetlands Conservation Act. The first Coastal and Marine Protected Area (CMPA), Hanryeo Marine National Park, was designated in 1968, and CMPAs have expanded significantly to approximately 470 sites since the 2000s. Korea's proactive engagement in international conventions further reinforces its leadership, with 26 Ramsar sites covering 26,265 hectares and 16 World Natural and Cultural Heritage sites, including Getbol (203,003 ha) and Jeju Volcanic Island. These actions reflect the alignment of the ROK's legal instruments with global priorities for OBCAs, particularly in advancing blue carbon strategies and marine biodiversity conservation.

- **Site-level Implementation of Climate Action:** The Muan, Suncheon, and Gochang Coastal Wetland Protected Areas (CWPA) - all NEAMPAN sites - have adopted individual management plans, yet they vary significantly in their integration of climate considerations. Muan's fourth management plan (2022-2026), led by Mokpo Regional Office of Oceans and Fisheries (ROOF), incorporates SWOT analysis and prioritizes local capacity-building, sustainable Getbol use, and marine biodiversity monitoring. However, it lacks a dedicated climate strategy. Gochang's third plan (2020-2024), prepared by Gunsan ROOF, centers on enhancing local economic benefits through sustainable fisheries rather than explicitly addressing climate change. While it acknowledges the ecological value of Gochang Getbol, it lacks a climate resilience framework, signaling the need for future plans to incorporate stronger climate adaptation measures. In contrast, Suncheon's third plan (2024-2028), developed by Yeosu ROOF, adopts a more integrated approach by assessing climate vulnerability, monitoring climate-related indicators, and implementing long-term response strategies. The plan includes measures to expand carbon sinks, restore habitats, and strengthen international cooperation on blue carbon. Among the three, Suncheon stands out as the most climate-responsive, whereas Muan and Gochang reflect gaps in local capacity, financing, and alignment with higher-level frameworks. Future plan revisions should enhance ecosystem resilience by integrating proactive climate actions, ensuring that protected areas contribute effectively to climate adaptation and biodiversity conservation.
- **The Role of NEAMPAN**: As a regional mechanism, NEAMPAN facilitates knowledge sharing, capacity building, and cross-border collaboration across North-East Asia. It serves as a platform for promoting innovative practices and fostering partnerships to address the interconnected challenges of climate change and biodiversity loss, thereby enhancing the collective effectiveness of MPAs in the subregion.

Recommendations

To enhance the effectiveness of MPAs in advancing OBCAs, this report proposes four strategic areas.

First, site-specific knowledge should be enhanced. This includes the development of high-resolution regional climate models tailored for MPAs, alongside ecological and socio-economic assessments to inform adaptive management. Public awareness should also be increased through simplified science communication.

Second, institutional frameworks must be strengthened. National and local MPA plans should be aligned with climate action priorities. NEAMPAN can be leveraged as a platform for cross-border cooperation and advisory systems.

Third, comprehensive capacity should be built. This includes expanding MPA size based on NEOLI (No-take, Enforced, Old, Large, Isolated) criteria, exploring alternative funding sources such as ESG-linked investments, and introducing innovative training programmes for local MPA managers.

Finally, functional MPA networks should be created. This involves reorganizing and expanding NEAMPAN sites to reflect ecological diversity, establishing national MPA networks to enhance synergy and collaboration, and organizing high-level meetings to strengthen NEAMPAN's governance and impact.

Conclusion

By integrating site-level knowledge, robust policy frameworks, institutional coordination, sustainable financing, and functional network governance, NEAMPAN and its member States are well-positioned to scale up ocean-based climate action. Through collaborative efforts, North-East Asia can serve as a global model in leveraging MPAs to achieve climate resilience, biodiversity conservation, and sustainable development.

ABBREVIATIONS

- CBD — Convention on Biological Diversity
- CCUS — Carbon Capture, Utilization, and Storage
- CDR — Carbon Dioxide Removal
- CMPAs — Coastal and Marine Protected Areas
- CWPA — Coastal Wetlands Protected Areas
- ESCAP — Economic and Social Commission for Asia and the Pacific
- EAAFP — East Asian-Australasian Flyway Partnership
- ESG — Environmental, Social, and Governance
- GCM — Global Climate Models
- GBF — Global Biodiversity Framework
- IPCC — Intergovernmental Panel on Climate Change
- IUCN — International Union for Conservation of Nature
- MAB — Man and the Biosphere
- MOE — Ministry of Environment (Republic of Korea)
- MOF — Ministry of Oceans and Fisheries (Republic of Korea)
- MPA — Marine Protected Area
- NbS — Nature-based Solutions
- NDC — Nationally Determined Contribution
- NEAMPAN — North-East Asian Marine Protected Areas Network
- NEASPEC — North-East Asia Subregional Programme for Environmental Cooperation
- OBCA — Ocean-Based Climate Actions
- RCM — Regional Climate Models
- ROOF — Regional Office of Oceans and Fisheries
- ROK — Republic of Korea
- SPM — Summary for Policymakers
- SWOT — Strength, Weakness, Opportunity, Threat
- UNFCCC — United Nations Framework Convention on Climate Change
- WCPA — Wetlands Conservation Protected Areas

- WHC World Heritage Convention

CHAPTER 1. INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

The climate crisis has driven the global community to proactively reduce greenhouse gas (GHG) emissions, implement mitigation strategies, and adapt to climate-related changes since the 1990s. This growing awareness has been increasingly reflected in public policies and the management strategies of the private sector. In parallel, a biodiversity crisis has emerged, characterized by habitat loss and species extinction. As reported by the World Economic Forum (WEF), the crisis of climate change and biodiversity loss are among the top risks facing humanity in the coming years (WEF, 2024). The world is now confronting a "twin crises", underscoring the urgent need for an integrated approach that addresses both challenges in a holistic manner, rather than treating them in isolation.

For many years, policies and investments related to these twin crises have largely focused on terrestrial areas, with limited attention to the substantial role that oceans play in mitigating climate impacts. However, more recently, there has been growing recognition of the role and potential of marine ecosystems in addressing the climate crisis, particularly in light of evidence that such ecosystems can sequester carbon up to 50 times faster than terrestrial ecosystems (Copertino, 2011). Blue carbon initiatives, spearheaded by coastal states and international organizations such as the United Nations Environment Programme (UNEP) and the International Union for Conservation of Nature (IUCN), are a key example of this emerging focus. In this context, ocean-based climate action is both timely and essential, given the substantial contributions of marine natural assets and their ecological and biological processes. Marine Protected Areas (MPAs), as representative common assets governed by institutional mechanisms at global, national, and local levels, hold considerable potential to contribute to climate change mitigation.

To maximize the effectiveness of MPAs in this regard, it is essential to harmonize top-down policy frameworks with bottom-up actions. At the regional level, practical solutions can be developed by assessing national initiatives and applying them in a site-specific manner. The North-East Asian Subregional Programme for Environmental Cooperation (NEASPEC) is a key regional framework supporting MPAs through the operation of the North-East Asian Marine Protected Areas Network (NEAMPAN) and is committed to designing and implementing ocean-based climate actions at both regional and local levels. The development of Ocean-Based Climate Actions (OBCAs) through MPAs is closely aligned with the NEASPEC mandate and its Strategic Plans.

In line with the above, this study aims to propose policy recommendations to strengthen ocean-based climate actions, and to support their integration into national marine policies of NEAMPAN member States.

1.2 SCOPE AND METHODS

This study encompasses scientific findings and policy frameworks concerning ocean-based climate actions, with a specific focus on Marine Protected Areas (MPAs) in both global and North-East Asian regional contexts. Figure 1 illustrates the outline and workflow of this study, as well as the methods

employed to fulfill its objectives.

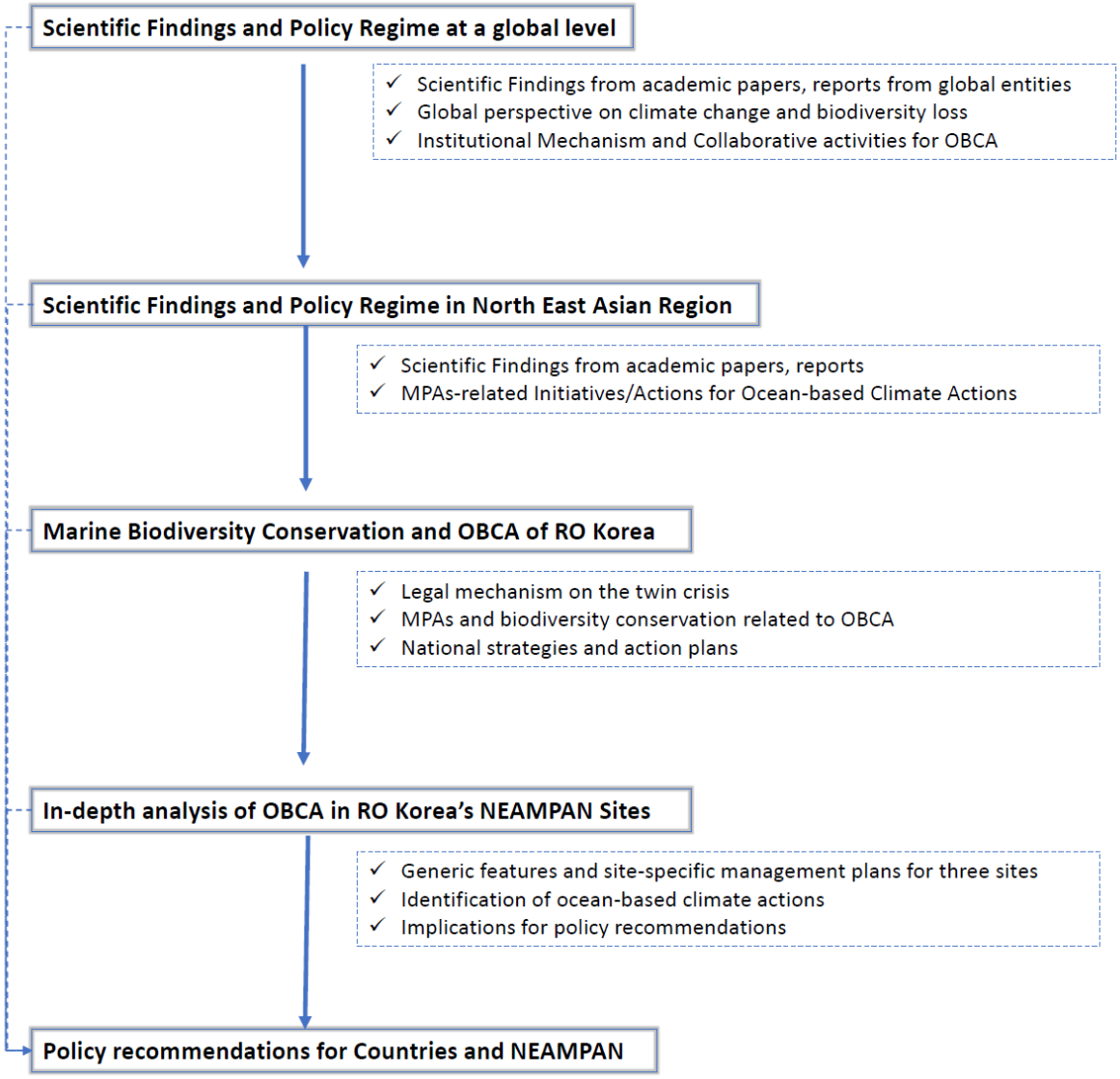

Figure 1. Workflow and Structure of the Study

CHAPTER 2. GLOBAL OVERVIEW OF SCIENTIFIC FINDINGS AND POLICY REGIME ON MARINE PROTECTED AREAS – OCEAN-BASED CLIMATE ACTIONS

This chapter provides a comprehensive overview of the current global landscape for ocean-based climate actions. It first examines recent scientific findings from peer-reviewed academic papers, as well as reports from public entities such as the Intergovernmental Panel on Climate Change (IPCC), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the World Wide Fund for Nature (WWF). These findings are interpreted with a focus on the climate and biodiversity crises affecting ocean and coastal areas.

Additionally, this section describes climate change- and biodiversity-related issues at the global level, supported by regional or site-specific findings that help to contextualize and reinforce the broader discussion on these twin crises. This section further introduces the policy regimes that address these issues, including relevant agendas, activities, initiatives, and legal and institutional mechanisms, which cover various efforts related to climate change, marine ecosystems, and protected areas.

2.1 SCIENTIFIC REVIEW ON CLIMATE CHANGE IMPACT ON MARINE ECOSYSTEMS

To understand global research trends on ocean-related climate change, academic papers were retrieved from the SCOPUS database using the keywords “ocean + climate change”. A total of 15,759 papers were identified between 1990 and 2023, showing a significant increase in publications during the late 2010s. This reflects a growing awareness among international organizations, coastal States, and scientists of the oceans’ critical role in addressing climate change, likely driven by increasing concerns over rapidly evolving environmental challenges.

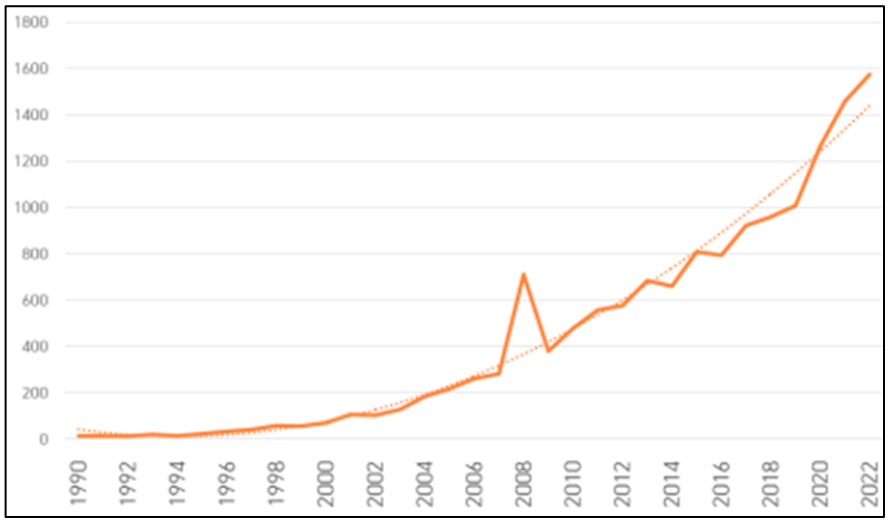

Figure 2. Annual research publications on ocean-related climate change, analyzed from SCOPUS database
Source: Nam (2023).

When comparing research using 10 sub-keywords related to marine climate change, among the 3,029 relevant papers extracted, “ocean acidification” accounted for approximately 50%, followed by studies on invasive species at 18% (with potential overlap), eutrophication at 16%, and marine

protected areas (MPAs) at 8%. Although the proportion of research on MPAs may appear lower compared to other marine topics, many of these issues are intrinsically linked to MPAs. For instance, invasive species and ocean acidification pose significant threats to marine ecosystems, particularly within those MPAs that safeguard coral reefs and indigenous marine species. Notably, research on MPAs has shown a higher proportion from 2018 to 2023 compared to the perioe from 1990 to 2017. This trend may reflect a growing emphasis on MPAs in response to contemporary environmental challenges.

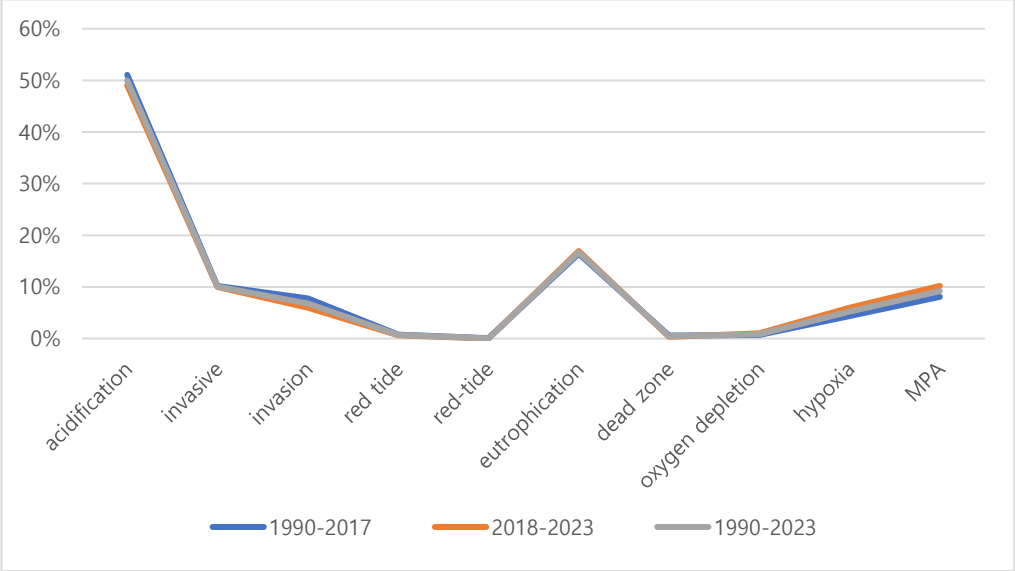

Figure 3. Thematic Proportion of Research Publications on Ocean-related Climate Change
Source: Nam (2023)
Note: Analyzed from SCOPUS database

2.1.1 Impact of Climate Change on Marine Ecosystems

Climate change, primarily driven by human-induced carbon dioxide emissions, affects marine ecosystems through three key processes: warming, acidification, and deoxygenation (low oxygen levels).[1] Brock et al. (2012) illustrated the mechanisms by which atmospheric changes influence biological responses through alterations in the oceanic system. In terms of biological responses, the International Council for the Exploration of the Sea (ICES) reported in 2011 that climate change drives multi-dimensional changes in marine ecosystems as follows:

- Changes in species distribution across all trophic levels;
- Decreases in primary productivity in low-latitude regions;
- Increases in primary productivity in high-latitude systems;
- Alteration in trophic-level interactions; and

[1] https://www.epa.gov/climateimpacts/climate-change-impacts-ocean-and-marine-resources#justice (accessed 14 November 2023)

- The Integration of lower trophic-level processes by top predators.

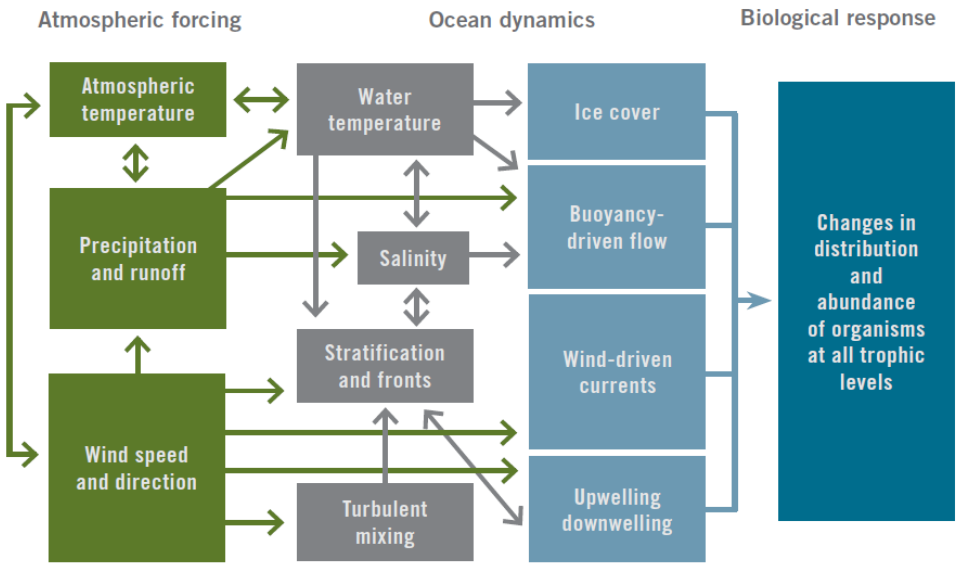

Figure 4. Interactions between the Atmosphere, the Oceans, and Living Organisms
Source: Brock et al. (2012)

Hoegh-Guldberg and Bruno (2010) provide a comprehensive overview of climate change impacts on marine ecosystem,[2] which can be categorized as follows:

- **Effects on ecosystem function**: Climate change alters the phenology and productivity of phytoplankton, affects animal metabolism, and disrupts eventual ecosystem functioning and biogeochemistry. These changes diminish the capacity of pelagic ecosystems to sequester carbon.
- **Reduced habitat complexity**: Habitat-forming species, such as corals, seagrass, mangroves, salt marshes, and oysters, face significant decline, leading to a loss of structural complexity in marine habitats.
- **Ecologically novel assemblages**: This includes the spread of invasive species and the rise of marine diseases, reshaping community compositions.
- **Local-global interactions, synergies and thresholds**: Ecosystems are becoming less resilient to both natural and anthropogenic stressors, as climate change exacerbates synergistic effects and pushes ecosystems closer to critical thresholds.

[2] https://www.ipcc.ch/report/ar6/wg2/chapter/chapter-3/

Pressure	Phytoplankton	Zooplankton	Benthos	Fish	Marine Mammals	Turtles	Marine birds	Mangroves and seagrasses	Corals
Change in wind patterns, storm tracks and hurricanes	Increase in vertical mixing leads to increase in spring primary production	Increased growth and development if primary production increases	Effects on pelagic egg and larval dispersal which affects recruitment	Effects on pelagic egg and larval dispersal which affects recruitment	Shift in pinniped ice breeding substrate; Increase in stranding rates; Prey availability	Disturbance of nesting and foraging; Effects on hatchling success	Change in prey availability; Change in distribution and migration timing; Destruction of breeding habitat; Reduced breeding success	Destruction of these habitats in severe storms and hurricanes	Destruction of reefs in severe storms and hurricanes
Changes in ocean circulation patterns	Northward shift of warm-water speces; Introduction of Pacific species from Arctic	Northward shift of warm-water speces; Introduction of Pacific species from Arctic; Increase in diversity in northern latitudes	Northward shift in warm-water species; Change in larval dispersal and population connectivity	Northward shift in warm-water species; Change in larval dispersal and population connectivity	Altered migratory and residency patterns; Altered prey availability will affect vital rates	Changes in vital rates dependent on prey availability; Changes in migratory routes	Changes in vital rates dependent on prey availability	Change in seed dispersal	Change in larval dispersal and in reef connectivity leading to shifts in distribution; Change in food availability
Ocean acidification	Reduced production of calcifying phytoplankton and possible extinction	Reduced production of calcifying organisms if unable to form skeleton and possible extinction	Lower growth and decrease in shell strength of benthic calcifiers	Little change in growth or mortality, but reduced ability to settle on coral reefs and avoid predators	Better sound propagation, changes in prey availability and abundance	Change in vital rates dependent on prey availability	Change in vital rates dependent on prey response	?	Decreases in calcification rates; Change in reproduction; Decrease in food availability
Increase in oxygen minimum zones/ Hypoxia	No effect	Species distributions may change; Jellyfish become more prevalent	Increase in mortality due to coastal hypoxia; Change in species composition and distribution	Decrease in habitat, reduced growth and thermal tolerance; Change in vital rates dependent on prey availability	Change in vital rates dependent on prey availability	Change in vital rates dependent on prey availability	Change in vital rates dependent on prey availability	Negligible for mangroves, but increased shading of seagrasses as a result of hypoxia	Negligilbe for tropical corals, but habitat reduction and mortality in cold water corals
Reductions in sea ice cover	Change in species assemblage, earlier pelagic blooms; Higher primary production	Change in species assemblage; Increased production	Change in species composition; Predatory release	Southward shift of Arctic species; Increase in available coastal habitat in North	Reduced polar bear and seal habitat including seal breeding habitat	No effect	Earlier arrival of birds at breeding grounds; Changes in distribution	No effect	No effect in tropical corals, food delivery changes for shallow cold water corals, algal overgrowth
Reduced AMOC (Northward shift of Gulf Stream)	Introduction of warm water species to northern ecosystems	Introduction of warm water species to northern ecosystems	Introduction of warm water species to northern ecosystems	Change in migration, introduction of warm water species to northern ecosystems	Change in vital rates dependent on prey availability	Affects distribution and migration as well as prey availability	Shift in distribution and change in vital rates dependent on prey availability	?	?

Figure 5. Effects of Climate-driven Oceanographic Changes on Components of the Ecosystem

Source: Brock et al. (2012)

Note: Colors indicate the likelihood of the response where blue indicates "extremely likely," green indicates "more than likely," red indicates likely, and unknown effects are indicated with "?".

The "Blue Paper" by Gaines et al. (2019), commissioned by the High-Level Panel for a Sustainable Ocean Economy (HLP), addresses the economic impacts of climate change on marine systems. This report highlights how changes in ocean climate, chemistry, circulation, sea levels, and ice distribution adversely affect marine habitats and biological productivity. These shifts significantly curtail the economic benefits derived from the ocean, including fisheries, maricultures, and marine tourism. Gaines et al. (2019) also estimated that climate-induced economic damages would amount to approximately USD 428 billion annually by 2050, escalating to USD 1.98 trillion annually by 2100 on a global scale.

In its Sixth Assessment Report, the IPCC (Cooley et al., 2022) emphasizes the need for a more integrated and synthesized understanding of the climate change impacts on marine ecosystems, calling for comprehensive strategies to address these challenges.

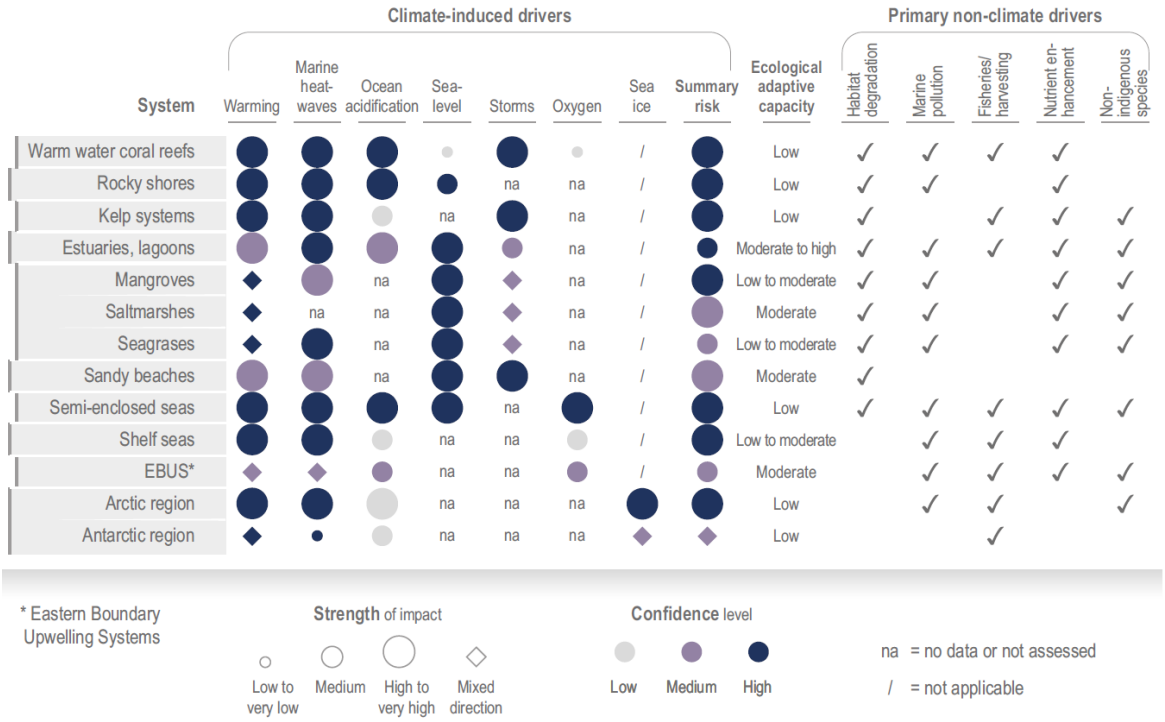

Figure 6. Observed Hazards to Coastal Ecosystems and Seas
Source: Cooley et al. (2022), IPCC AR6 WGII

The authors thoroughly detail the magnitude of climate impacts and the probability of damage occurrence, integrating these factors within a matrix of habitats and climate-induced drivers across various regions. Notably, sea-level rise and storms can significantly alter coastal and marine ecosystems, potentially as much as warming, heatwaves, and ocean acidification. Warming and heatwaves are principal contributors to the degradation of coral reefs, kelp forests, and rocky shores. Conversely, sea-level rise predominantly affects estuaries, salt marshes, seagrass beds, and sandy beaches, which are intricately linked to carbon sequestration through biological processes in oceanic and coastal systems.

The invasion of alien species is recognized as one of the most significant impacts of climate change, posing a severe threat to the survival of indigenous species and the integrity of their ecosystems. This

challenge is particularly acute in marine and coastal ecosystems, including MPAs. Pecl et al. (2017), through an extensive review of relevant research, provide robust evidence of climate change-induced species redistribution across both terrestrial and marine systems. Remarkably, the velocity of species redistribution in marine systems is four times faster than in terrestrial ones. This rapid shift disrupts the function and structure of ecosystems, placing MPAs and their valuable living resources at consideratable risk. Consequently, the sustainable delivery of ecosystem services from marine and coastal areas is jeopardized.

Recent studies further underscore the significance of climate-driven species range shifts and biological invasions, which are increasingly drawing global attention. The growing body of literature on these phenomena (Pecl et al., 2023; Wesselman et al., 2024) highlights their direct ecological impacts and broader implications for biodiversity conservation, management strategies and the well-being of human communities (Pecl et al., 2023).

2.1.2 Impact of Climate Change on Marine Protected Areas

Marine Protected Areas (MPAs) are vital conservation tools designed to protect biodiversity, enhance the health and resilience of marine ecosystems, and provide societal benefits. However, climate change, compounded by various anthropogenic stressors, is significantly altering marine environments. Key effects, including ocean warming, acidification, oxygen depletion and sea level rise, are expected to have an increasing impact on MPAs, particularly those hosting habitats and species that are particularly vulnerable and valuable in the context of climate change. MPAs are not immune to the broader climate-related changes affecting marine and coastal regions. These include shifts in water temperatures and ocean currents, rising sea levels, intensifying ocean acidification, and changes in precipitation and storm patterns, along with their cascading effects.

Interestingly, MPAs may experience even more pronounced impacts of climate change compared to their neighboring unprotected areas. Bruno et al. (2018) provide a comprehensive analysis of the challenges MPAs face under climate change scenarios. Their study reveals that, despite localized protections, the continuation of business-as-usual greenhouse gas emissions will lead to significant habitat and species losses within MPAs, especially in low-latitude and tropical regions. By 2100, average sea surface temperatures within MPAs are projected to rise by 2.8°C, intensifying issues such as habitat degradation and species loss. The study further emphasizes that warming and reduced oxygen levels will surpass natural variability in 42% of no-take reserves by mid-century. This poses a severe threat to marine ecosystems and undermines the effectiveness of MPAs as tools for biodiversity conservation. These findings underscore the urgent need for climate-adaptive management strategies to safeguard the ecological integrity and resilience of MPAs in the face of ongoing climate change.

	Tropical	Subropical	Temperate	Polar
MPAs only	0.032 (2458)	0.034 (2738)	0.036 (2738)	0.038 (166)
Zone	0.032 (13227)	0.031 (9233)	0.032 (13940)	0.065 (6868)

Figure 7. Projected Rates of Increase (mean values of change in °C / year and number of grid cells) of Ocean Temperatures in MPAs and for Entire Latitudinal Zones (all 1x1 degree cells) under RCP 8.5

Source: Bruno et al. (2018)

Note: Overall mean rates of the global ocean are 0.0333 (°C / year, N=43,268 cells). Zone-specific values were based on cell area-weighted means.

In conclusion, climate change is increasingly undermining the effectiveness of MPAs. Traditionally established under the assumption that the biodiversity they protect would remain static, MPAs now face challenges in adapting to dynamic changes such as ocean warming, acidification, and sea-level rise. These shifts impact species distribution and health, disrupt ecosystems, and threaten coastal communities. Consequently, there is a growing need to adapt MPAs to not only protect existing biodiversity but also anticipate and safeguard against future changes (Bruno et al., 2018; Hoegh-Guldberg and Bruno, 2010; Doney et al., 2012; Poloczanska et al., 2013; Knutson et al., 2021; Bindoff et al., 2019; Diamond et al., 2017).

2.2 Global Perspectives on the Policy Regime of Marine Protected Areas and Climate Change

2.2.1 Marine Protected Areas under the Climate Change Era

Marine species and habitats face threats from numerous stressors, including exploitation, coastal development, pollution, invasive species, shipping, underwater noise, and disease. To address these challenges and mitigate their impacts, the establishment of Marine Protected Areas (MPAs) has become a fundamental strategy for marine biodiversity conservation (O'Regan et al., 2021). While MPAs can provide resilience against localized stressors, their effectiveness in mitigating the broader impacts of climate change remains limited and varies considerably across regions and ecosystems. For example, MPAs may offer some protection to marine communities by buffering the immediate impacts of heatwaves and promoting faster recovery compared to non-protected areas. However, they often cannot fully counteract long-term changes, such as shifts in species composition and biodiversity losses driven by persistent climate change (Bruno et al., 2018; D'agata and Maina, 2022; Ziegler et al., 2023).

Despite these challenges, well-managed MPAs are expected to play a crucial role in safeguarding marine biodiversity and supporting coastal communities (Grorud-Colvert et al., 2021). In response to climate change, numerous international organizations and initiatives are intensifying efforts to

improve MPA-related policies and expand their coverage across the oceans.

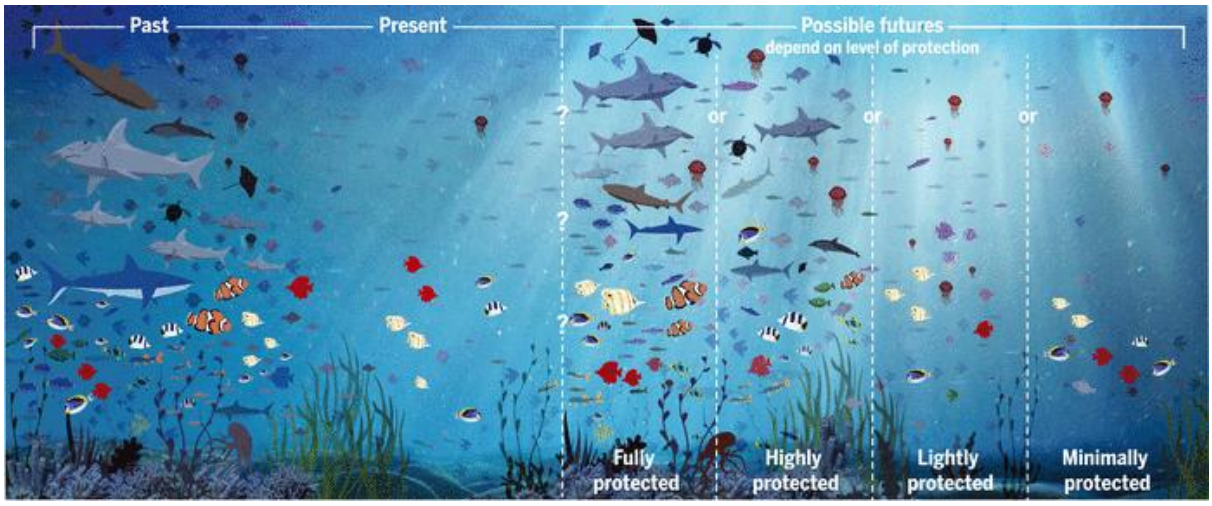

Figure 8. Possible Futures according to Protection Levels
Source: Grorud-Colvert et al. (2021)

2.2.2 Global Biodiversity Framework and the 30x30 Target

The Global Biodiversity Framework (GBF) is a strategic plan developed under the Convention on Biological Diversity (CBD), an international treaty with 196 parties. Adopted at the fifteenth meeting of the Conference of the Parties (COP 15) in 2022, the GBF outlines an ambitious plan to halt biodiversity loss and ensure ecosystems remain resilient and capable of continuing to provide essential services to humanity. Building upon the strategic goals of previous frameworks, such as the Aichi Biodiversity Targets, the GBF aims to transform society's relationship with nature, with a vision of living in harmony with biodiversity by 2050.

One of the most prominent aspects of the GBF is the "30x30" target, which aims to protect at least 30% of the planet's land and oceans by 2030. This target represents a crucial element in global efforts to combat biodiversity loss, mitigate climate change, and protect critical ecological processes. The rationale behind the 30x30 target is to safeguard vital ecological areas, ensuring the conservation of biodiversity, the maintenance of ecosystem services, and the preservation of genetic diversity essential for resilience and adaptation to climate change.

The 30x30 target has garnered widespread support from environmental organizations, scientists, and governments, who view it as a necessary step toward large-scale environmental conservation. However, its implementation faces multiple challenges, including balancing land and marine uses, respecting indigenous rights, and fostering international cooperation. The success of the 30x30 initiative will hinge on effective management, sufficient funding, and the integration of biodiversity targets into broader national and international policy frameworks.

While there has been a substantial progress in expanding MPAs, achieving the 30x30 goal – specifically protecting 30% of the ocean by 2030 – will require intensified global efforts. This will necessitate stronger international collaboration, more robust regulatory frameworks, and increased financial and human resources to support MPA establishment and management. In 2000, MPAs covered

approximately 2 million km², or just 0.7% of the global ocean. Since then, this coverage has expanded over tenfold, reaching 29,028,224 km², equivalent to 8.01% of the global ocean. This substantial expansion underscores the increasing recognition of MPAs as essential tools for conserving marine biodiversity and sustainably managing ocean resources[3].

Currently, 39% of the global ocean falls within national jurisdictions, with 18.30% of these areas designated as protected. In stark contrast, Areas Beyond National Jurisdiction (ABNJ), which comprise the remaining 61% of the global ocean, have only 1.44% under protection. International discussions are now focused on developing streamlined mechanisms to establish MPAs in ABNJ. These efforts are critical to addressing the disparity between protection in national waters and the high seas, which are integral for conserving global biodiversity and ensuring the sustainable use of oceanic resources.

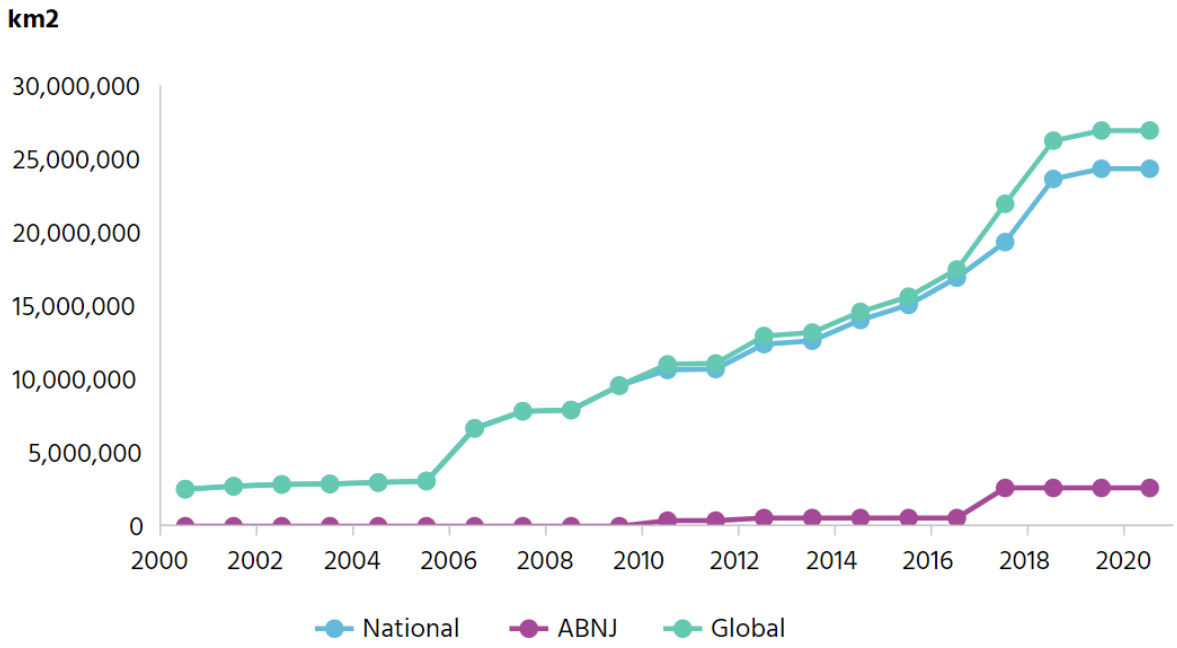

Figure 9. Growth in Marine Protected Area Coverage
Source: https://www.protectedplanet.net/en/thematic-areas/marine-protected-areas

2.2.3 Other Effective Area-based Conservation Measures (OECM)

The concept of Other Effective Area-Based Conservation Measures (OECMs) was formally endorsed through Decision 14/8 of the Convention on Biological Diversity (CBD) at the fourteenth meeting of the Conference of the Parties (COP 14), held in Sharm El-Sheikh, Egypt, in November 2018, building upon the Aichi Biodiversity Targets adopted in 2010. OECMs recognize and promote a diverse range of area-based conservation efforts that, while not meeting the strict criteria of protected areas, contribute significantly to the long-term conservation of biodiversity. OECMs may include areas managed for sustainable use that provide critical habitat protection and biodiversity benefits. Key

[3] https://www.protectedplanet.net/en/thematic-areas/marine-protected-areas

characteristics of OECMs are as follows:

- **Conservation focus**: Although not primarily designated as protected areas, OECMs effectively support biodiversity conservation, whether through singular or multiple objectives.
- **Management practices**: OECMs employ various management strategies, including sustainable natural resource use, culturally specific practices by indigenous peoples and local communities, or private conservation initiatives.
- **Long-term commitment**: OECMs are designed to deliver lasting conservation benefits, with management practices focused on maintaining biodiversity over time.
- **Recognition and support**: OECMs help address conservation gaps, particularly in landscapes and seascapes not designated as protected areas, enhancing ecological connectivity and resilience.

Prominent international organizations, such as the International Union for Conservation of Nature (IUCN), the United Nations Environment Programme (UNEP), and the World Conservation Monitoring Centre (WCMC), play a pivotal role in advancing the OECM framework. These institutions provide technical guidance, develop governance policies, and support the identification and management of OECMs through their commissions and programmes. Numerous coastal States are actively integrating OECMs into their national and local conservation strategies. Examples include:

- **Canada**: Designating several regions as OECMs to support its national goal of conserving 25% of its terrestrial and aquatic territories by 2025.
- **Colombia**: Incorporating OECMs into its National System of Protected Areas to strengthen its conservation framework.
- **The Philippines**: Including OECMs in its National Integrated Protected Areas System, recognizing the critical role of community-managed areas in biodiversity conservation.

Other countries such as Australia, France, Fiji, and Indonesia also implement OECMs as complements to their protected area networks, adopting a holistic approach to biodiversity preservation. These countries recognize that OECMs not only facilitate the achievement of international conservation targets but also address ecological gaps left by conventional protected areas, thereby playing an essential role in the global endeavor to sustain and enhance natural habitats and the ecosystem services they provide.

It is crucial to understand that OECMs differ from MPAs primarily in their regulatory mechanisms, which are generally non-binding or less stringent (Claudet et al., 2022). This flexibility allows OECMs to accommodate diverse management approaches tailored to specific ecological, economic, and social contexts. By doing so, OECMs secure conservation outcomes while advancing sustainable development goals. Unlike MPAs, OECMs are adaptable to a variety of ecological, economic, and social contexts, making them essential for comprehensive marine and coastal management. Through this strategic framework, OECMs not only contribute to biodiversity preservation but also bolster sustainable practices and community resilience, thereby enhancing the overall vitality of marine ecosystems (Maxwell et al., 2020).

2.2.4 High Seas Treaty (BBNJ)

The Biodiversity Beyond National Jurisdiction (BBNJ) treaty, commonly referred to as the High Seas Treaty, represents landmark international efforts to govern and conserve marine biodiversity in areas beyond national jurisdiction. The Treaty was adopted at the fifth session of the Intergovernmental Conference (IGC 5.3) in June 2023, following a long-standing negotiation process among international entities and countries. The BBNJ treaty is viewed as an extension of the United Nations Convention on the Law of the Sea (UNCLOS), addressing the gaps that UNCLOS does not fully over, specifically concerning biodiversity protection in the high seas. While UNCLOS provides the basic legal framework for all ocean spaces, the BBNJ Treaty focuses more on the conservation and sustainable use of biodiversity in the high seas. Key functions of the BBNJ Treaty are as follows:

- Promote equity and fairness;
- Address environmental degradation;
- Combat climate change; and
- Prevent biodiversity loss in the high seas.

Aligned with the ambitious "30x30" target, the BBNJ Treaty is a crucial tool for tackling climate change impacts on marine and coastal ecosystems. It marks a significant step forward in global environmental governance by aiming to preserve marine biodiversity and enhance the resilience of ocean ecosystems.

The European Union (EU) and Small Island Developing States (SIDS) have emerged as leading advocates of the treaty, pushing for robust conservation measures and sustainable use of marine resources. Meanwhile, organizations such as IUCN, UNEP, the High Seas Alliance, and IOC-UNESCO provide strong support for high seas conservation initiatives. Meanwhile, countries such as Brazil, China, and other developing nations emphasize the right to access and exploit both living and non-living marine resources. In this context, Regional Fisheries Management Organizations (RFMOs) and the International Seabed Authority (ISA) play pivotal roles in promoting sustainable fishing and regulating deep-sea mining activities.

Currently, 34 MPAs have been designated in the high seas. However, only two—the Ross Sea Region and the South Orkney Islands Southern Shelf Marine Protected Area— are considered to have fully or highly effective protection measures. These two MPAs account for 23.7% of the total area covered by high seas MPAs, with the Ross Sea Region covering 1,931,766 km² and the South Orkney Islands Southern Shelf Marine Protected Area covering 94,717 km². Together, they provide full or high protection over 2,026,483 km² out of the total 8,537,888.4 km² designated as high seas MPAs.

A persistent challenge in high seas conservation is the prevalence of "paper parks" – MPAs that exist in legal designation only, without enforcement or effective management. Such ineffective MPAs undermine the goals of biodiversity conservation and fail to deliver their intended ecological benefits. Effective management and enforcement are essential to ensure that MPAs serve as functional tools for biodiversity protection and climate resilience. Without proper implementation, MPAs cannot fulfill their potential to address climate change and safeguard marine ecosystems (Giakoumi et al., 2018; O'Regan et al., 2021; Lopazanski et al., 2023).

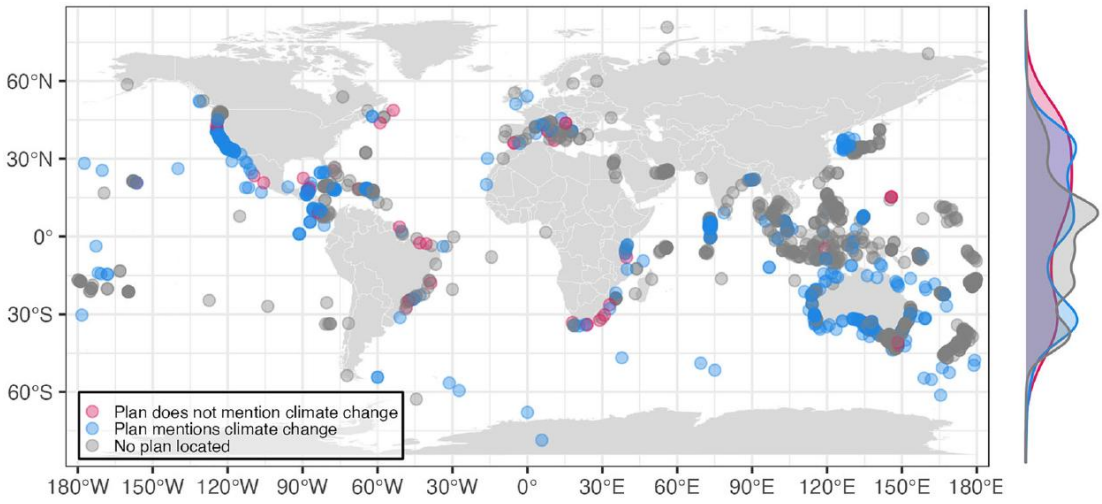

Figure 10. Overview of Climate Change Inclusion in MPA Management Plans
Source: Lopazanski et al. (2023)

2.2.5 Blue Carbon and Nature-based Solution

Blue carbon ecosystems (BCEs), such as mangroves, seagrass meadows, and tidal marshes, are increasingly recognized for their significant role in carbon sequestration and climate change mitigation. These ecosystems collectively store over 30,000 teragrams (Tg) of Carbon across approximately 185 million hectares globally. Conservation of BCEs could prevent emissions equivalent to 304 Tg CO_2e annually. Furthermore, restoration of these ecosystems could sequester an additional 841 Tg CO_2e per year by 2030, which accounts for about 3% of global emissions based on 2019 and 2020 data (Macreadie et al., 2022).

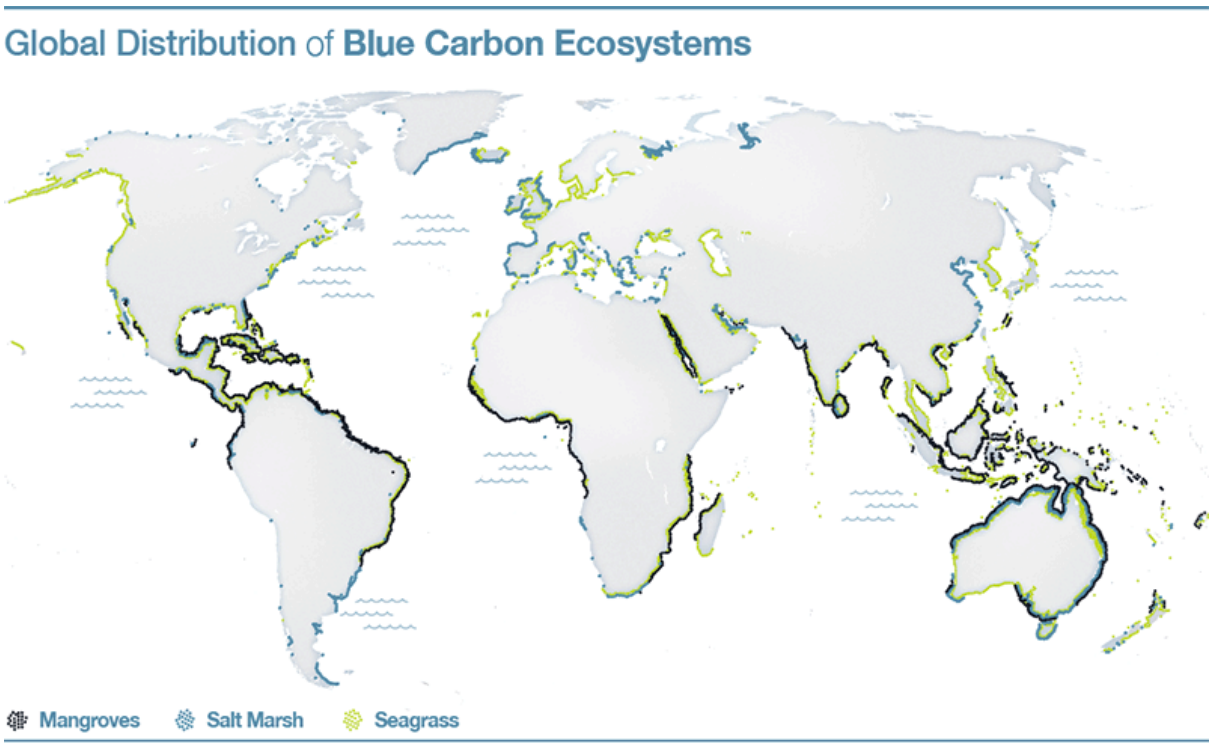

Figure 11. Global Distribution of Blue Carbon Ecosystems
Source: thebluecarboninitiative.org

These ecosystems are increasingly valued for their role in mitigating climate change, leading to growing interest in their conservation and restoration, particularly through MPAs (Howard et al., 2017). The concept of blue carbon also extends to coral reefs and oceanic carbon sinks, highlighting the importance of these habitats not only for their ecological functions but also for their potential contributions to climate change mitigation and adaptation strategies (Thomas, 2014).

Consequently, the protection of blue carbon ecosystems has become a growing priority in marine management, drawing significant attention from scientists, policymakers, coastal communities, and the private sector. This interest spans a spectrum of stakeholders, from those whose activities contribute to ecosystem degradation to those striving to reduce their carbon footprints. Blue carbon, as a key nature-based solution (NbS)[4] in coastal and marine areas, is also recognized for its vital role in mitigating climate change impacts. It also supports the implementation of Nationally Determined Contributions (NDCs) under the Paris Agreement. Accordingly, the blue carbon project has received substantial backing from the United Nations Framework Convention on Climate Change (UNFCCC), reinforcing its global importance in climate action.

[4] Although various definitions of Nature-based Solutions (NbS) are available, the one most commonly used comes from the IUCN. It describes NbS as "actions to protect, sustainably manage, and restore natural and modified ecosystems, effectively and adaptively addressing societal challenges while simultaneously providing benefits for human well-being and biodiversity" (Cohen-Shacham et al., 2016)

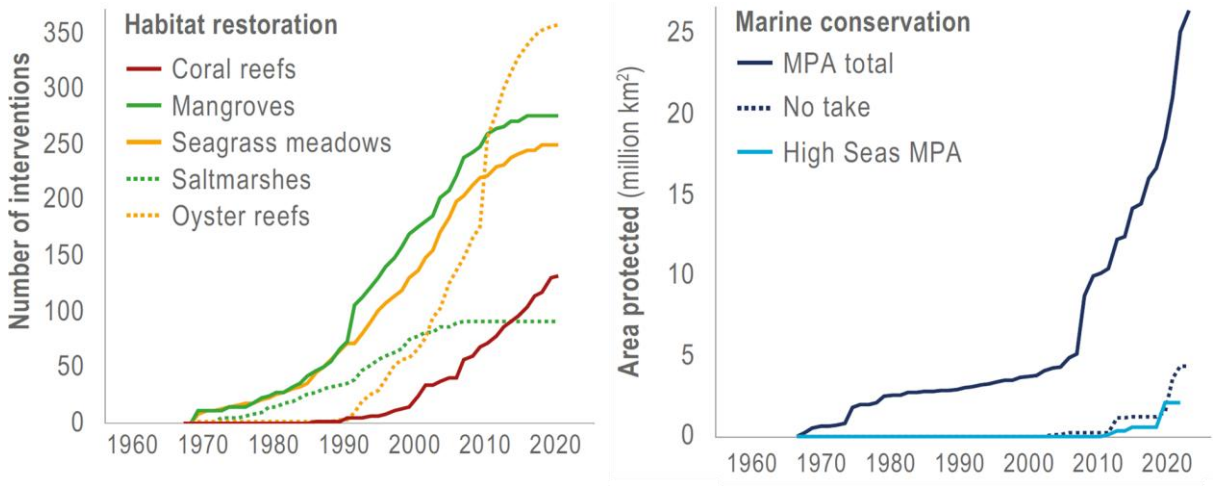

Figure 12. Implemented Nature-Based Solutions.

Source: Cooley et al. (2022)

Note: The data shows cumulative habitat restoration projects and area-based conservation (protected area) since the 1970s.

MPAs encompass blue carbon ecosystems such as mangroves, seagrass meadows, and salt marshes. By protecting these vital habitats, MPAs help maintain their ecological integrity and longevity, thereby preventing carbon emissions that could result from habitat degradation or destruction. This protective measure not only supports biodiversity conservation but also plays a crucial role in climate change mitigation.

Notably, organizations such as UNEP, IOC-UNESCO, and IUCN actively support initiatives aimed at protecting and restoring blue carbon ecosystems. These efforts mitigate climate change by enhancing carbon storage while generating crucial co-benefits such as biodiversity conservation and coastal protection (Macreadie et al., 2021; Reiter et al., 2021). Many of these projects integrate scientific, legal, and economic dimensions to foster the sustainable and equitable management of ocean resources. Moreover, frameworks developed through such collaborations facilitate the inclusion of blue carbon in international agreements such as the Paris Agreement, promoting a climate-just approach to ocean conservation. Organizations such as IUCN, Conservation International (CI), and the Blue Carbon Initiative play a critical role in this field by developing methodologies for assessing carbon storage, facilitating blue carbon projects, and conducting scientific research on the carbon sequestration capacities of marine systems.

While the Paris Agreement does not explicitly mention Nature-Based Solutions, it is strongly aligned with the concept. The preamble of the Agreement acknowledges the importance of ecosystem integrity, including oceans, and the protection of biodiversity, linking these efforts to climate justice. Additionally, Article 5.2 of the Agreement outlines policy approaches and incentives aimed at reducing emissions from deforestation and forest degradation.

The Paris Agreement further highlights the role of ecosystems in climate mitigation. Article 5.1 calls for the conservation and enhancement of greenhouse gas sinks and reservoirs, referencing those

identified under the UNFCCC, including biomass, forests and oceans, as well as other terrestrial, coastal, and marine ecosystems (Art. 4.1(d). UNFCCC).

2.2.6 Marine Protected Areas Network

From a collective action perspective, MPAs and their networks are increasingly recognized as crucial tools for conserving marine biodiversity and ensuring sustainable resource management. International organizations play a crucial role in facilitating the establishment and governance of MPAs, particularly in addressing transboundary marine conservation challenges. These organizations are instrumental in adopting measures to address marine environmental problems, demonstrating the importance of collective action in marine conservation. Such efforts have resulted in policies that promote the development of regional and sub-national MPA networks (Foster et al., 2017).

In relation to climate change, the designation of MPA networks requires the integration of ecological resilience, connectivity, and adaptive management strategies. The effectiveness of MPAs in enhancing resilience to climate change remains a topic of ongoing research. For instance, studies of the world's largest scientifically designed MPA network on the coast of California have revealed mixed outcomes, with limited capacity to mitigate the impacts of marine heatwaves on community structure in marine ecosystems (Smith et al., 2023). In addition, the connectivity of ocean ecosystems, influenced by climate variability, presents challenges to the effectiveness of MPA networks (Fox et al., 2016). Nonetheless, MPAs remain crucial for biodiversity protection and enhancing the resilience of marine species to climate change through improved connectivity (Cristiani et al., 2023).

MedPAN (The Mediterranean Network of Marine Protected Areas Managers)

MedPAN was established under the framework of UNEP-MAP to strengthen collaborative efforts in addressing shared challenges and to promote the effective conservation of marine ecosystems across the Mediterranean.[5] Since 2008, the initiative has been managed by a dedicated organization based in Marseille, France. MedPAN works in partnership with more than 110 MPAs, engaging primarily with public institutions from the 21 Contracting Parties to the Barcelona Convention. Through a comprehensive partnership strategy, MedPAN provides technical support to local MPA managers and coordinates regional actions. Its efforts include delivering practical conservation solutions, facilitating knowledge exchange, advancing capacity-building initiatives, and promoting the dissemination of harmonized information within a robust regional community of practice. The MedPAN network also includes various subregional and national MPA networks, including AdrionPAN (covering the Adriatic-Ionian Sea), CroMPA (MPAs in Croatia), RAMPE (Spain), and the French MPA Forum (a national initiative in France). These networks work collaboratively under the MedPAN umbrella to ensure the sustainable management and conservation of marine ecosystems across the Mediterranean Sea.

CaMPAM (Caribbean Marine Protected Areas Management Network)

CaMPAM was created in 1997 under the framework of the Caribbean Environment Programme of the UN Environment Programme (UNEP-CEP) and the Specially Protected Area and Wildlife (SPAW) Protocol of the Cartagena Convention. Since its inception, it has received support from governments,

[5] https://medpan.org/en

private foundations, and individual experts. This initiative fosters an inclusive network, bringing together MPA researchers, administrators, managers, and educators from governmental and non-governmental organizations, as well as private sector stakeholders. Through various mechanisms, CaMPAM facilitates the exchange of ideas, best practices, and lessons learned in MPA management and marine conservation. The network is guided by an Executive Leadership and Resources Team, which defines strategic objectives and provides leadership and resources. The team includes partners, MPA practitioners, and marine conservation scientists, all working collaboratively to strengthen marine biodiversity conservation across the Caribbean.[6]

OSPAR MPA Network (Oslo and Paris Conventions)

The OSPAR Contracting Parties began nominating sites to the OSPAR Network of Marine Protected Areas (MPAs) in 2005, following the adoption of the OSPAR Recommendation 2003/3 on the establishment of a coherent network of MPAs. All 12 Contracting Parties located along the North-East Atlantic have contributed sites within their national waters to the network. Additionally, these Parties have collectively designated MPAs in Areas Beyond National Jurisdiction (ABNJ) within the OSPAR maritime area. The North-East Atlantic Environment Strategy (NEAES) 2030 sets ambitious goals for expanding and enhancing the OSPAR MPA network. It aims to ensure that, by 2030, at least 30% of the OSPAR maritime area is covered by MPAs or other effective areas-based conservation measures (OECMs). These areas are intended to be representative, ecologically coherent, and effectively managed to meet conservation objectives.[7] As of 1 October 2021, the OSPAR MPA Network comprised 583 MPAs, including 8 collaboratively designated MPAs in ABNJ. These protected areas cover a combined surface area of 1,468,053 km^2, representing 10.8% of the OSPAR maritime area.[8]

CTMPAS (Coral Triangle Marine Protected Area System)

The establishment and commitment of the CTMPAS is a key mission of the Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF). This initiative was formalized through the signing of the Leaders' Declaration in 2009. This multilateral partnership involves six countries (Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands, and Timor-Leste) working collaboratively to sustain the region's exceptional marine and coastal resources. Together, the participating countries address critical issues such as food security, climate change, and marine biodiversity. The primary goal of the CTI is to develop a comprehensive and effectively managed CTMPAS. Significant progress has been made through the efforts of the MPA Working Group, which focuses on improving management effectiveness and advancing the design and establishment of MPA networks across the Coral Triangle region.

National and Sub-National MPA Network

Australia and Canada serve as exemplary models in establishing MPA networks within their jurisdiction. Australia is a global leader in MPA management, hosting the world's largest network of MPAs. In 2012,

[6] https://campam.gcfi.org/

[7] https://oap.ospar.org/en/ospar-assessments/committee-assessments/biodiversity-committee/status-ospar-network-marine-protected-areas/assessment-reports-mpa/mpa-2021/

[8] https://www.ospar.org/work-areas/bdc/marine-protected-areas

Australia launched the National Representative System of Marine Protected Areas, designed to serve as sanctuaries to protect marine life across its vast waters.

Canada is developing a national network of MPAs composed of 13 interconnected networks, each guided by a unified vision, goals, principles, design and eligibility criteria, and management approaches. These networks are established within spatially defined bioregions as outlined in the Canadian Science Advisory Secretariat's Science Advisory Report (CSAS SAR) 2009/056. These bioregions span Canada's Exclusive Economic Zone (EEZ) and the Great Lakes and are classified based on their ecological attributes.[9]

Other countries such as the United Kingdom, Sweden, and the United States, have also established their own MPA networks. However, in these cases, the networks often resemble inventories of individual MPAs rather than fully integrated working networks.

In the United States, California stands out, with 124 MPAs forming the world's largest scientifically designed and functionally coherent MPA network. Established between 2004 and 2012, this network represents a significant global achievement, providing an ideal framework for studying both human interactions with MPAs and the climate impacts on protected areas. Despite these advancements, empirical evidence regarding the effectiveness of MPAs in enhancing ecological resilience to climate change remains mixed. For example, research has shown limited success in mitigating the impacts of marine heatwaves on community structure in California's MPA network (Smith et al., 2023).

[9] https://www.dfo-mpo.gc.ca/oceans/networks-reseaux/index-eng.html

Chapter 3. Regional Overview on Scientific Findings and Policy Regime on Marine Protected Areas and Ocean-Based Climate Action

This chapter presents a review of recent scientific research on marine ecosystems affected by climate change in the East Asian region, with a specific focus on the geographic boundaries of the NEAMPAN member countries. It also outlines policies and initiatives addressing climate change and biodiversity within the NEAMPAN geographic scope.

3.1 Scientific Review on Marine Protected Areas and Ocean-Based Climate Action in the Area of North-East Asian Marine Protected Areas Network

3.1.1 Overview of Climate Change Impacts on the Marine Environment

Climate change has significantly altered the marine environment in North-East Asia, with noticeable shifts in seawater temperature, precipitation patterns, and ecosystem responses driven by global warming and anthropogenic activities. The East Asian marginal seas (EAMS), including the Yellow Sea, East China Sea, and East Sea/Sea of Japan, have experienced some of the fastest seawater temperature increases globally, at rates 2–4 times higher than the global average from 1982 to 2006 (Jung et al., 2017). These changes are associated with climate regime shifts in the mid-1970s, late 1980s, and late 1990s, resulting in significant regional variations in ocean conditions and marine ecosystems (Hyun et al., 2020).

Recent studies from China, Japan, and the Republic of Korea highlight key climate-related phenomena, including shifts in sea surface temperatures (SSTs), marine heatwaves (MHWs), and extreme weather events, all driven by anthropogenic global warming. For example, Hayashi (2023) reports an increased frequency of extreme ocean warming (EOW) events around Japan, attributing all EOW occurrences in 2022 to climate change. The study emphasizes the importance of limiting global warming to 1.5°C rather than 2°C to reduce the likelihood of record-high SSTs. You et al. (2022) document broader impacts of global warming, such as intensified summer monsoons, shifts in the subtropical high, and increased climate extremes at higher global warming levels. Oh et al. (2023) explore the spatiotemporal characteristics of East Asian MHWs, linking them to monsoon activity and remote subtropical influences. Their findings suggest that MHWs can potentially be predicted through early identification of such precursors.

Other studies underscore the dynamic interactions between ocean currents and climate events. For instance, Lee et al. (2023) describe the variability of the East Korea Warm Current (EKWC) and its interactions with extreme events such as typhoons and marine heatwaves, highlighting the unprecedented intensification of the EKWC in August 2021. Hyun et al. (2020) report rapid warming in the EAMS, causing shifts in phytoplankton populations and reduced primary productivity. Manda et al. (2022) examine how the warming East China Sea enhances torrential rainfall in Japan by intensifying convective systems, thereby linking SST changes to extreme weather. Their study also highlights how climate change has increased the probability of EOW events, which have been observed around Japan since the 2000s.

It is noteworthy that the biological impacts of warming seas are evident in the northward migration or

expansion of habitat ranges for marine organisms in the East Sea/Sea of Japan (Son et al., 2020; Nam et al., 2023). The IPCC AR6 Report states that the Asian region is experiencing significant biological transitions due to climate change, with critical concerns for kelp forests and coral reefs in the NEAMPAN area. These ecosystems may have already surpassed key ecological tipping points (Cooley et al., 2022).

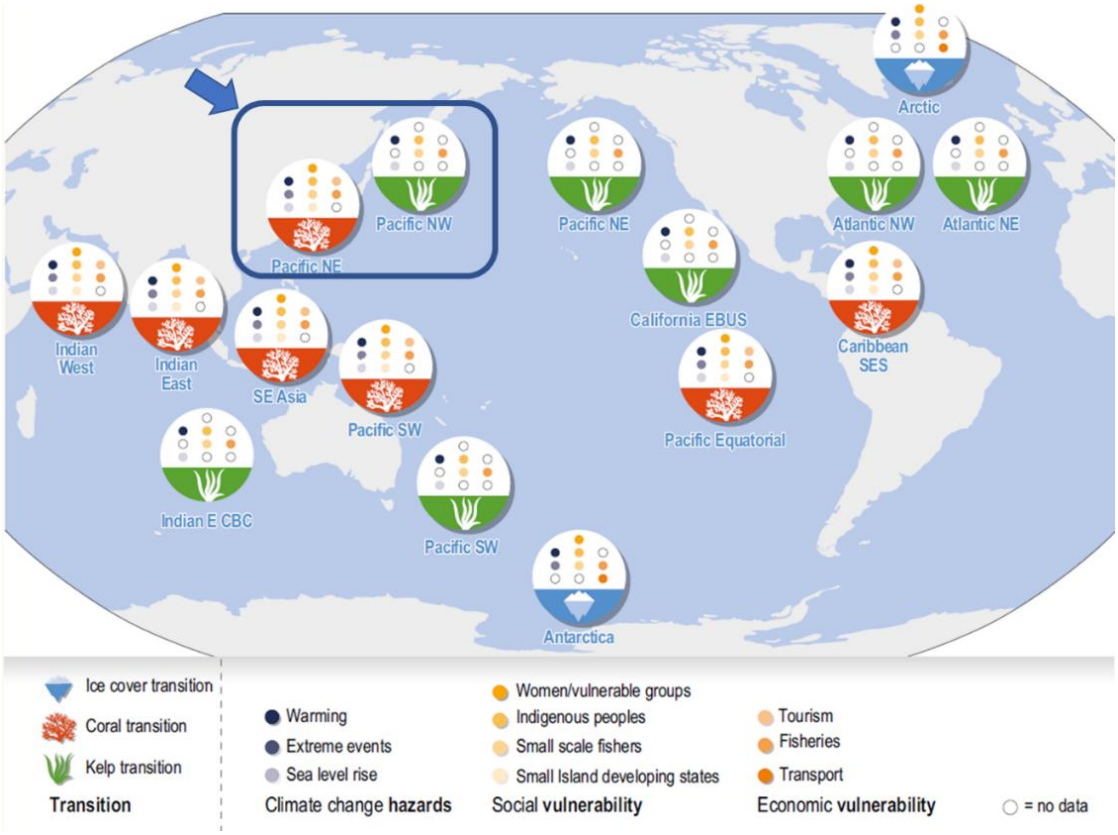

Figure 13. Global Map Depicting Ocean Systems Worldwide Where Ecological Tipping Points Have Been Surpassed

Source: Cooley et al. (2022)

Note: SES: semi-enclosed sea; EBUS: eastern boundary upwelling system; CBC: coastal boundary current.

3.1.2 Impact on Coral Reef Ecosystem

Climate change has significantly affected coral reef ecosystems in North-East Asia, primarily through rising sea surface temperatures, ocean acidification, and the increasing frequency of marine heatwaves. These stressors collectively contribute to coral bleaching, a process in which corals expel their symbiotic algae, resulting in diminished coral health and, in severe cases, coral mortality. In the Ryukyu Archipelago in the East China Sea, climate change, coupled with local stressors such as agricultural runoff, has caused widespread coral bleaching and alterations in native coral genera (Liu, 2023). These changes threaten the sustainability of coral reef fisheries, which are vital for food and nutrition security in the region (Takeuchi, 2023).

Globally, rising temperatures driven by greenhouse gas emissions have been identified as a major cause of mass coral bleaching (Mellin et al., 2022). This situation is further exacerbated by the

destruction of reef structures, the progression of ocean acidification, and the prevalence of coral diseases due to climate change (Glass et al., 2022)

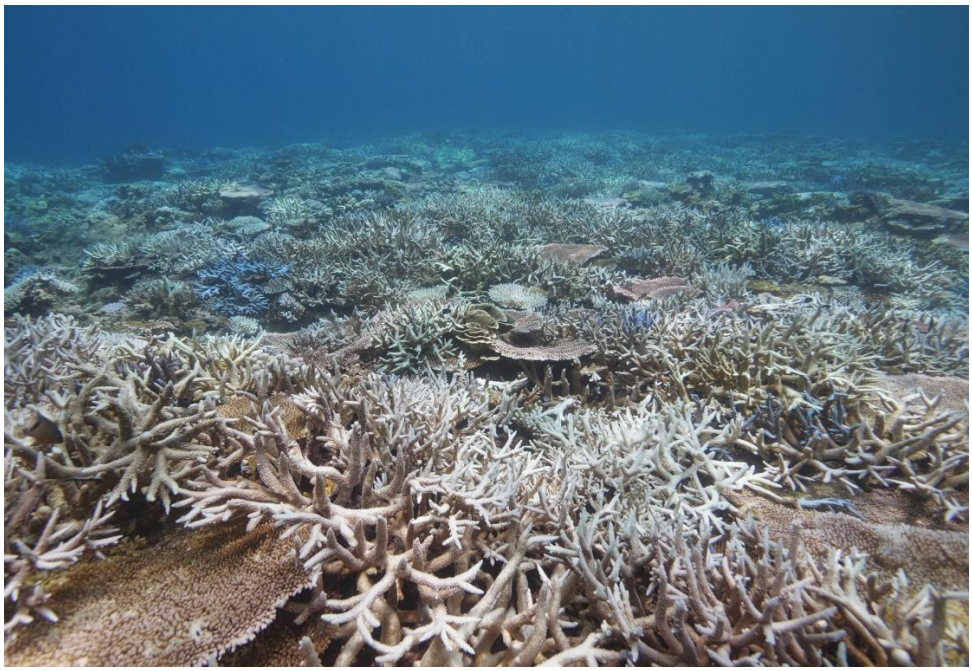

Figure 14. Coral Reef Near the Xisha Islands Following a Bleaching Event in Summer 2020

*Source: Image by Lian Jiansheng (*https://dialogue.earth/en/ocean/16428-parlous-state-chinas-coral-reefs*)*

Interestingly, studies in the Central Indo-Pacific, which include parts of North-East Asia, suggest that overall coral cover has not declined as dramatically as previously projected, indicating some degree of resilience within these ecosystems. However, negative correlations between coral cover, coastal urbanization and sea surface temperature highlight the persistent threats posed by climate change (Suyani et al., 2022). Research on coral-associated microorganisms highlights the vulnerability of symbiotic relationships within coral reefs under current and projected climate scenarios, suggesting the need for microbe-focused conservation approaches (Chan et al., 2023). Projections under high greenhouse gas emission scenarios predict significant declines in coral cover on most reefs globally by 2100, though some regions may experience less severe impacts (Mellin et al., 2024).

Despite these projections, effective management strategies addressing local disturbances have demonstrated potential in mitigating climate change impacts on coral reefs, as demonstrated in Sekisei Lagoon, southern Japan (Sully et al., 2021). Nonetheless, the adaptation potential of coral communities to climate change remains limited. Modelling studies suggest shifts in species composition towards more temperature-tolerant and fast-growing species, depending on local environmental conditions (Sato et al., 2019).

3.1.3 Impact on Seagrass Beds

Numerous studies emphasize the extensive impacts of climate change on seagrass beds across North-East Asia, underscoring the complexity of these effects. Rising sea surface temperatures pose a

significant threat to the growth and survival of temperate seagrasses, such as those along the coasts of the Republic of Korea. However, phenomena such as cold-water upwelling may mitigate high-temperature stress during growing seasons, potentially altering reproductive phenology and enhancing seagrass meadow survival in specific regions (Daru et al., 2023).

Despite these localized mitigating factors, the overall outlook for seagrass ecosystems under changing climate conditions presents a range of challenges. Seagrasses function as crucial blue carbon ecosystems, yet climate change-related factors such as warming, increased precipitation, and sea level rise can alter their community composition and carbon sequestration capacities (Chen and Lin, 2022). For instance, changes in species dominance within seagrass beds can affect their carbon storage potential, limiting their contribution to climate change mitigation (Liu et al., 2022).

Ocean acidification and warming also impact seagrass metabolism and productivity. Some species demonstrate resilience, with enhanced carbon sequestration under elevated CO_2 levels, though responses to temperature increases vary (Qin et al., 2020). These climate impacts are further compounded by anthropogenic pressures, such as habitat loss, shifts in species composition, and increased vulnerability to invasive species (Tang and Hadibarata, 2022). Moreover, climate change affects not only the growth and reproduction of seagrass but also the broader ecosystems they support. This highlights the need for comprehensive research on their direct and indirect responses to environmental changes (Sunny, 2017).

In summary, seagrass beds in North-East Asia face a combination of climate-related stressors, including rising temperatures, altered precipitation patterns, and sea level rise, alongside potential localized mitigating effects such as cold-water upwelling. These dynamics highlight the importance of continuous monitoring and adaptive managements to sustain seagrass ecosystems and their critical role in carbon sequestration.

3.1.4 Scientific Findings for Countries in North-East Asian Region

Climate change has profoundly impacted marine ecosystems across North-East Asia, including China, Japan and the Republic of Korea, with significant implications for MPAs. The East-Asian Marginal Seas (EAMS), comprising the Yellow Sea, the East China Sea, and the East Sea, have experienced some of the highest sea surface temperature increases globally. These changes have altered the composition and abundance of lower trophic levels, affecting seasonal shifts in phytoplankton peak abundance (Hyun et al., 2020).

In China, climate change has triggered substantial shifts in marine systems, including increases in red tide blooms and ocean acidification, which have raised mortality rates among calcifying organisms. These shifts disrupt species interactions, trophic food webs, and key habitats such as coral reefs, seagrass, and mangroves (Kang et al., 2021). In Japan, climate variability has affected coastal environments and aquaculture, posing threats to food security and economic growth. For instance, the cultivation of Japanese scallops, a key economic species, has been affected by climate drivers such as the Arctic Oscillation and East Asian monsoon, demonstrating the direct impact of climate change on coastal environments and aquaculture (Williamson et al., 2021). In the Republic of Korea, projected increases in surface seawater temperature and decreases in seawater pH will likely affect the structure

and functioning of marine ecosystems (Jung et al., 2017).

Overall, marine ecosystems in the climate change era are facing multiple stressors, including warming, acidification and deoxygenation, which threaten marine biodiversity and ecosystem services they provide (Tittensor et al., 2021). These changes underscore the urgent need for adaptative planning and management strategies to maintain ecosystem structure and function, particularly within MPAs (Wang et al., 2021). For example, species redistributions, such as the lizardfish in Chinese coastal waters, highlight the need for precautionary management approaches to sustain healthy marine ecosystems (Sumaila, 2019). Collectively, these studies illustrate the complex and multifaceted impacts of climate change on marine ecosystems and MPAs in North-East Asia, emphasizing comprehensive and coordinated responses to address them.

3.2 Marine Protected Areas-related Initiatives and Actions for Ocean-based Climate Actions

The NEAMPAN region, encompassing the jurisdiction of the People's Republic of China, Japan, the Korean peninsula and the Russian Federation, as well as adjacent international waters, faces significant development pressures. The anthropogenic stressors have led to substantial degradation of the ecological integrity and biodiversity of marine ecosystems. In addition to these human-induced impacts, climate change has emerged as a pivotal driver of ecosystem alteration.

In response to the observed variability and degradation within these ecosystems, regional bodies and national governments have taken proactive measures to preserve marine biodiversity and its inherent values through the establishment of Marine Protected Areas (MPAs). This part examines regional-level initiatives related to the networking of MPAs and the conservation of marine ecosystems.

3.2.1 Northwest Pacific Action Plan (NOWPAP)

The Northwest Pacific Action Plan (NOWPAP) was launched to foster regional cooperation in East Asia for the protection of the marine environment in the Northwest Pacific region. It was officially endorsed by China, Japan, the Republic of Korea, and the Russian Federation under the auspices of the United Nations Environment Programme (UNEP) as part of the Regional Seas Programme in 1994. The primary objective of NOWPAP is to promote understanding and cooperation among countries in the Northwest Pacific region through the exchange of information and technology focused on marine environmental protection.

NOWPAP currently operates through four Regional Activity Centers (RACs), each with distinct missions and responsibilities:

- China: Data and Information Network Regional Activity Centre (DINRAC) in China
- Japan: Special Monitoring and Coastal Environmental Assessment Regional Activity Centre (CEARAC)
- Republic of Korea: Marine Environmental Emergency Preparedness and Response Regional Activity Centre (MERRAC)
- Russian Federation: Pollution Monitoring Regional Activity Centre (POMRAC) in the Russian Federation

Based on the functions and objectives of the RACs, and the policy framework outlined in the NOWPAP Mid-Term Strategy 2018-2023, activities related to the establishment and management of MPAs are primarily focused on monitoring and research. The strategy identified four key objectives:

- Support ecosystem-based integrated coastal and river basin management (ICARM)
- Assess the status of the marine and coastal environment
- Prevent and reduce land- and sea-based pollution
- Conserve marine and coastal biodiversity

Strategy #4, which emphasizes the conservation of marine and coastal biodiversity, is closely linked to MPAs or OECMs. The Mid-Term Strategy also includes plans to formulate a medium-term strategy specifically for marine biodiversity conservation. However, the current status of this plan remains uncertain.

3.2.2 Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)

PEMSEA was established in 1993 as a project under the United Nations Development Programme (UNDP), implemented by the United Nations Office for Project Services (UNOPS) and funded by the Global Environment Facility (GEF). Initially named the "Regional Programme on Marine Pollution Prevention and Management in the East Asian Seas", the initiative later evolved into an independent intergovernmental organization. This transformation was formalized with the signing of the *"Putrajaya Declaration of Regional Cooperation for the Sustainable Development of the Seas of East Asia"* in 2009, which established a more structured and enduring framework for regional objectives.

PEMSEA operates through implementation networks such as the PEMSEA Network of Local Governments (PNLG), and the PEMSEA Network of Learning Centers (PLNC). These networks play a crucial role in the implementation of the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA). The latest SDS-SEA Implementation Plan 2023-2027 was finalized in late 2022 following a broad consultative process. Building on the achievements and mid-term review of the 2018-2022 plan, the new framework is more closely aligned with global priorities, including the post-2020 Biodiversity Framework, SDGs and the growing agenda on the blue economy. The structure of the 2023-2027 Plan is organized around the following components:

- Priority Management Programs ("Healthy Ocean")
    A. Biodiversity Conservation and Fisheries Management
    B. Climate Change Adaptation and Disaster Risk Reduction
    C. Pollution Reduction, Waste and Water-Use Management
- Cross-cutting Governance Programs ("Effective Governance")
    A. Ocean Governance and Strategic Partnerships
    B. Capacity Development
    C. Knowledge Management
    D. Gender Equality and Social Inclusion
- Additional Pillars
    A. Healthy People

B. Healthy Economies

The new Plan maintains marine biodiversity conservation as a central pillar of regional ocean governance, with MPAs recognized as key tools under the Biodiversity Conservation and Fisheries Management program. This underscores PEMSEA's commitment to ecological resilience and sustainable fisheries, aligned with the 30x30 target and principles of integrated coastal and ocean management.

3.2.3 Ramsar Regional Center East Asia (RRC-EA)

The Ramsar Regional Center – East Asia (RRC-EA) is a formally recognized regional initiative under the Ramsar Convention. Established as a Ramsar Regional Initiative (RRI), the RRC-EA was inaugurated in 2009 through the efforts of the Ministry of Environment (MOE) of the Republic of Korea. Its primary role is to serve as a regional hub for capacity building, information exchange, and cooperation. The Center facilitates these activities among a diverse group of stakeholders, including government entities, managers of Ramsar Sites and other wetland areas, international and national non-governmental organizations, technical experts, and private sectors. This collaborative approach aligns with the Ramsar Convention's mission to promote wetland conservation and the wise use of wetlands across the region.[10]

The RRC-EA works with 18 countries[11] in East, Southeast and South Asia that are Contracting Parties to the Ramsar Convention, while also collaborating with non-Contracting Parties in the region to support further implementation of the Convention. The RRC-EA's missions include:

- Actively supporting the implementation of the strategic goals and targets of the Ramsar Convention by providing direct assistance to member countries in East, Southeast, and South Asia;
- Strengthening and coordinating international cooperation and networking, with a focus on the East, Southeast, and South Asian region;
- Developing and leading a prioritized program of capacity building, training, and awareness-raising for member countries;
- Enhancing communication among member countries and various wetland stakeholders in East, Southeast, and South Asia; and
- Providing support for the financing of strategic priorities for the conservation and wise use of wetlands.

The RRC-EA acts as a significant hub for connecting Ramsar sites and promoting collaborative activities across the region. While its missions and roles cover both terrestrial and marine environments, including coastal and oceanic ecosystems, its networking efforts specific to marine and coastal sites, particularly those within the NEAMPAN frameworks, appear to be somewhat limited.

[10] http://rrcea.org/about/

[11] Bangladesh, Bhutan, Cambodia, China, Democratic People's Republic of Korea, India, Indonesia, Japan, Lao PDR, Malaysia, Mongolia, Myanmar, Nepal, Philippines, Republic of Korea, Sri Lanka, Thailand, and Viet Nam

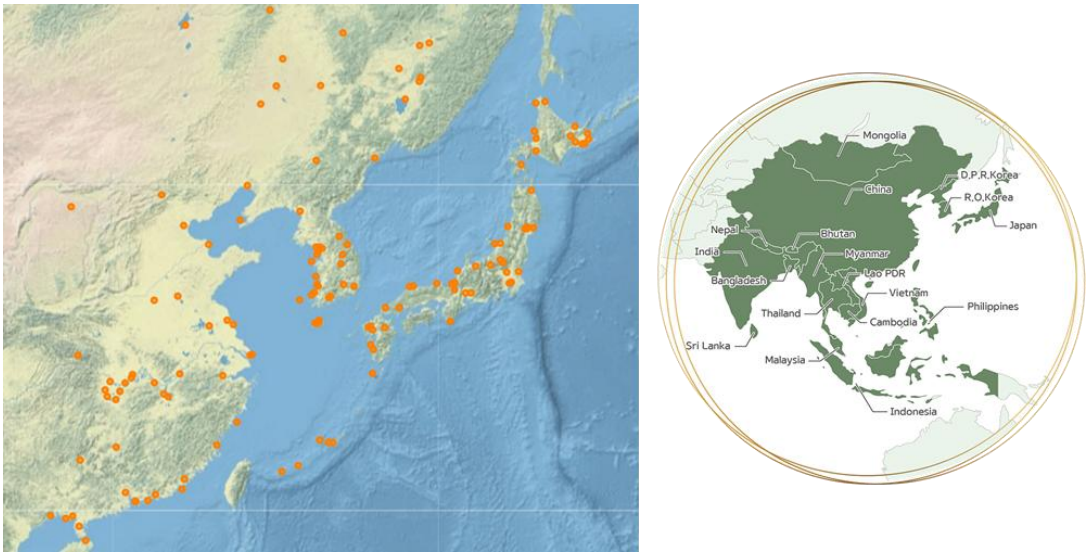

Figure 15. Distribution of Ramsar Sites in the NEAMPAN Area[12] and Member States of RRC-EA

3.2.4 East Asian-Australasian Flyway Partnership (EAAFP)

The East Asian-Australasian Flyway Partnership (EAAFP) was inaugurated in 2006, with the primary objective of safeguarding migratory waterbirds, their habitats, and the livelihoods of the people who rely on them. The partnership currently includes 40 Partners, including 18 national governments, 6 intergovernmental agencies, 14 international NGOs, 1 international organization, and 1 international private enterprise.[13] EAAFP provides a flyway-wide framework to facilitate dialogue, cooperation, and collaboration among various stakeholders dedicated to the conservation of migratory waterbirds and their habitats. These stakeholders include government authorities, site managers, technical institutions, UN agencies, development organizations, private sector actors, academia, non-governmental organizations, community groups and local residents. Through its comprehensive framework, EAAFP promotes integrated efforts to ensure the long-term sustainability of migratory waterbird populations and the ecosystems that support them.

Partners within the EAAFP collaborate to develop the Flyway Site Network, which currently includes 154 internationally significant sites. The network aims to ensure that these wetlands are managed sustainably. The partnership focuses on research, monitoring, and information exchange, alongside efforts to promote communication, education, participation, and awareness (CEPA) regarding the conservation of migratory waterbirds and their habitats. Additionally, EAAFP supports capacity building for site managers and develops conservation strategies that operate across the entire flyway.

12 https://rsis.ramsar.org/ris-search/?language=en&f%5B0%5D=regionCountry_en_ss%3AJapan&f%5B1%5D=regionCountry_en_ss%3AChina&f%5B2%5D=regionCountry_en_ss%3ADemocratic%20People%27s%20Republic%20of%20Korea&f%5B3%5D=regionCountry_en_ss%3ARepublic%20of%20Korea

13 https://www.eaaflyway.net/

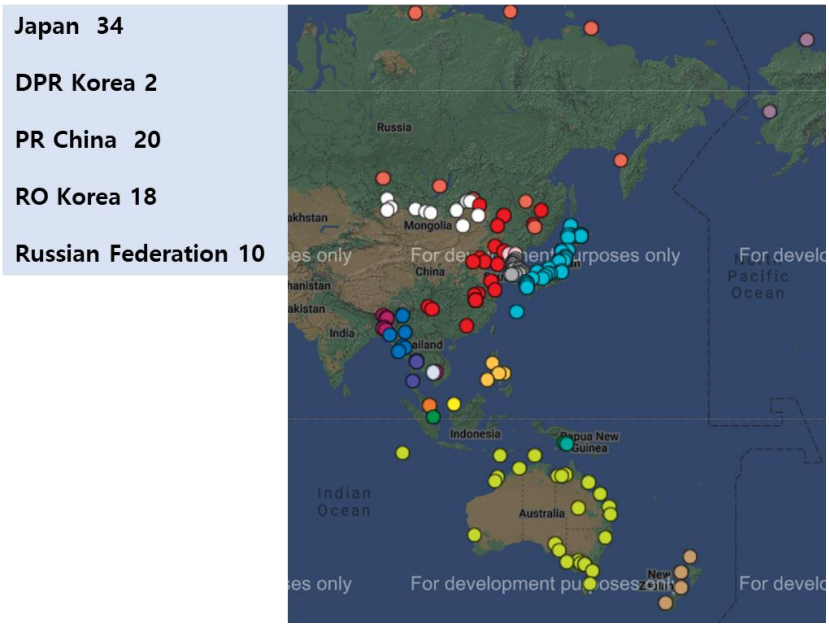

Figure 16. Distribution of Sites within the EAAFP[14] and NEAMPAN Member States[15]

Note: The base map is sourced from Google.

The objectives[16] of EAAFP are as follows:

- Develop the Network of sites of international importance for the conservation of migratory waterbirds along the East Asian- Australasian Flyway;
- Enhance communication, education and public awareness of the values of migratory waterbirds and their habitats;
- Enhance flyway research and monitoring activities, build knowledge and promote exchange of information on waterbirds and their habitats
- Build the habitat and waterbird management capacity of natural resource managers, decision-makers and local stakeholders;
- Develop, especially for priority species and habitats, flyway wide approaches to enhance the conservation status of migratory waterbirds.

14 https://www.eaaflyway.net/the-flyway/flyway-site-network/
15 https://www.eaaflyway.net/wp-content/uploads/2023/11/FNS-List-November-2023.pdf
16 https://www.eaaflyway.net/vision-and-mission/

CHAPTER 4. MARINE BIODIVERSITY CONSERVATION AND OCEAN-BASED CLIMATE ACTION OF THE REPUBLIC OF KOREA

The Republic of Korea has enacted a range of laws aimed at achieving net-zero emissions and ensuring biodiversity conservation. Key legislation includes the National Framework Act on Climate Change and Green Growth, the Natural Environment Conservation Act, the Marine Environment Conservation Act, the Marine Ecosystem Act, the Wetlands Conservation Act, the Coastal Wetlands Act (Getbol Act) and the Biodiversity Conservation Act, among others.

This chapter provides an overview of the legal system addressing the twin crises of climate change and biodiversity loss, with a particular focus on the mechanisms applicable to ocean and coastal areas. It also examines national strategies and plans related to ocean-based climate actions, highlighting significant efforts in biodiversity conservation. Recognizing the importance of marine ecosystem conservation and restoration as key components of ocean-based actions, this chapter further delves into recent initiatives and challenges, such as coastal wetland restoration, blue carbon initiative, establishment of marine ecological axis, and World Heritage designation efforts.

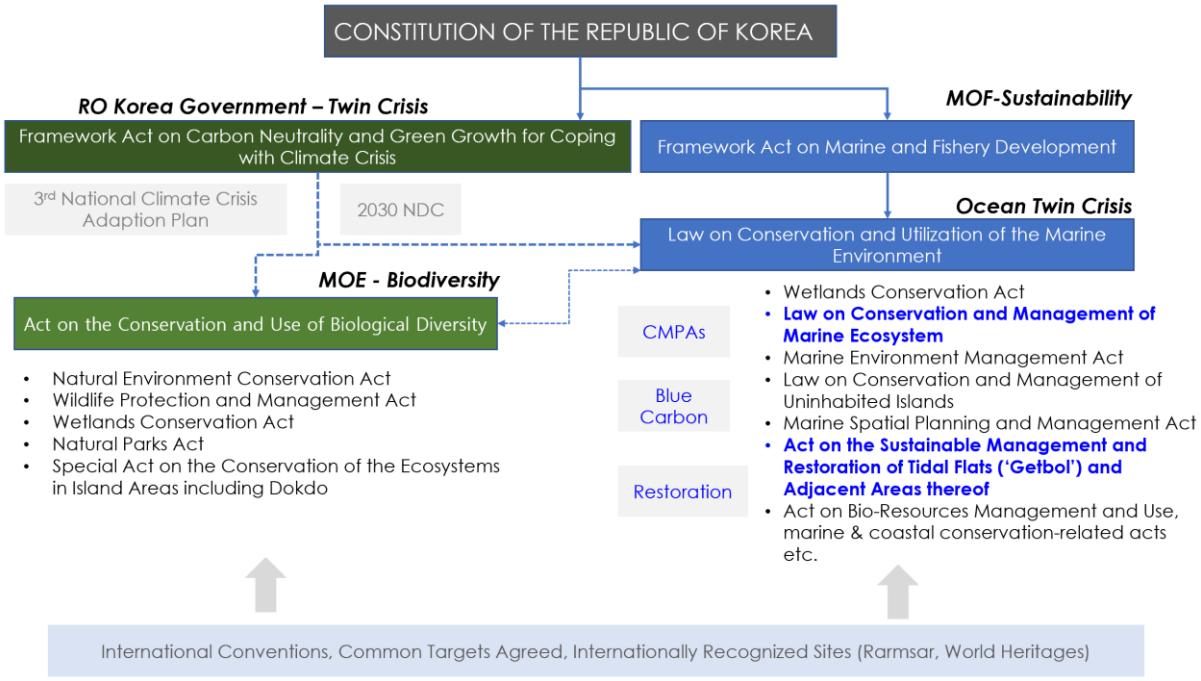

Figure 17. Overview of Legal Mechanisms on Twin Crises and Marine Biodiversity Conservation

4.1 LEGAL MECHANISM TO ADDRESS TWIN CRISES IN THE REPUBLIC OF KOREA

The Republic of Korea (ROK) has established a robust legal framework to respond to climate change and ensure the socio-economic sustainability of its society. Recognizing that climate change affects the health and sustainability of both marine and terrestrial ecosystems, the government has taken proactive steps to address the ecological challenges intensified by accelerated climate change. This section outlines the ROK's legal and institutional frameworks for addressing climate change and

conserving biodiversity at the national level.

4.1.1 Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis

The Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis (hereinafter "Carbon Neutrality Framework Act") (Act No. 18469) was enacted in September 2021 and entered into force in March 2022. It governs all national policies and initiatives related to climate change, including greenhouse gas reduction, carbon sinks and climate change adaptation. The act represents a comprehensive revision of the former "Framework Act on Low Carbon and Green Growth", which was enacted in January 2010. The 2021 enactment aims to align the ROK with the Paris Agreement and fulfill its international commitments in combating climate change. This shift in terminology from "Low Carbon" to "Carbon Neutrality" underscores a more proactive approach to galvanizing national climate change policy.

Key provisions of the Carbon Neutrality Framework Act include:

- *National Vision Setting and Strategy Formulation (Art. 7)*: The ROK Government has set its climate-related vision as "Transition to a carbon-neutral society by 2050". A national strategy on carbon neutrality and green growth should be established and implemented to realize this vision.
- *Mid- and Long-Term Green House Emission Reduction Target (Art. 8):* The Government has committed to reducing GHG emissions by at least 35% from 2018 levels by 2030.
- *National Framework Plan on Carbon Neutrality and Green Growth (Art. 10):* A 20-year national framework plan should be formulated and updated every five years. This plan includes (1) national vision and emission reduction targets, (2) global and national climate change projections, (3) current status and future outlook of GHG emissions and absorption, (4) sectoral and annual measures to meet the targets, and (5) climate change monitoring, impact assessment, and policy measures for green growth.
- *Local Plans Formulation and Implementation (Arts. 11-12):* Provincial and city-level governments are required to establish and implement their own carbon neutrality and green growth plans, tailored to their socio-economic and environmental contexts, while aligning with the national plan.
- *Carbon Neutrality and Green Growth Commissions (Arts. 15-22):* At both national and local levels, these commissions serve as advisory bodies, responsible for deliberating and deciding on the vision, targets, strategies, and implementation plans.
- *Additional Provisions:* The act also addresses climate change impact assessments, greenhouse gas emission trading schemes, carbon-neutral cities, green buildings and transportation initiatives, expansion of carbon sinks, development of carbon capture, utilization, and storage (CCUS) technologies, international mitigation projects, climate crises adaptation policies, climate crisis monitoring and prediction systems, and establishment of a Climate Response Fund.

4.1.2 Overview of the National Strategy on Carbon Neutrality and Green Growth and 2050 Net-Zero Target

The National Strategy on Carbon Neutrality and Green Growth, as indicated on the Carbon Neutrality Framework Act, was formulated in April 2024. This strategy was prepared through an inter-ministerial process coordinated by the Presidential Commission on Carbon Neutrality and Green Growth, co-chaired by the Prime Minister and a civil society representative.

The strategy outlines a comprehensive set of actions to tackle climate change and its related challenges. Notably, Action #2 under the "Responsible Carbon Neutrality" strategy focuses on the conservation of marine biodiversity and the establishment of MPAs, emphasizing the expansion of carbon sinks. Key coastal ecosystems in the Republic of Korea, such as non-vegetated tidal wetlands ("Getbol"), seagrasses, and underwater aquatic forests (including artificial reefs), have received considerable attention from public sectors for their role in carbon sequestration and biodiversity conservation.

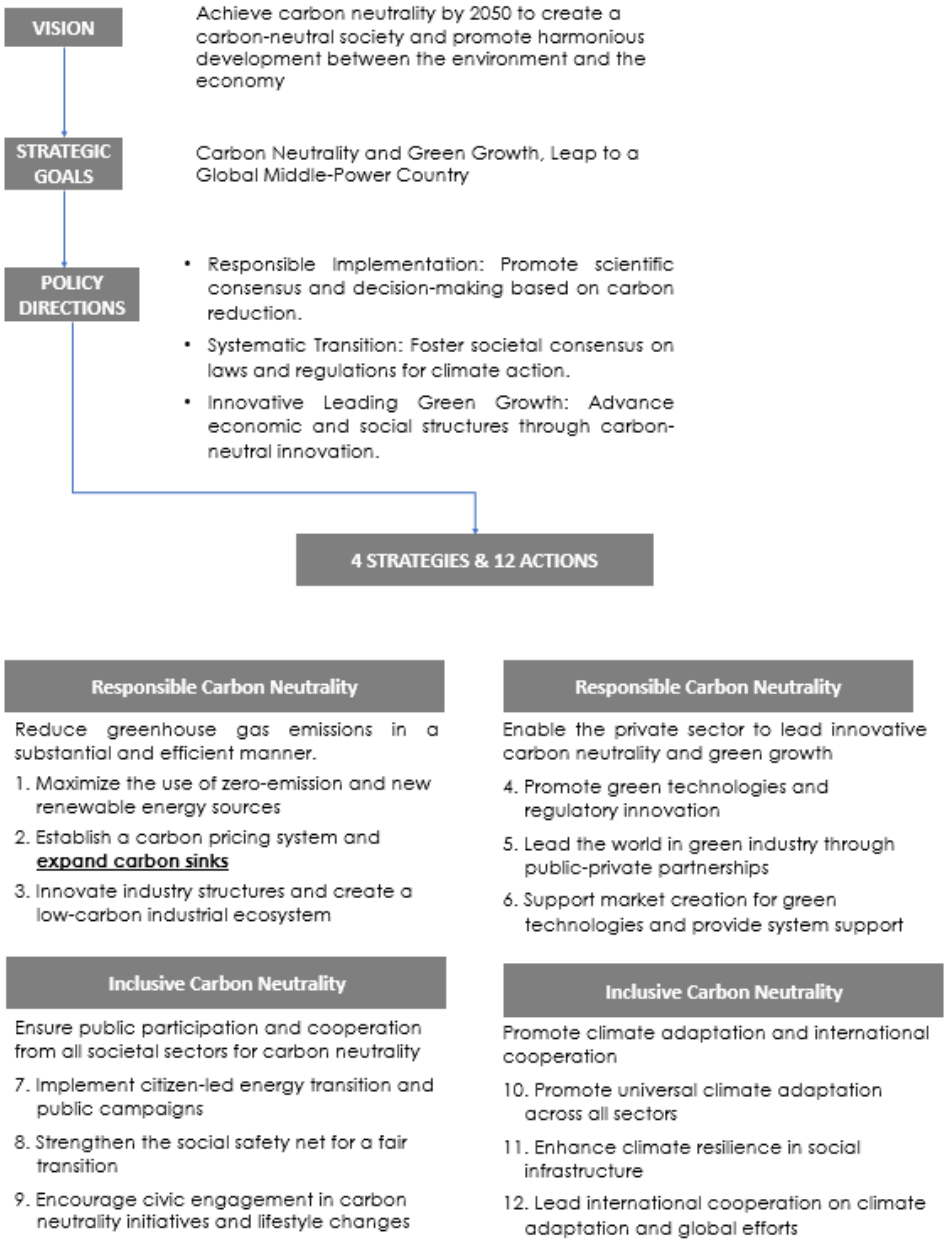

Figure 18. National Strategy on Carbon Neutrality and Green Growth

Source: Republic of Korea Government, 2023. Adapted from the official strategy document in Korean

Under this strategy, and pursuant to the Carbon Neutrality Framework Act of 2021, the Government has set its 2030 carbon neutrality targets (Nationally Determined Contribution, NDC) through deliberation and decision by the Presidential Commission on Carbon Neutrality and Green Growth. Carbon Dioxide Removal (CDR) measures are pivotal to achieving the national goal of carbon neutrality by 2050. As GHG emission reductions alone are insufficient to meet the 2030 targets, the Government has adopted additional measures, such as carbon sinks, CCUS, and international reductions.

The table below outlines sector-specific GHG reduction targets required to meet the 2030 NDC and progress toward the 2050 carbon neutrality goal.

ITEM	Sector	2018 emissions	2030 emissions	
			Previous (Oct 2021)	Adjusted (Apr 2023)
Total emissions		727.6	436.6 (40.0%)	436.6 (40.0%)
Emissions	Transition	269.6	149.9 (44.4%)	145.9 (45.9%)
	Industry	260.5	222.6 (14.5%)	230.7 (11.4%)
	Buildings	52.1	35.0 (32.8%)	35.0 (32.8%)
	Transportation	98.1	61.0 (37.8%)	61.0 (37.8%)
	Agriculture, livestock, and fisheries	24.7	18.0 (27.1%)	18.0 (27.1%)
	Waste	17.1	9.1 (46.8%)	9.1 (46.8%)
	Hydrogen	(-)	7.6	8.4
	Fugitive emissions, etc.	5.6	3.9	3.9
Absorption / removal	Carbon sinks	(-41.3)	-26.7	-26.7
	CCUS	(-)	-10.3	-11.2
	International reduction	(-)	-33.5	-37.5

Table 1. Republic of Korea's Carbon Reduction Targets by Sector (2030 NDC)

Note: Units are million tons of CO_2e, and percentage indicate reductions from 2018 baseline
Source: https://2050cnc.go.kr/eng/contents/view?contentsNo=67&menuLevel=2&menuNo=119

4.1.3 Ocean Nature-Based Solutions in the Third National Climate Crisis Adaptation Plan (2023)

The Third National Climate Crisis Adaptation Plan (2023), formulated based on the Carbon Neutrality Framework Act of 2021, is currently being implemented across all relevant sectors. This plan outlines four major policy directions:

1. Advancing the scientific basis for climate observation, prediction and adaptation;
2. Creating a safe society capable of tackling climate disasters and risks;
3. Establishing a societal foundation adaptive to climate change; and
4. Implementing climate adaptation with broad stakeholder engagement.

Nature-based Solutions (NbS) for ocean and coastal areas are integral to the adaptation measures outlined in the plan. These measures focus on expanding MPAs and blue carbon-based coastline management. The structure of the National Adaptation Plan and its provisions related to marine and coastal components are outlined in detail below.

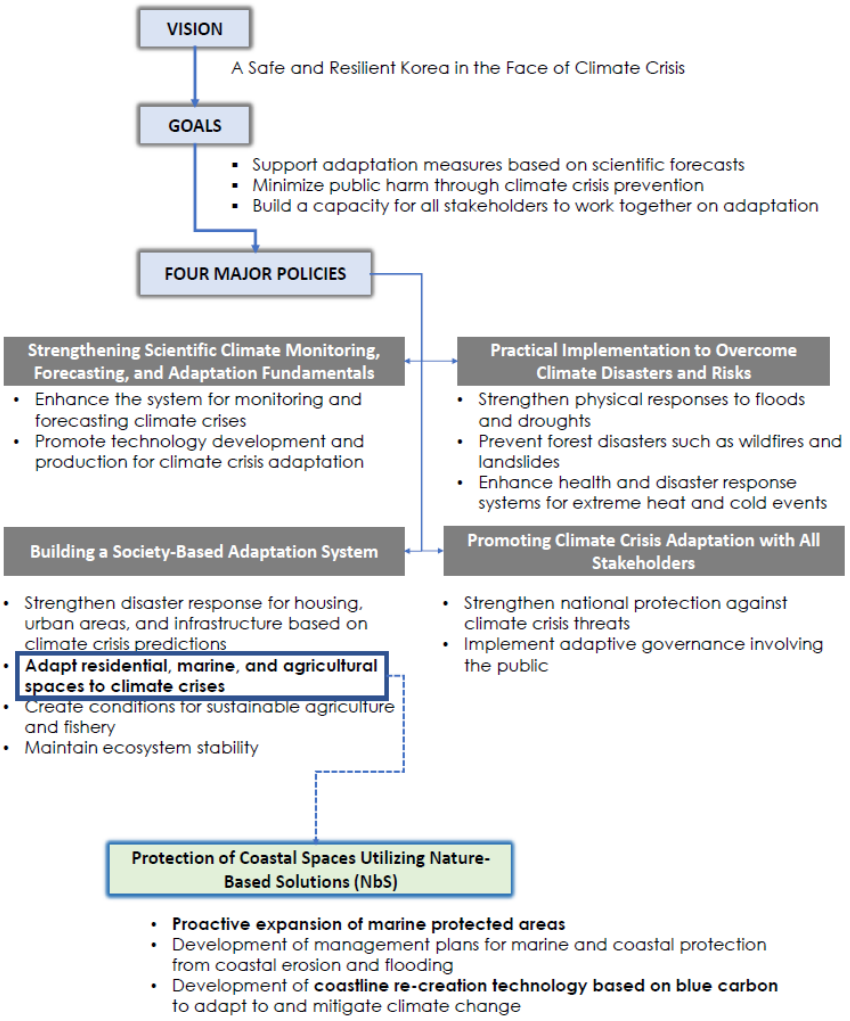

Figure 19. Overview of the Third National Climate Crisis Adaptation Plan and Marine-Related Actions
Source: Republic of Korea Government, 2023. Adapted from the official plan in Korean.

4.1.4 Marine Biodiversity Conservation in the National Biodiversity Conservation Policy Regime

The Ministry of Oceans and Fisheries (MOF) in the Republic of Korea (ROK) has developed a comprehensive policy framework for the conservation of marine and coastal biodiversity, aligned with the national biodiversity conservation strategy led by the Ministry of Environment (MOE). Biodiversity conservation in the ROK is governed by the Act on the Conservation and Use of Biological Diversity (Biodiversity Act, Act No. 199661), enacted in February 2012. This overarching Act integrates a range of biodiversity-related legislation, including the Natural Environment Conservation Act, the Wildlife Protection and Management Act, the Wetlands Conservation Act, the Natural Parks Act, the Special Act on the Conservation of Ecosystems in Island Areas including Dokdo, and the Act on Bio-Resources Management and Use.

Key provisions of the Biodiversity Act include:

- **Formulation of National Strategy on Biodiversity (Art. 7):** The Government shall prepare a national strategy for the conservation and sustainable use of biodiversity. This strategy addresses ecosystem status, biodiversity protection and management, sustainable use practices, threats to biodiversity, alien species management, research and technology development, and promotion of ecosystem services.
- **Investigation of Biodiversity (Art. 9)** and **Preparation of National Species List (Art. 10)**: The Government is required to assess the status of biodiversity and natural resources, identify threats, and compile a national species list based on these findings.
- **Support for Conservation and Restoration of Ecosystems (Art. 15)** and **Contracts for payments for Ecosystem Services (PES) (Art. 16)**: These articles promote conservation and restoration practices, including the use of financial incentives through PES contracts to enhance ecosystem service benefits.
- **Benefit Sharing from Biological Resources (Art. 19)** and **Protection of Traditional Knowledge (Art. 20)**: These provisions regulate the equitable sharing of benefits from the use of biological resources between providers and users. It also emphasizes the importance of researching and protecting traditional knowledge held by individuals and communities.
- **Risk Assessment and Management from Introduction of Alien Species (Arts. 21 to 11):** The Act mandates the assessment and management of risks associated with the introduction of alien species.

While the Biodiversity Act does not provide specific legal provisions for marine and coastal biodiversity conservation, its strategy includes initiatives such as blue carbon ecosystems as a key NbS to address climate change in coastal and marine areas. The strategy also emphasizes the 30x30 conservation target as a central goal.

4.2 Marine Protected Areas and Biodiversity Conservation related to Ocean-Based Climate Action

The ROK Government operates an integrated ocean governance system through the Ministry of Oceans and Fisheries (MOF). This unique governance system addresses a broad spectrum of marine and fisheries issues, including marine environment and ecosystem management, ocean climate change response, natural hazard mitigation, mariculture and catch fisheries, port development, shipping and logistics, marine tourism, and marine science and technology. The MOF was established in 1996 to address significant marine challenges, including large-scale oil spills and widespread red-tide outbreaks that occurred in 1995. Since its inception, the MOF has led to the enactment of a number of laws and regulations addressing marine and fisheries-related issues. Based on these legal frameworks, the ministry has developed issue-specific strategies and plans. To implement its policies, actions, and projects, the MOF oversees several specialized public entities, such as Korea Marine Environment Management Corporation (KOEM, 1997), Korea Institute of Marine Science and Technology Promotion (KIMST, 2005), Korea Fisheries Resources Agency (FIRA, 2012), National Maritime Museum of Korea (MMK, 2012), National Marine Biodiversity Institute of Korea (MABIK, 2014), Korea Ocean Business Corporation (KOBC, 2017), National Ocean Science Museum (KOSM, 2020). The three policy pillars under the MOF - marine management, port and shipping, and fisheries

– have all evolved and expanded in terms of budgets, human resources, and institutional capacity. Notably, the marine management pillar has experienced more rapid growth and has attracted greater public attention compared to the other two pillars.

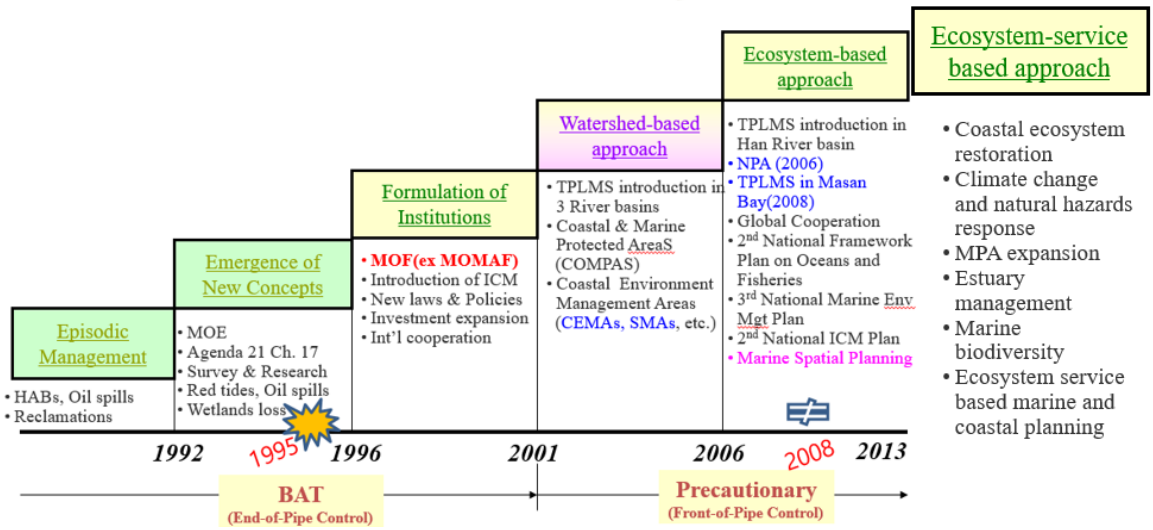

Figure 20. Evolution of marine environment policy in the Republic of Korea

Source: modified from Nam, 2016

Note: Large-scale red-tides and an oil-spill accident in 1995 triggered the establishment of the Ministry of Oceans and Fisheries, which underwent dismantling of the Ministry from 2008 to 2013.

Considering the evolutionary features of the marine policy regime in the ROK, this section presents an overview of the legal mechanisms for marine environment protection, national policies and plans related to MPAs and marine biodiversity, as well as key statistics on coastal and marine protected areas (CMPAs).

4.2.1 Legal Mechanisms for Marine Environment Protection

The Ministry of Oceans and Fisheries (MOF) has its own framework act to address all issues related to marine and fisheries affairs, known as the Framework Act on Marine and Fishery Development (No. 5805, 1999). This Act identifies marine environment protection as one of MOF's core missions. Consequently, the ROK Government, through MOF, has developed and implemented various legal and institutional mechanisms to conserve and manage the marine environment and resources. As the lead agency for marine environmental and ecosystem protection, MOF oversees major marine environmental issues and related policies in close cooperation with the Ministry of Environment (MOE), which is responsible for overall national environmental policy. This unique governance structure fosters productive synergy but occasionally leads to conflicts at the ministerial level.

Within this governance framework, MOF has enacted the Law on Conservation and Utilization of the Marine Environment, addressing matters specific to marine environments. This law is a comprehensive revision of the Marine Environment Management Act (No. 8260, 2008), which superseded the Marine Pollution Prevention Act (No. 3079, 1979). The Marine Environment Conservation Act addresses a broad spectrum of marine environmental and ecological issues. Major policy measures under this Act include the following:

- **Formulation of a Comprehensive Plan for Marine Environment Management (Art. 10):** MOF shall formulate and implement a 10-year comprehensive plan for the conservation and utilization of the marine environment.
- **Establishment and Compliance of Marine Environmental Standards (Art. 13 & Art. 14)**: MOF prepares marine environmental standards, considering those set under the Framework Act on Environmental Policy led by MOE.
- **Marine Spatial Planning (Art. 15):** MOF shall formulate marine spatial plans at both national and provincial levels.
- **Response to Ocean Climate Change (Art. 17):** Central and local governments shall prepare policies to address climate change impacts, including surveying, monitoring, prediction, and adaptation measures.
- **Comprehensive Marine Environmental Survey (Art. 18)**
- **Marine Environmental Quality Assessment (Art. 19)**
- **Impact Assessment of Marine Uses (Art. 20)**

The 5th Comprehensive Plan, established in 2021 and set to be implemented by 2030, addresses key areas such as land-based pollution, marine ecosystem protection and restoration, development of marine ecotourism, sea-based pollution management, air quality management in ports, marine bioindustry development, response to ocean climate change, marine spatial planning, and international cooperation. MPAs and marine biodiversity conservation are detailed in Strategy 2, “Healthy Marine Ecosystem”, while Strategy 6 outlines actions related to ocean climate change.

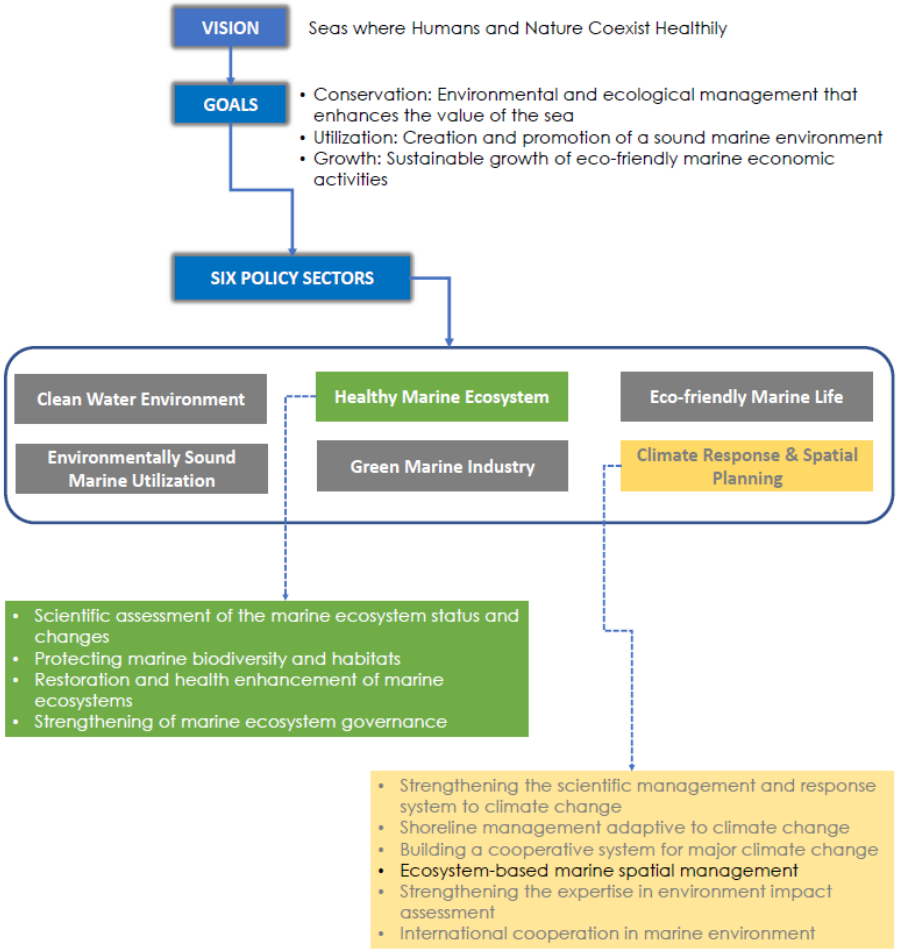

Figure 21. The 5th Comprehensive Plan for Marine Environment Management and the Marine Ecosystem & Climate Change-related Sectors (2021)

Note: This brief structure was adopted and modified from the plan in Korean.

4.2.2 Marine Ecosystems and Biodiversity Conservation Mechanisms

The Republic of Korea (ROK) has developed its legal and institutional mechanisms for marine ecosystem conservation systematically, adapting to socio-economic circumstances, public awareness, and global trends in marine biodiversity and ecosystem management. The first law dedicated to marine habitat conservation, the Wetlands Conservation Act (No. 17844), was enacted in 1999 and has been jointly managed by both MOE and MOF. Before MOF's establishment in 1996, most ecosystem protection actions were handled by MOE. Following the enactment of this law, MOF is responsible for designating coastal wetlands protection areas (CWPA) and conserving coastal wetlands, commonly referred to as "Getbol".

Since then, MOF has enacted several key laws to safeguard marine biodiversity, including the Coastal Management Act (No. 5913, 1999), the Law on Conservation and Management of Marine Ecosystem (Marine Ecosystem Act, No. 8045, 2006), the Law on Conservation and Management of Uninhabited Islands (No. 8620, 2007), the Marine Spatial Planning and Management Act (No. 15607, 2018), and

the Act on the Sustainable Management and Restoration of Tidal Flats and their Adjacent Areas (No. 16276, 2019).

Among these, the Marine Ecosystem Act serves as the overarching legal framework for marine ecosystem protection. Key management measures include:

- **Formulation of a Framework Plan on Conservation and Management of Marine Ecosystems (Art. 9):** MOF shall establish a National Plan for marine ecosystem conservation and management every 10 years.
- **Establishment of Marine Ecological Axis (Art. 9-2)** and **Formulation of Marine Ecological Axis Management Plan (Art. 9-3):** The marine ecological axis refers to an integrated network of key areas designed to conserve marine ecosystems and maintain the continuity of their structure and functions, as defined in Article 2 of the Act. MOF shall establish the marine ecological axis considering habitat and migration of marine organisms, and prepare the management plan every five years, based on comprehensive ecosystem surveys and expert advisory processes.
- **Comprehensive Survey of Marine Ecosystems (Art. 10)**
- **Preparation of Marine Ecology Map (Art. 12)**
- **Protection of Migratory Marine Animals (Art. 16)**
- **Prevention of Incidental Catch of Protected Marine Organisms (Art. 18-2),**
- **Formulation of Conservation Plans for Marine Protected Organisms (Art. 19).**
- **Management of Ecosystem-disturbing Species (Art. 23)**
- **Harmful Marine Organisms (Art. 24)**
- **Designation and Management of Marine Protected Areas (Art. 25)** and **Formulation of MPA Management Plans (Art. 28):** MOF may designate three types of MPAs – Marine Organism Protected Areas, Marine Ecosystem Protected Areas, Marine Landscape Protected Areas - based on their ecological and cultural values, such as biodiversity, landscape, production, scarcity, uniqueness, or carbon sink capacity. Additionally, provincial governors and metropolitan mayors may designate their own MPAs according to the established criteria.
- **Formulation of Marine Biodiversity Conservation Plan (Art. 38)**
- **Promotion of Biodiversity Research (Art. 39)**
- **Contracts for Management of Marine Biodiversity (Art. 41)**
- **Designation of Marine Eco-Parks (Art. 43-2):** MOF may designate MPAs and adjacent areas, or CWPAs and adjacent areas as marine eco-parks.
- **Conservation of Seascapes (Art. 45)** and **Restoration of Marine Ecosystems (Art. 46)**: MOF shall establish a plan for marine ecosystem restoration.
- **Marine Ecosystem Conservation Charges (Art. 49):** MOF is authorized to impose conservation charges on entities or persons conducting development projects that significantly impact marine ecosystems and degrade marine biodiversity.

According to Article 9 of the Marine Ecosystem Act, MOF has established and implemented the Framework Plan on Conservation and Management of Marine Ecosystems. The 2nd National Plan,

established in 2019 and set to be implemented by 2028, outlines strategies and actions addressing key conservation priorities.

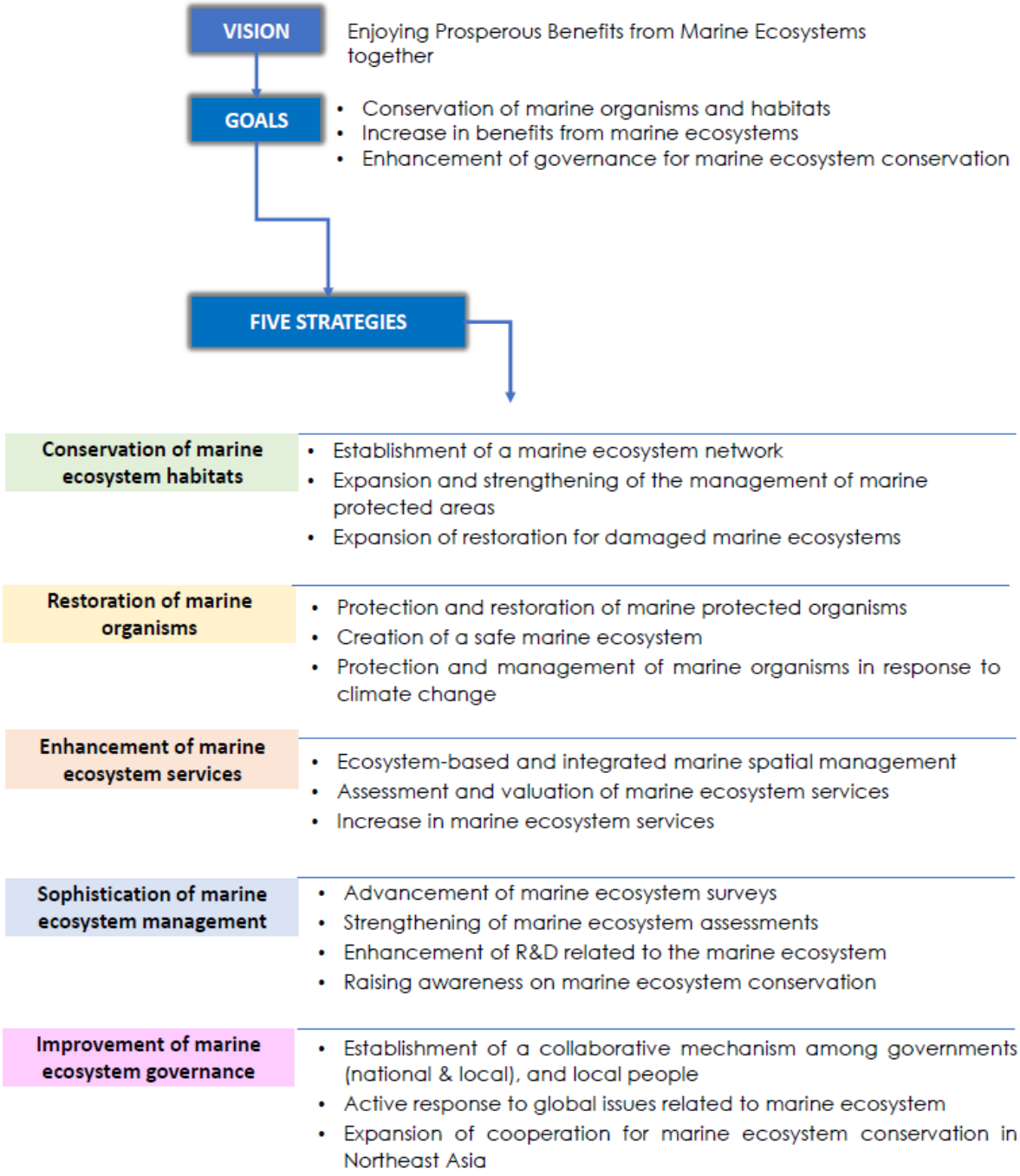

Figure 22. The 2nd Framework Plan on Conservation and Management of Marine Ecosystems (MOF, 2019)
Note: This brief structure was adopted and modified from the plan in Korean.

4.2.3 Coastal and Marine Protected Areas: An Integral Vehicle for Marine Biodiversity Conservation

CMPA Governance in the Republic of Korea

The International Union for Conservation of Nature (IUCN) defines a protected area as “a clearly defined geographical space, recognized, dedicated, and managed through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.” In line with the IUCN’s definition of Marine Protected Areas (MPAs), the Republic of Korea (ROK) has established MPAs, distinguished by their jurisdictions and management objectives. The first MPA in the ROK, Hanryeo Marine National Park, was designated in 1968 under the Natural Parks Act, governed by the MOE. Subsequently, other ministries, including MOF, the Ministry of Culture, Sports and Tourism (MCST), and the Ministry of Land, Infrastructure and Transport (MOLIT), enacted marine ecosystem-related laws and designated additional MPAs.

Ministry	Type of CMPAs
Ministry of Oceans and Fisheries (MOF)	・Wetlands Protected Areas (coastal waters) ・Marine Organism Protected Areas (coastal waters) ・Marine Ecosystem Protected Areas (coastal waters) ・Marine Landscape Protected Areas (coastal waters) ・Uninhabited Conservation Islands (terrestrial and water areas) ・Fishery Resources Protected Areas (terrestrial and water areas) ・Coastal Environmental Conservation Areas (terrestrial and water areas)
Ministry of Environment (MOE)	・National Parks, Provincial Parks (coastal waters and lands) ・Wildlife Protected Areas (coastal waters and lands) ・Specially Protected Islands (terrestrial area)
Ministry of Culture, Sports and Tourism (MCST)	・Natural Heritage: Natural Monuments, Scenic Spots (coastal waters and lands)
Ministry of Lands, Infrastructure and Transportation (MOLIT)	・ Fishery Resources Protected Areas (terrestrial and water areas)

Table 2. Ministries and Types of Protected Areas under Their Jurisdiction

Each ministry's geographical jurisdiction includes both coastal land and water areas, often resulting in conflicts over the designation and management of Protected Areas (PAs), particularly between MOF and MOE. Notably, areas such as National Parks in marine areas and Uninhabited Protected Islands and their surrounding waters have been points of contention in terms of leadership over environmental and ecosystem policies. Despite these conflicts, the benefits derived from cooperative mechanisms between the two ministries substantially outweigh the social costs associated with competition and disputes.

Brief History of CMPAs Policy Evolution

The designation of National Parks in marine areas in 1968 marked a significant milestone in recognizing the value of seascapes. Similarly, Fisheries Resources Protected Areas were designated in both marine and terrestrial areas to ensure the sustainable use of fishery resources. However, until the late 1990s, CMPAs primarily focused on enhancing tourism and natural resource utilization opportunities.

By the mid-1990s, rising public awareness emphasized the importance of marine ecosystems, particularly tidal mudflats (Getbol). Civil activists and experts advocated for the conservation of Getbol and opposed the reclamation of publicly owned waters, including tidal flats. In response to growing domestic demand for ecosystem protection and increasing international pressures for biodiversity conservation, the ROK Government began revising and innovating its national policies to safeguard marine and coastal ecosystems. Below is an outline of the evolution of CMPAs policy in the ROK.

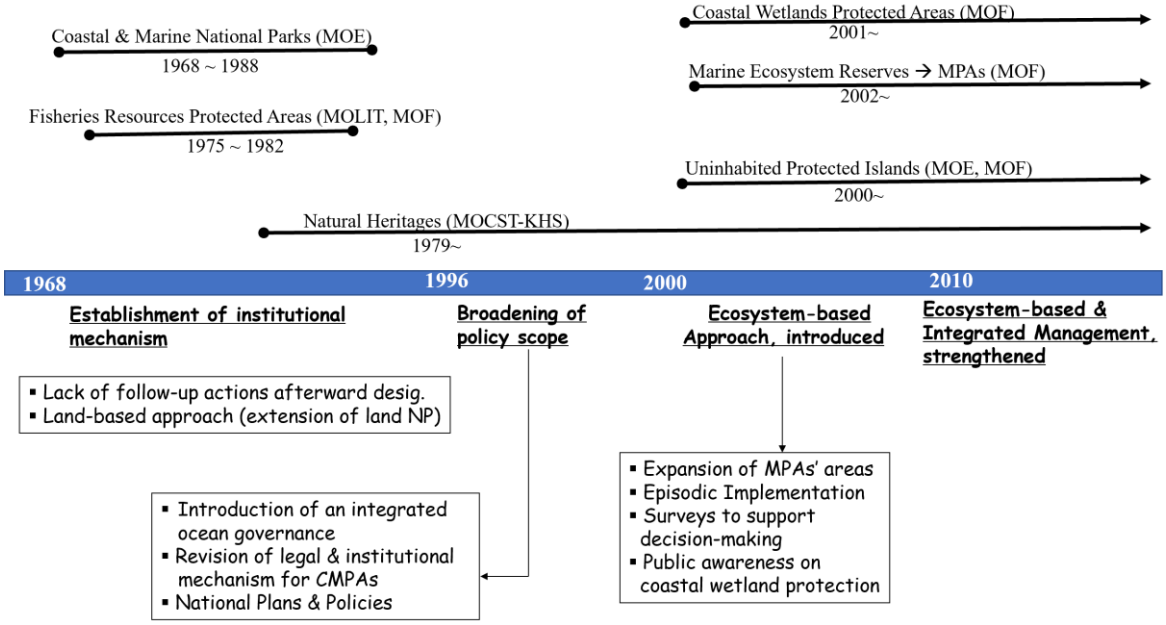

Figure 23. Brief Overview of the Evolution of Coastal and Marine Protected Areas (CMPAs) in the Republic of Korea

Source: revised from Nam et al., 2004

The ROK has a comprehensive legal system comprising ten laws governing the designation and management of marine and coastal protected areas (CMPAs). Most laws related to marine ecosystems were enacted in the early 2000s. In addition to MPA-related laws, the ROK Government has developed legal frameworks for Other Effective area-based Conservation Measures (OECMs), such as the Marine Spatial Planning and Management Act (formerly the Coastal Management Act before 2018) and the Coastal Wetlands Act (commonly known as the Getbol Act).

Statistics of CMPAs

The ROK's CMPAs currently cover a total area of 11,262 km^2, comprising terrestrial parts of 1,989 km^2, and seawater parts of 9,273 km^2. These areas include 470 protected areas, categorized as (1) terrestrial

parts, including National Parks, Fishery Resources Protection Areas, Uninhabited Protected Islands, and Natural Monuments, and (2) seawater parts, including Coastal Wetlands Protected Areas and MPAs designated under the Marine Ecosystem Act, which are legally binding protected areas.

Types		Area (km^2)	No.	Laws (Ministries)
MPA	Seascapes	5	1	Marine Ecosystem Act (MOF)
	Marine Organisms	94	2	
	Marine Ecosystems	265	16	
Coastal Environment Conservation Area		830	4	Marine Environment Management Act (MOF)
Fishery Resources Protection Area		2,625	5	Fisheries Act (MOF) & National Lands Planning and Use Act (MOLIT)
Uninhabited Protection Islands		7	135	Uninhabited Islands Management Act (MOF)
Natural Heritage	Scenic Spots	17	15	Cultural Heritage Protection Act (MCST-KHS)
	Natural Monuments	896	3	
	Natural Protection Area	25	4	
Natural Parks	National	2,681	4	Natural Parks Act (MOE)
	Provincial	323	1	
	County	4	4	
Especially Protected Uninhabited Islands		-	259	Islands Ecosystem Act (MOE)
Coastal Wetlands Protected Area		1,501	17	Wetlands Conservation Act (MOE & MOF)
Total		**9,273**	**470**	

Table 3. Statistical Features of CMPAs in the Republic of Korea (as of May 2024)

Sources: adopted and upgraded from Nam et al. (2004), Choi (2022, personal communication), and information portals of relevant ministries

Note: This information is not recommended to be used as official statistics on the ROK's CMPAs.

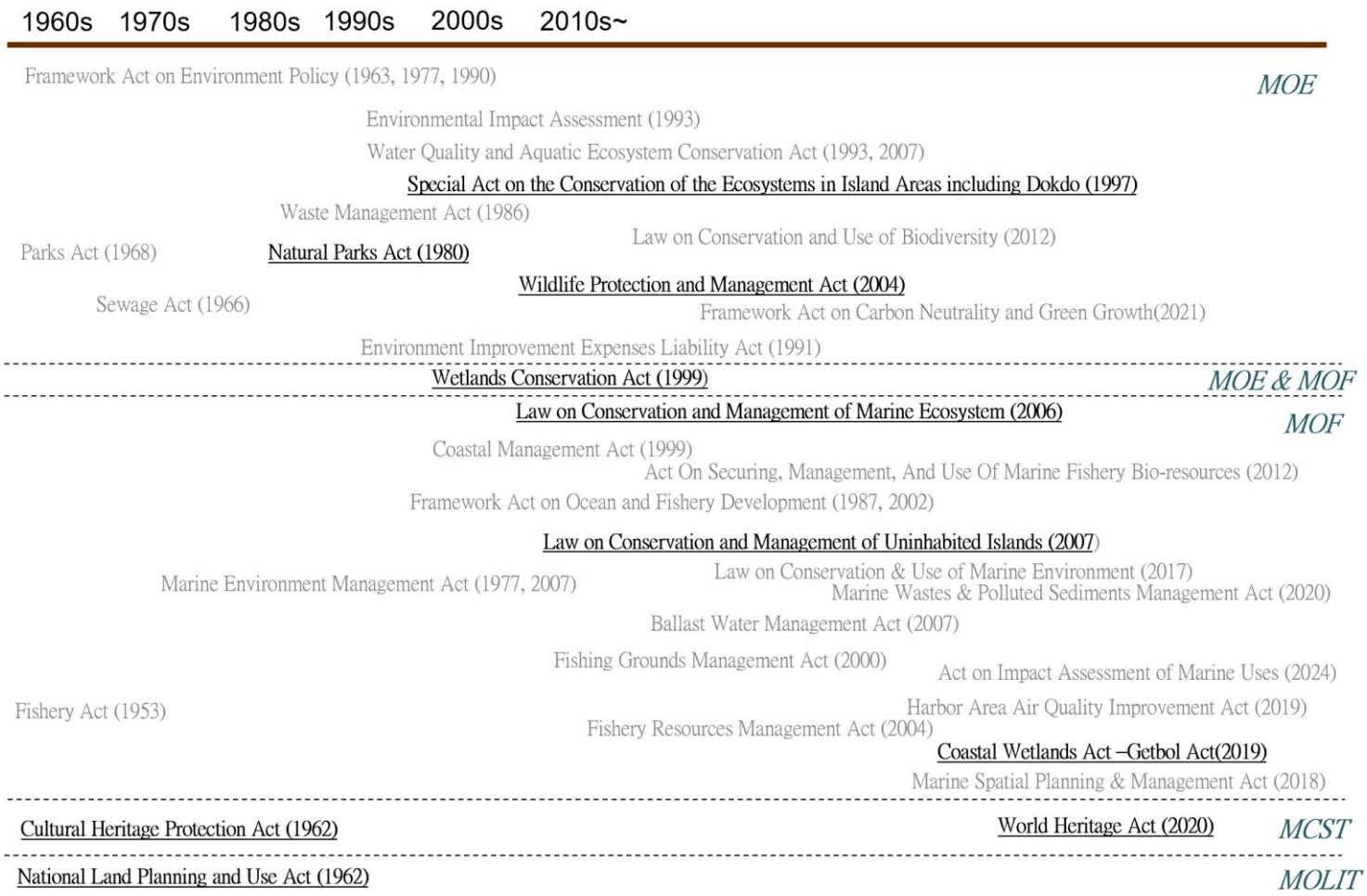

Figure 24. Historical Landscape of Legal Mechanism on CMPAs in the Republic of Korea

Source: updated from Nam, 2017

Note: Laws that pertain specifically to the designation and management of CMPAs and OECMs are presented in the figure as underlined and bold.

Figure 25 summarizes the evolution of CMPAs in the Republic of Korea, highlighting the nation's growing commitment to marine and coastal biodiversity conservation over the decades.

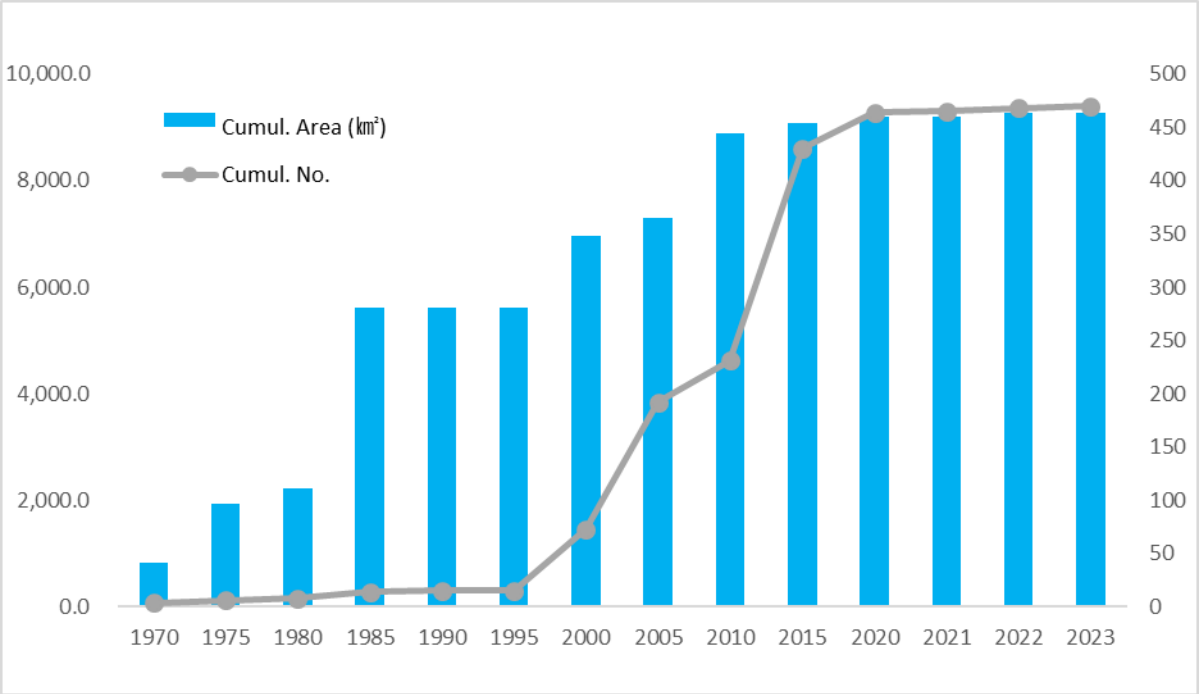

Figure 25. Cumulative Statistics of Areas and Numbers of the ROK's CMPAs

Sources: revised and updated from Nam et al. (2004) and Choi (2022, personal communication)
Note: The area and number of CMPAs in the Republic of Korea have increased significantly since the mid-2000s, a period when the ROK Government actively strengthened its marine biodiversity conservation policy.

- 1970s: The establishment of Hanryeo Marine National Park marked the inception of MPAs and the beginning of seascape conservation in the ROK.
- 1980s: Although growth was modest, awareness regarding the importance of marine biodiversity gradually increased.
- 1990s: Public awareness campaigns and the growing focus on protecting tidal flats (Getbol) led to a rise in CMPA designations. Civil activism played a crucial role during this period, advocating stronger conservation measures.
- 2000s: The enactment of significant marine ecosystem laws spurred a substantial increase in the number and area of CMPAs, marking the most considerable growth period.
- 2010s: This decade saw continued expansion of CMPAs, emphasizing the integration of marine spatial planning practices into conservation efforts.
- 2020-2023: Enhanced inter-ministerial cooperation and a strategic focus on both CMPAs and OECMs characterized this period. Policies evolved toward comprehensive, holistic protection of marine and coastal ecosystems.

4.2.4 Marine Ecological Axis as an Instrument for Ecological Networking

The Marine Ecological Axis and its associated management plan were established under the 2nd Framework Plan on Conservation and Management of Marine Ecosystems (2019). According to Article 9-2 of the Marine Ecosystem Act, the Ecological Axis is defined as a network connecting important areas or waters to integrate the conservation and management of marine ecosystems and biodiversity, thereby maintaining the continuity of ecosystem structure and function. Prior to the formulation of the 2nd Framework Plan, the ROK Government had already emphasized ecological networking. In October 2007, it declared the establishment of the Three Major Ecological Axes: Baekdu Daegan,[17] the Demilitarized Zone (DMZ) and Islands & Getbol.

In response to evolving policy needs and to implement the actions outlined in the Marine Ecosystem Act and the 2nd Framework Plan, the ROK Government designated Five Marine Ecological Axes in December 2022 (MOF Notice No. 2021-232) as follows:

Category	Name of Marine Ecological Axis	Backgrounds & Purpose
Conservation of key habitats and migratory paths of marine life	Tidal Flats (Getbol) Conservation to the West Sea	Conservation of feeding grounds and nurseries for seabirds, coastal fish, and invertebrates
	Islands Ecosystem Conservation to the South Sea	Conservation of spawning grounds, nurseries, and supply sites for various seaweeds, invertebrates, and fish
	Ecosystem Conservation to the East Sea	Conservation of the inflow pathways for cold current marine organisms supplied from the DPRK Cold Current waters
Conservation of the main migratory routes of marine protected mammals	Conservation of Migratory Marine Protected Species (seals - porpoises)	Conservation of the main migratory routes for “protected marine species” such as seals and porpoises
Observation of changes in marine ecosystems due to climate change	Climate Change Observation	Monitoring of tropical and subtropical marine life emergency areas for the development of adaptation strategies

Table 4. Five Marine Ecological Axes and Their Purposes of Designation

Source: MOF Public Notice entitled Designation of Marine Ecological Axis (No. 2021-232, December 27, 2021)

Following the designation of the Marine Ecological Axes, the ROK Government formulated the Management Plan for the Marine Ecological Axis in July 2023, to be implemented by 2028. The plan

[17] It refers to the mountain range that stretches along the length of the Korean Peninsula, serving as the backbone of the ROK and extending into the DPRK, where it reaches its highest peak at Mountain Baekdu (called Mountain Changbai in China).

aims to promote three major strategies and eight actions, under the vision of “Enhancement of marine ecosystem services through conservation and utilization”. The strategies and actions are tailored to the socio-ecological characteristics and management conditions of each Marine Ecological Axis. Consequently, each of the five Marine Ecological Axes has its own management directions and specific actions, ensuring localized and effective conservation efforts.

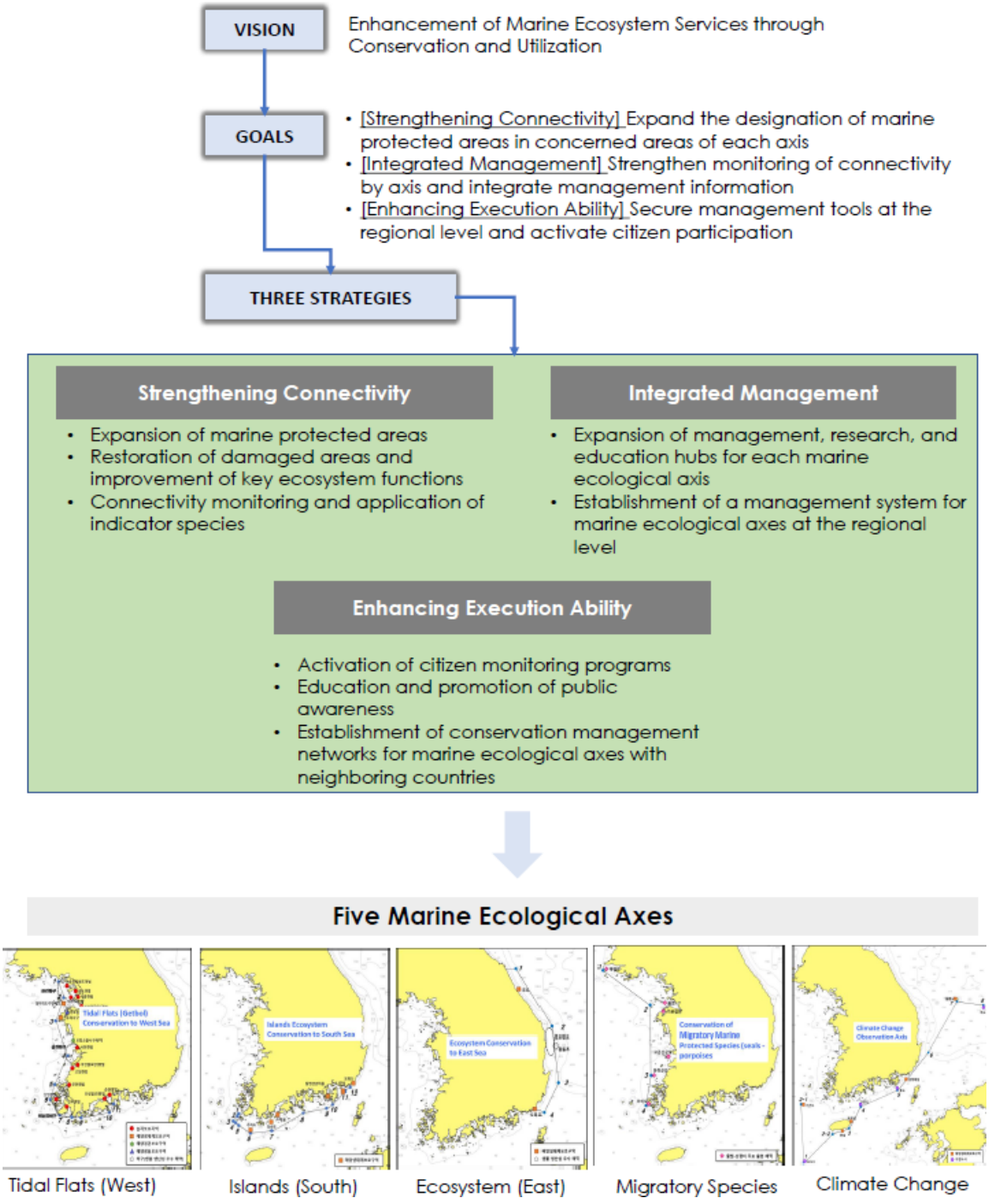

Figure 26. Structure of the Management Plan for Marine Ecological Axis (MOF, 2023)

Note: This brief structure was adopted and modified from the plan in Korean.

4.2.5 Restoration of "Getbol" and Blue Carbon

The ROK Government enacted the Act on the Sustainable Management and Restoration of Tidal Flats (Getbol) and Adjacent Areas (hereinafter referred to as the "Coastal Wetlands Act" or "Getbol Act") in 2019. This legislation aims to protect Getbol ecosystems and enhance their health and resilience. While the Getbol Act does not specifically address protected areas, it clearly emphasizes the importance of conserving healthy Getbols and restoring degraded Getbol ecosystems. Under this act, MOF is mandated to formulate a national plan for the restoration and management of Getbol and their adjacent areas (Article 7). The act further empowers the Minister to designate five types of tidal flat management areas (Article 10): tidal flat conservation area, tidal flat safety management area, tidal flat production area, tidal flat sabbatical area, and tidal flat experience area. Additionally, the Minister may designate "clean tidal flats" within the "tidal flat production area" or its parts, based on an appropriate assessment process initiated upon request by local governments (Article 14).

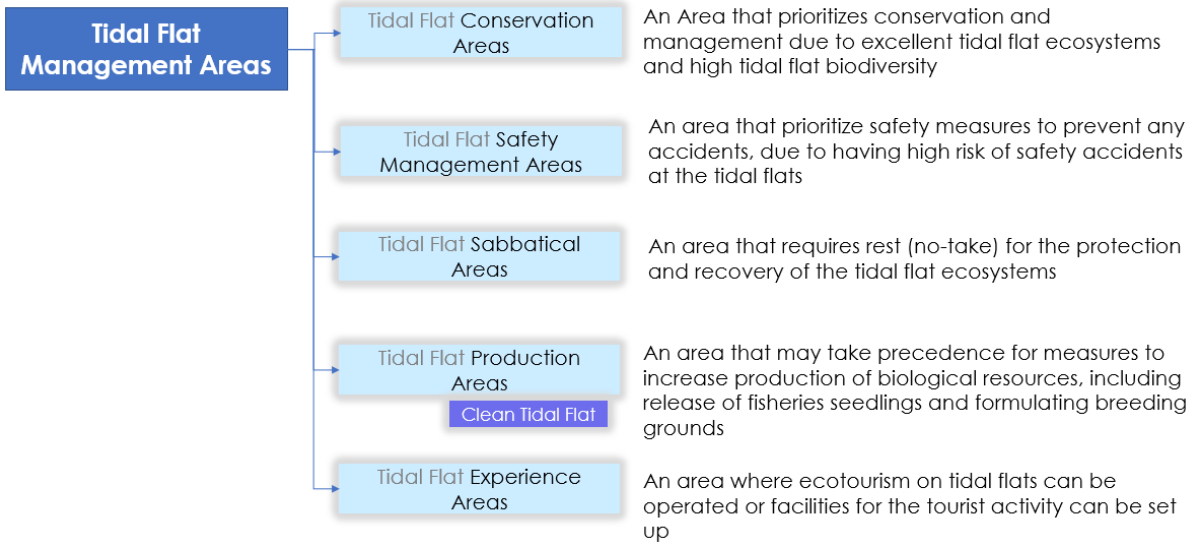

Figure 27. Categories of Tidal Flat Management Areas under the Getbol Act

MOF formulated the 1st National Plan for Restoration and Management of Getbol and Adjacent Areas in 2021. Notably, this plan includes specific actions related to Blue Carbon, highlighting the role of Getbol restoration in climate change mitigation through carbon sequestration in tidal sediments. Building on this, the Blue Carbon Promotion Strategy was adopted as a national policy during a cabinet meeting in 2023, further emphasizing the critical link between tidal ecosystems and climate action.

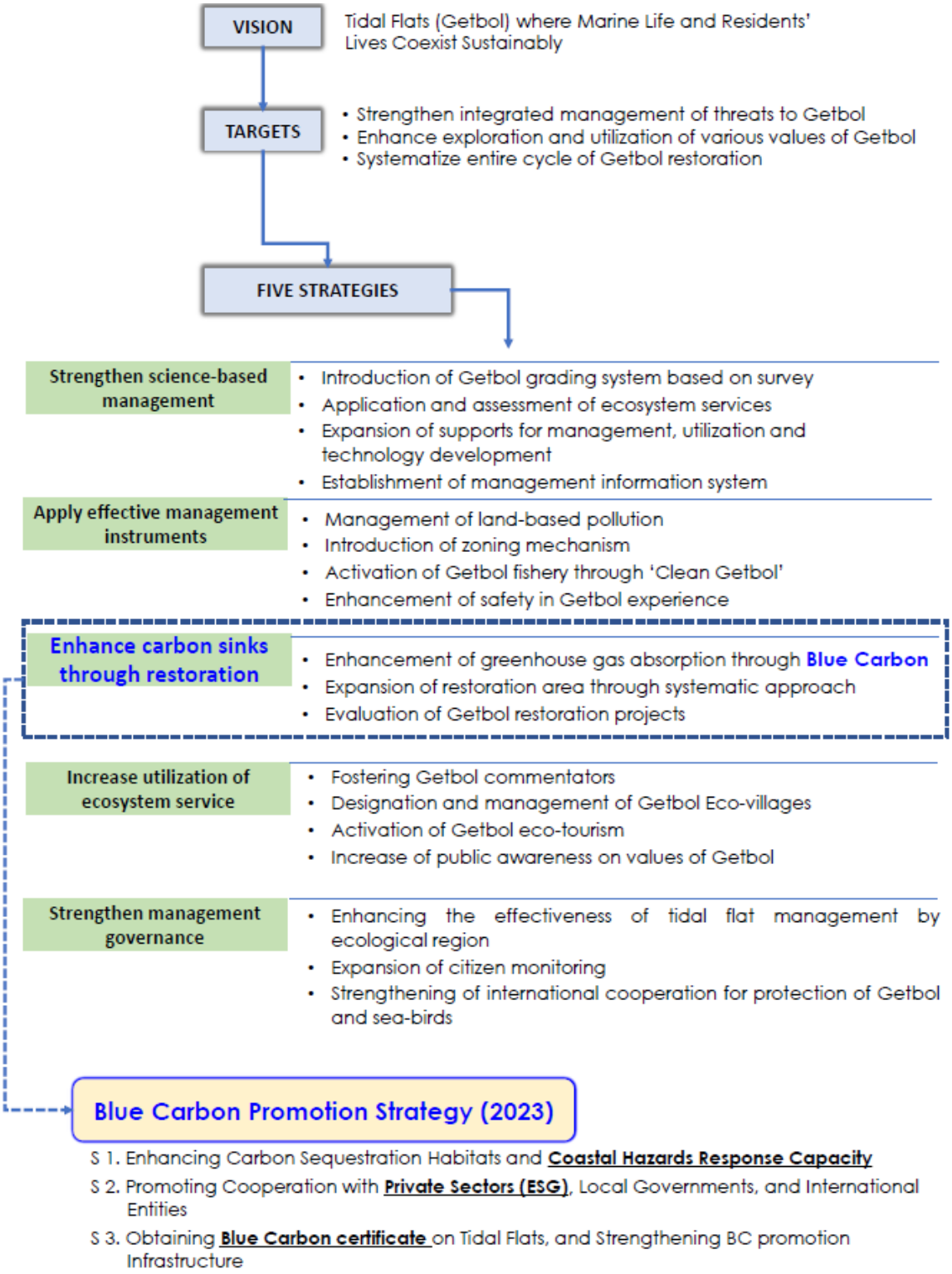

Figure 28. Brief Overview of the 1st National Plan for Restoration and Management of Getbol and Adjacent Areas (MOF, 2021), and Its Relationship with Blue Carbon Promotion Strategy (MOF, 2023)

Note: This brief structure was adopted and modified from the plan and the strategy in Korean.

4.2.6 Internationally Recognized Protected Areas as a Supportive Mechanism for Marine Biodiversity Conservation

The global community has made concerted efforts to conserve marine biodiversity and ensure the sustainable use of marine ecosystem services. These efforts include the establishment of common goals such as the Aichi Targets (specifically Targets 6, 10, and 11) and UN Sustainable Development Goal 14 (Life Below Water). Recent milestones such as the Global Biodiversity Framework and the High Seas Treaty further highlight international commitments to marine conservation. Key international conventions and frameworks, including the Ramsar Convention on Wetlands, the Convention on Biological Diversity (CBD), and the World Heritage Convention, act as accelerators for achieving these goals at global, national, and local levels.

Countries recognizing the importance of marine biodiversity conservation have ratified these conventions to align national policies with international guidelines. The Government also ratified the World Heritage Convention on 14 September 1988, and the Ramsar Convention on 28 July 1997, subsequently enacting domestic law to implement their objectives and manage marine ecosystems accordingly.

Ramsar Sites in the Republic of Korea

The ROK has 26 designated Ramsar sites, covering a total area of 26,265 hectares. Of these, 9 sites are located in coastal water areas, spanning 18,549 hectares, which accounts for 70.6% of the total Ramsar site area.

Site	Designation date	Area (ha)	References
Daebudo tidal flat	October 25, 2018	453	CWPA
Dongcheon estuary	January 20, 2016	540	CWPA, FRPA, NEAMPAN
Gochang and Buan tidal flats	December 13, 2010	4,550	CWPA, NEMAPAN, UNESCO MAB, World Heritage
Janghang wetland	May 21, 2021	596	WPA, in an estuary
Suncheon Bay	January 20, 2006	3,550	CWPA, FRPA, Scenic Spots, NEAMPAN, UNESCO MAB
Jeungdo tidal flat	September 1, 2011	3,130	CWPA, World Heritage
Muan tidal flat	January 14, 2008	3,589	CWPA, FRPA, NEAMPAN
Seocheon tidal flat	September 9, 2010	1,530	CWPA, World Heritage
Songdo tidal flat	July 10, 2014	611	CWPA by local government
Total		18,549	

Table 5. Ramsar Sites Located in Coastal Waters and Estuarine Areas of the Republic of Korea

Note: This data on the Ramsar Sites was sourced from the official website of the Ramsar Convention Secretariat. https://www.ramsar.org/country-profile/republic-korea

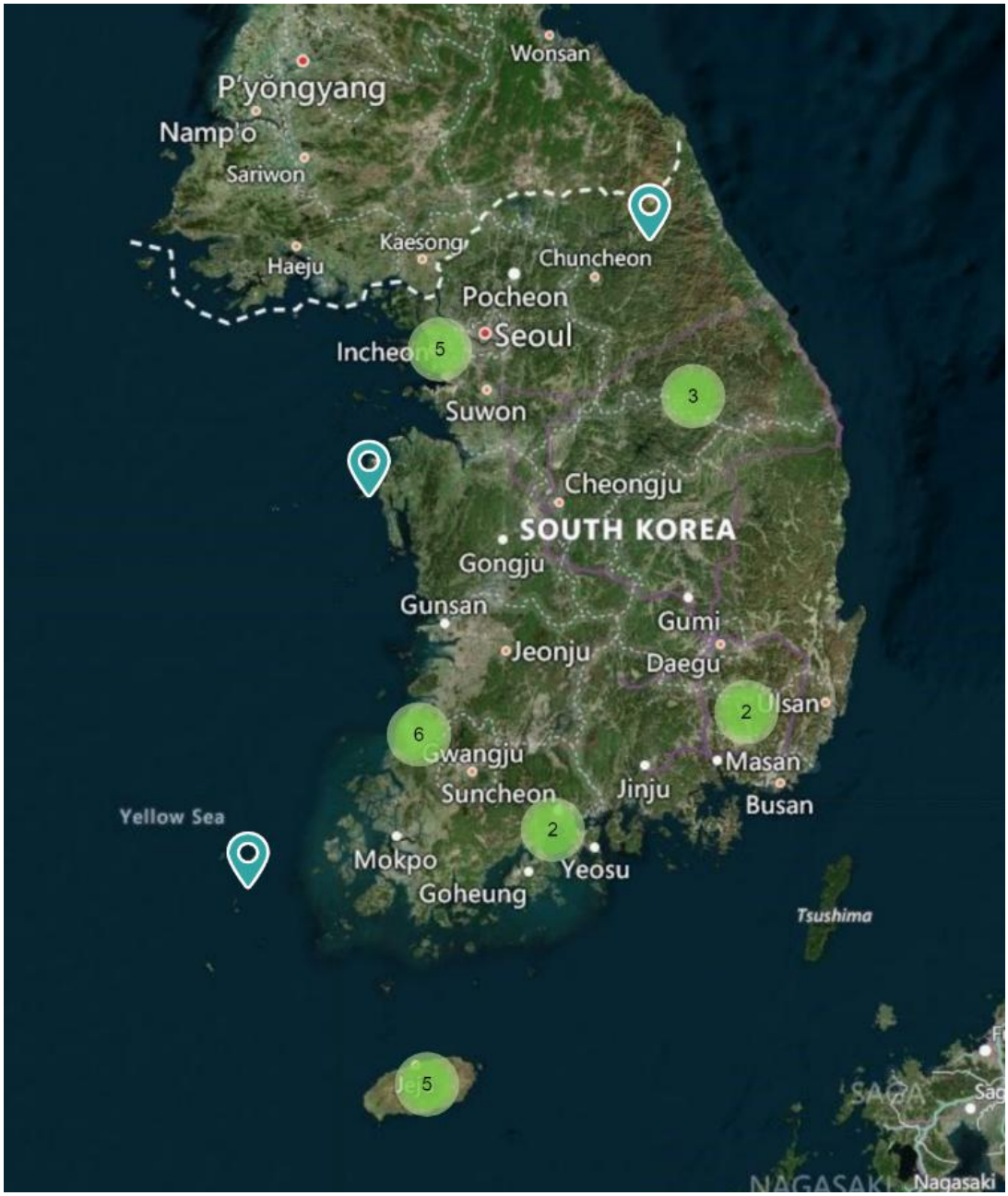

Figure 29. Locations of Ramsar sites in the Republic of Korea

Source: https://www.ramsar.org/country-profile/republic-korea

World Natural Heritage Sites in the Republic of Korea

The ROK boasts 16 World Natural and Cultural Heritage sites, including two World Natural Heritages: Getbol (Korean tidal flats) and Jeju Volcanic Island and Lava Tubes, inscribed in 2021 and 2007, respectively. The Getbol World Heritage site covers a total area of 203,003 hectares, comprising the property area of 128,411 hectares and a buffer zone of 74,592 hectares. This area is approximately 11 times larger than the total area of Ramsar sites located within coastal waters in the ROK.

Name & Location	Property (ha)	Buffer Zone (ha)	Reference
Seocheon Getbol	6.809	3,657	CWPA, Ramsar, World Heritage
Gochang Getbol	5,531	1,880	CWPA, Ramsar, FRPA, World Heritage, NEAMPAN
Shinan Getbol	110,086	67,254	CWPA, Ramsar, NEAMPAN
Boseong-Suncheon Getbol	5,985	1,801	CWPA, Scenic Spots, FRPA, MAB, Ramsar, NEAMPAN
Total	128,411	74,592	203,003 ha

Table 6. Statistics of the Getbol World Natural Heritage Sites in the Republic of Korea

Note: Area information was adopted from https://whc.unesco.org/en/list/1591/maps/.

The inscription of Getbol as a World Heritage site holds significant meaning for Korean society, representing international recognition of its ecological and cultural values. Korean citizens take great pride in this global acknowledgement, which simultaneously fosters a stronger sense of stewardship and responsibility toward Getbol conservation. This recognition elevates the global status of these tidal flats, while providing a critical platform to prevent their invisible degradation and exploitation.

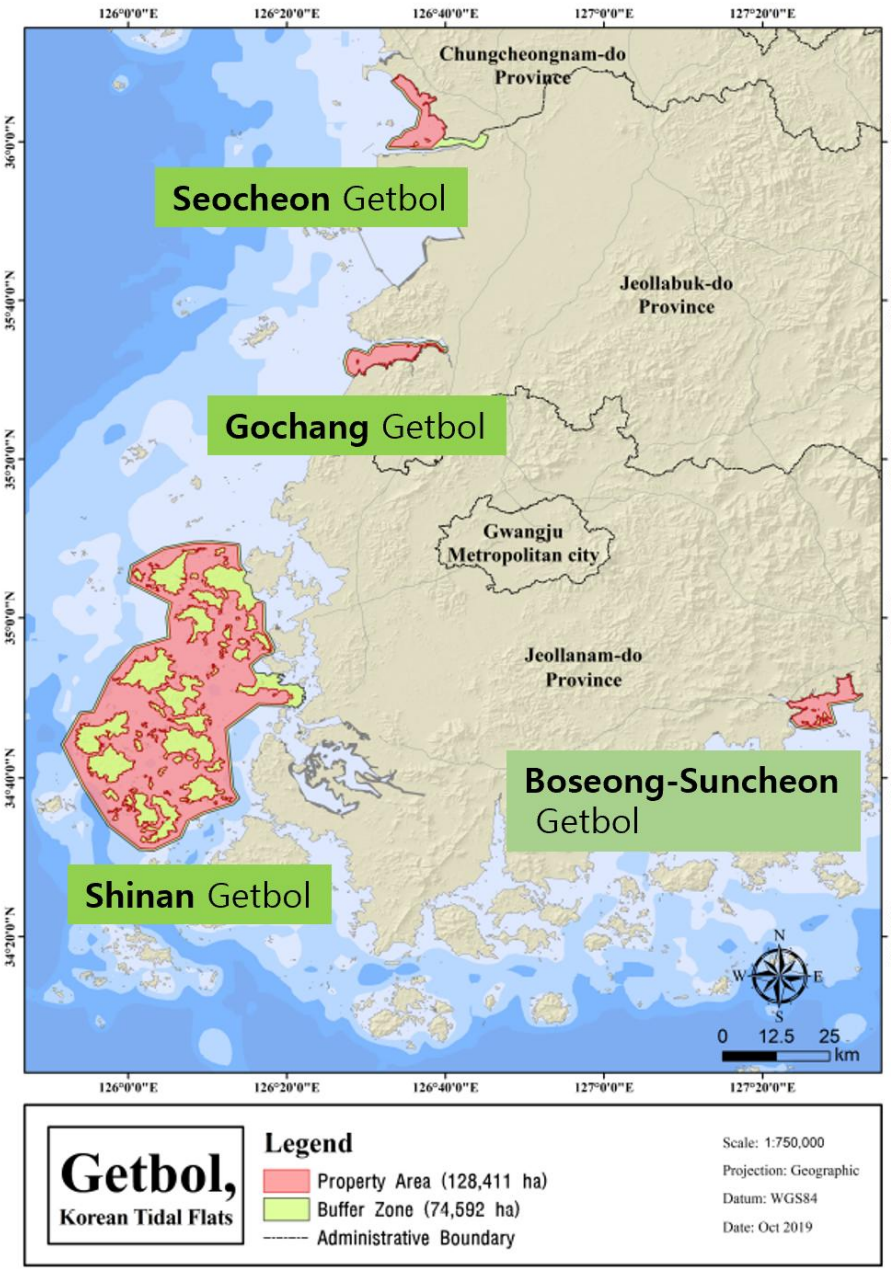

Figure 30. Location Map of the Getbol World Natural Heritage Sites in the Republic of Korea
Source: https://whc.unesco.org/en/list/1591/maps/

4.3 Section Summary

The Republic of Korea (ROK) has established a comprehensive legal framework to address climate change and biodiversity conservation. Key laws include the National Framework Act on Climate Change and Green Growth (2021), the Natural Environment Conservation Act, the Marine Environment Conservation Act (2008), the Marine Ecosystem Act (2006), the Wetlands Conservation Act (Getbol Act) (2019), and the Biodiversity Conservation Act (year).

- **Framework Act on Carbon Neutrality and Green Growth (2021):** Governs policies on greenhouse gas reduction, climate change adaptation, and sets a vision for carbon neutrality by 2050. Includes mid-and long-term emission reduction targets and mandates local governments to formulate and implement plans aligned with the national strategy.
- **Marine Environment Conservation Act (2008):** Enacted by the MOF, it addresses a wide range of marine environmental and ecological issues, such as marine spatial planning, climate change response, and comprehensive marine environmental surveys.
- **Marine Ecosystem Act (2006):** Serves as the overarching legal mechanism for marine ecosystem protection, establishing frameworks for conservation and management plans, marine ecological axes, and marine biodiversity conservation.
- **National Strategy on Carbon Neutrality and Green Growth (2024):** Formulated in April 2024, this strategy involves cooperation among various ministries and agencies. It includes specific actions targeting marine biodiversity conservation, such as the expansion of marine protected areas and carbon sinks.
- **3rd National Climate Crisis Adaptation Plan (2023):** Focused on climate change adaptation measures, including the expansion of MPAs and adoption of blue carbon-based coastline management strategies.

The ROK has established diverse MPAs under multiple legal frameworks, including the Marine Ecosystem Act, Natural Parks Act, and Wetlands Conservation Act. This multi-ministerial governance structure occasionally creates jurisdictional tensions; however, the resulting inter-agency collaboration generates institutional synergies that exceed the administrative costs.

- **Historical Evolution of CMPAs**: Since the designation of Hanryeo Marine National Park in 1968, CMPAs have evolved significantly. This evolution has been marked by a substantial increase in both the number and area of protected sites, particularly since the early 2000s, reflecting a growing emphasis on marine biodiversity conservation.
- **Marine Ecological Axis**: Defined under the Marine Ecosystem Act, it serves to connect important marine areas, integrating conservation efforts. The establishment of the Five Marine Ecological Axes in 2021 represents a significant step forward in creating a cohesive and effective ecological network.

In addition to its national management systems, the ROK actively participates in international conventions such as the Ramsar Convention and the World Heritage Convention to strengthen its

marine biodiversity conservation efforts.

- **Ramsar Sites**: The ROK has designated 26 Ramsar sites, spanning a total area of 26,265 hectares, with significant portions located in coastal waters.
- **World Natural Heritages**: The ROK is home to 16 World Natural and Cultural Heritage sites, including the Getbol (Korean tidal flats) and Jeju Volcanic Island and Lava Tubes. The Getbol World Heritage site, inscribed in 2021, covers 203,003 hectares emphasizing its international recognition of its ecological and cultural values.

CHAPTER 5. IN-DEPTH ANALYSIS OF OCEAN-BASED CLIMATE ACTIONS (OBCA) IN NEMAPAN SITES OF THE REPUBLIC OF KOREA

The Republic of Korea (ROK) has witnessed a dynamic evolution in Coastal and Marine Protected Areas (CMPAs) policy and legal mechanisms for conserving marine ecosystems and biodiversity. Recognizing the importance of regional collaboration, the ROK has actively participated in regional cooperation mechanisms. Notably, under the North-East Asian Marine Protected Areas Network (NEAMPAN) initiative, established in 2013 to provide a robust platform for MPAs and their networking in the East Asia Region, three Korean MPAs have joined the network: Gochang, Muan, and Suncheon Coastal Wetlands Protected Areas (CWPAs).

The ROK Government has developed and implemented management plans for each CWPA to preserve their ecological values and ensure their sustainable benefits for local communities and the broader population. These plans aim to prevent damage from invisible exploitation, such as reclamation and dredging in publicly owned waters. However, the marine ecosystems and biodiversity of these areas continue to face threats from both anthropogenic stressors and the ongoing impact of global climate change. Initial management plans prioritized anthropogenic issues, and climate change considerations have been less emphasized during early implementation stages.

Effective biodiversity conservation requires integrated approaches addressing both anthropogenic threats and climate change impacts. Nationally, the Ministry of Oceans and Fisheries (MOF) acknowledge this need and has begun incorporating climate change concerns into CMPA policy frameworks. However, such recognition is not consistently reflected in local-level management plans.

This chapter examines the management plans and practices of the three NEAMPAN sites in the ROK from the perspective of climate change response. It discusses limitations and potential improvements in addressing the climate crisis in marine and coastal areas and explains relevant operational mechanisms under the Wetlands Conservation Act, since all NEAMPAN sites in the ROK are designated as CWPAs under this legislation.

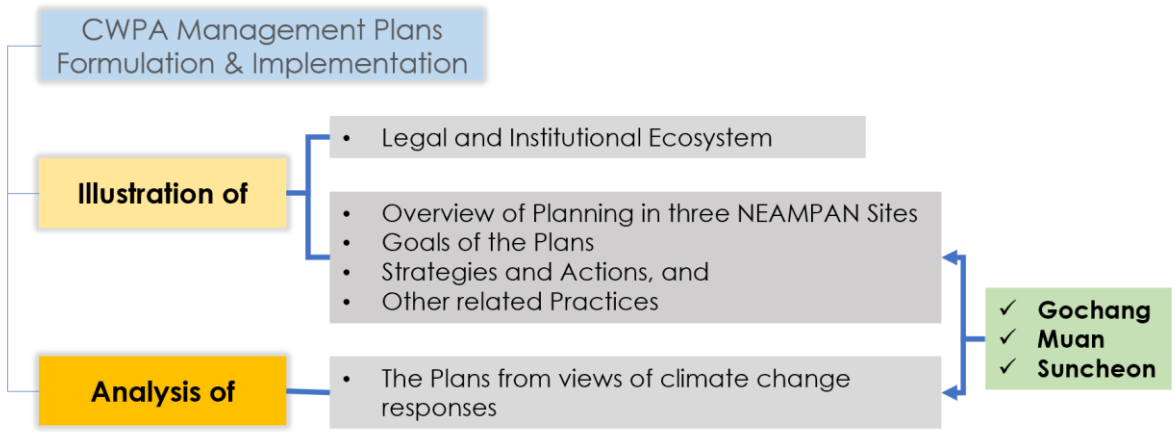

Figure 31. Overview of Chapter 5

5.1 Legal and Institutional Environment surrounding CWPAs Planning and Management

All NEAMPAN sites in the ROK fall under the CWPAs category within the national CMPAs legal system. The Wetlands Conservation Act serves as the primary legal foundation for the designation, planning, and implementation of CWPA management processes. As aforementioned, the Wetlands Conservation Act, jointly legislated by MOE and MOF, ensures that national plans for wetlands conservation are developed and implemented through close cooperation.

While the Framework Plan for Wetlands Conservation is primarily led by the MOE in its planning phase, the designation process for Wetlands Protected Areas (WPAs) is independently carried out by the two ministries: MOF oversees tidal flats, and MOE manages terrestrial wetlands. To minimize jurisdictional conflicts and overlaps and maximize synergies, an active consultation process involves both ministries alongside local stakeholders and environmental NGOs.

The management planning process for each CWPAs follows a similar pattern to the designation process, particularly in transboundary areas spanning coastal and terrestrial zones. The formulation of the management plans engages a broad range of actors, including MOF, government-affiliated agencies such as Korea Marine Environment Management Corporation (KOEM), Regional Offices of Oceans and Fisheries (ROOF), local governments (provincial, city, and county levels), expert groups, NGOs, and local communities, including fishery and tourism sectors.

The plans are also integrated into broader national policies, such as the Getbol Conservation and Restoration Plan, the National Blue Carbon Strategy, the Restoration Strategy of Getbol Ecosystems, and the National Biodiversity Conservation Strategy. The recent survey conducted by KOEM on Getbol ecosystems and their socio-economic conditions plays a substantial role in designing specific management actions.

During the implementation phase, local governments and ROOF are key players responsible for securing budgets to execute planned actions and projects, and monitoring activities within the CWPA boundaries. Coastal communities, particularly fishermen associations, retain traditional use rights for commercial fisheries and clams, coupled with responsibilities toward Getbol ecosystem conservation. Furthermore, international protected area systems and conventions addressing the twin crises of biodiversity loss and climate change directly influence the planning and management of CWPAs.

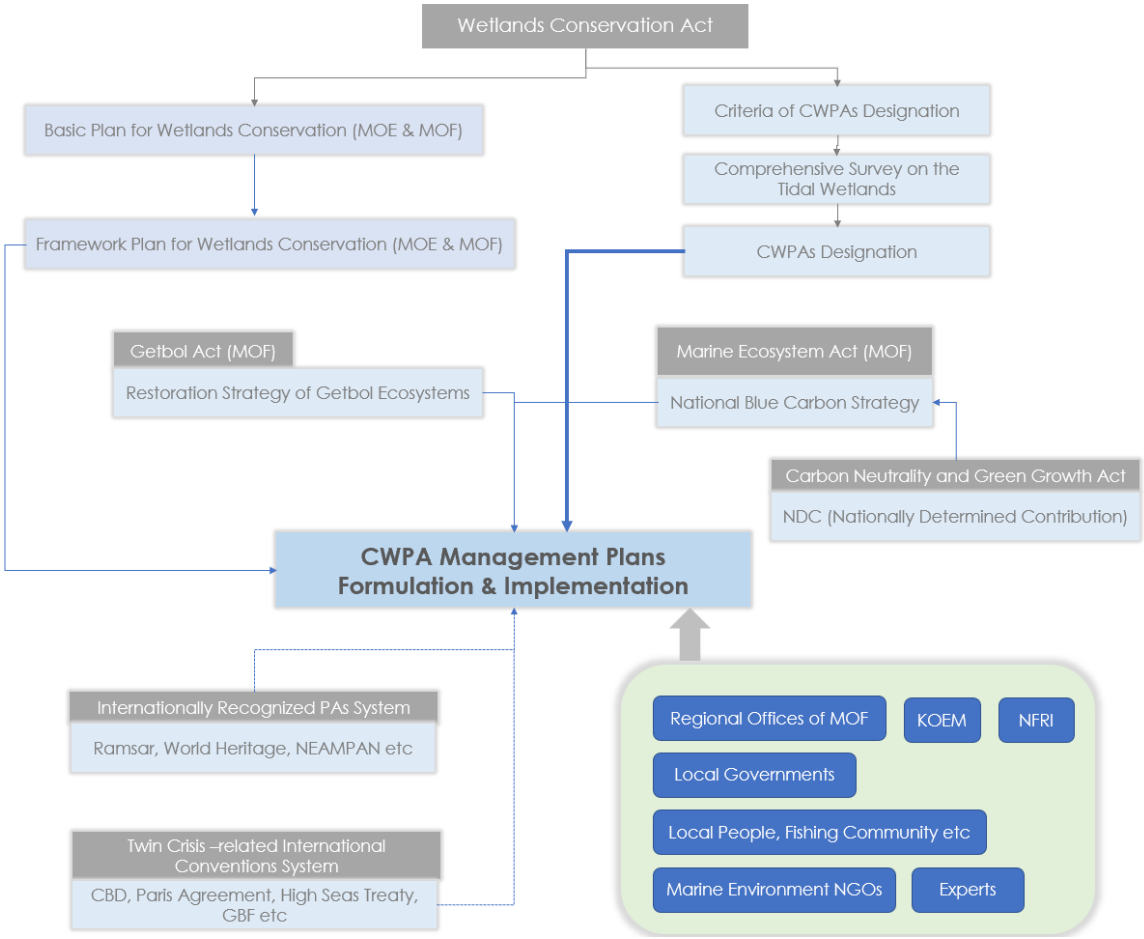

Figure 32. Legal and Institutional Environments of CWPAs Planning and Management

Note: Procedures and standards on CWPAs designation are detailed in a report prepared by Jang and Kim and submitted to NEASPEC in 2022.

5.2 Management Plans of NEAMPAN Sites

This subsection reviews the current status of management plans of the three NEAMPAN sites in the ROK: Muan, Suncheon, and Gochang CWPAs.

Muan and Suncheon Getbols were among the earliest designated sites under the Wetlands Conservation Act, while Gochang joined the CWPAs at a later stage. For reference, Julpo Getbol, an area of 4.9 km^2 adjacent to Gochang Getbol, was designated as a CWPA on 5 December 2006.

The management plans for CWPAs are usually recommended to be updated every five years. However, the actual intervals vary based on local managerial and financial capacities. The following analysis provides details on the management plans for the three NEAMPAN sites, emphasizing their alignment with OBCA and their effectiveness in addressing climate change challenges.

Name	Designation Dates	Area (km^2)	Local Governments & Regional Offices of Oceans and Fisheries	Planning History
Muan CWPA	Dec. 28, 2001	42.00	・Muan County ・Jeollanam-do ・Mokpo ROOF	・1st Plan (2003-2010) ・2nd Plan (2011-2015) ・3rd Plan (2017-2021) ・4th Plan (2022-2026)
Suncheon CWPA	Dec. 31, 2003	28.00	・Suncheon City ・Jeollanam-do ・Yeosu ROOF	・1st Plan (2004-2018) ・2nd Plan (2019-2023) ・3rd Plan (2024-2028)
Gochang CWPA	Dec. 31, 2007	64.66	・Gochang County ・Jeollabuk-do ・Gunsan ROOF	・1st Plan (2010-2013) ・2nd Plan (2014-2018) ・2nd Plan (2020-2023)

Table 7. CWPA Designation and Authorities related to their Management

Note: The planning order before 2014 is arbitrarily assigned due to unavailable records.

5.2.1 Review of the Muan CWPA Management Plan

The Muan CWPA has undergone four management plans since its initial designation:

- The 1st Plan (2003-2010): formulated and developed by the MOF; and
- The 2nd to 4th plans: each spanning five years, with the most recent (2022-2026) prepared by the Mokpo ROOF.

The transition of management planning responsibility from the national MOF to the regional Mokpo ROOF indicates recognition of the importance of building local management capacity, with the MOF providing technical and administrative support.

The 4th Plan consists of (1) introduction, (2) domestic and international management case studies, (3) evaluation of the 3rd Plan's implementation performance, (4) assessment of management conditions, (5) strategies and actions. and (6) output assessment and feedback.

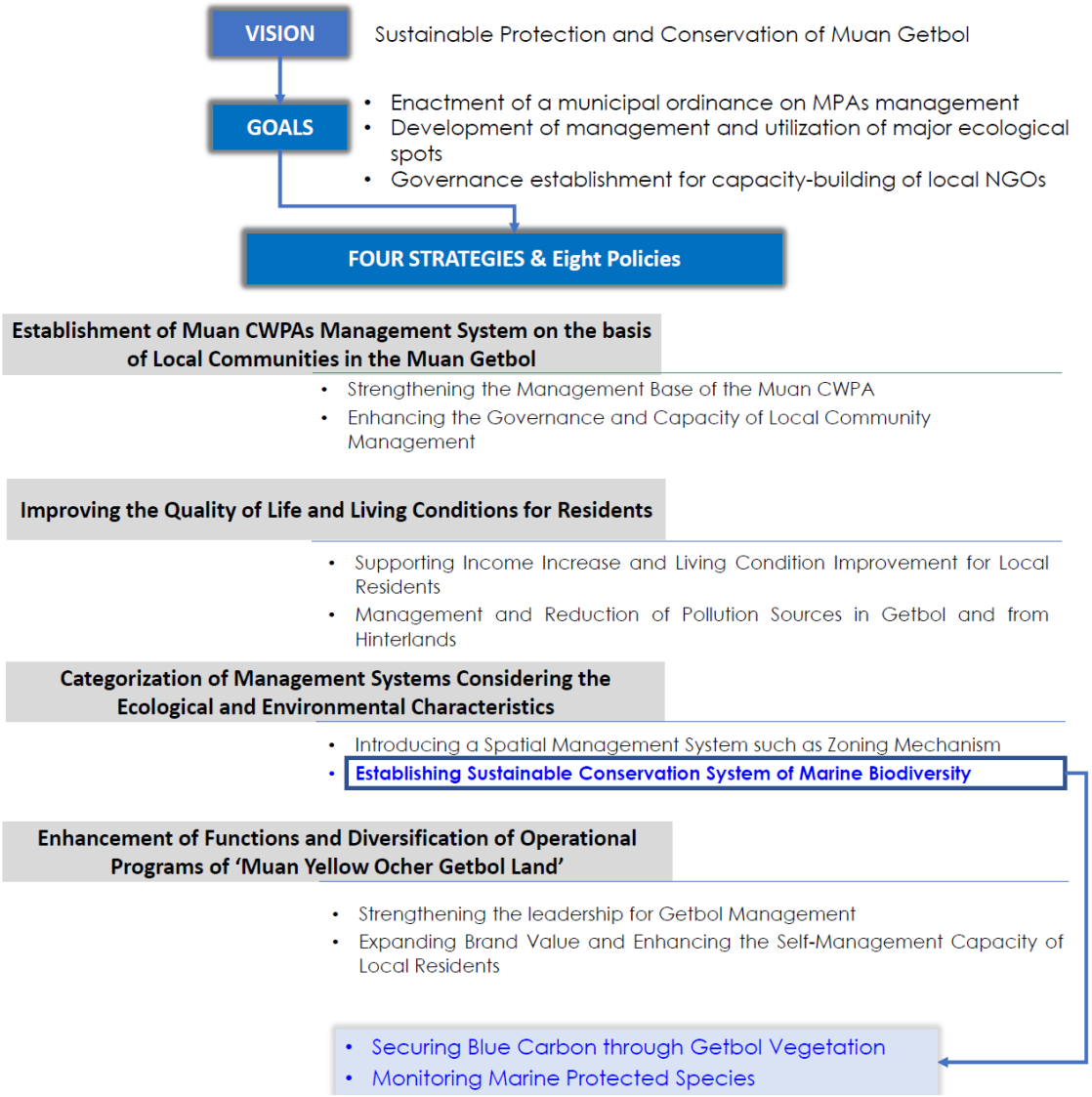

Figure 33. Outlines of the 4th Muan CWPA Management Plan (2022-2026)
Source: Adopted and restructured from Mokpo ROOF (2021)

SWOT analysis of Management Conditions

The management conditions of the Muan CWPAs were assessed using a SWOT (strengths, weaknesses, opportunities, and threats) framework. The SWOT analysis acknowledged recent challenges such as COVID-19, demonstrating planner awareness of recent conditions. However, climate change, as the most concerning issue, was not addressed, missing a critical opportunity for integrating climate-related actions.

Vision, Goals, and Basic Directions

The plan's vision centers on "Sustainable Protection and Conservation of Muan Getbol" with goals including 1) enacting a municipal ordinance on MPA management, 2) developing management and utilization of major ecological spots, and 3) establishing governance for capacity-building of local NGOs.

To achieve the goals, two basic policy directions guide actions through four management strategies: 1) strengthening the sustainability of the Getbol environment and its biodiversity, and 2) diversifying utilization of Muan's "yellow ocher Getbol" and enhancing cooperation. Despite its recent development (2021), the plan does not address climate change concerns explicitly.

Strategies and Actions

The plan includes four strategies and 16 actions. OBCA-related actions are articulated under Strategy 3 (Categorization of Management Systems), titled "Establishing Sustainable Conservation Systems of Marine Biodiversity". This section focuses on expanding blue carbon ecosystems through active vegetation and monitoring climate-vulnerable marine protected species. Other actions under the Strategies address controlling anthropogenic stressors on the ecosystem and promoting the local economy by sustainably utilizing Getbol resources.

5.2.2 Review of the Suncheon CWPA Management Plan

The first Management Plan for Suncheon CWPA was formulated in 2003, concurrently with its designation, enabling immediate plan implementation. The 1st and 2nd Plans were prepared by MOF, while the 3rd Plan was developed by Yeosu ROOF in 2023.

Management Condition

The planner recognizes the necessity and importance of climate change scenarios, vulnerability assessments, and Carbon Dioxide Removal (CDR). These elements are considered as essential for preventing habitat shrinkage, mitigating biodiversity loss and risks to endangered species, and enhancing blue carbon potential. The SWOT analysis further strengthens this recognition by identifying the high ecological connectedness of the Bay Getbol and the abundance of blue carbon resources as opportunities. The management condition analysis is subsequently reflected in the vision, goals, and strategies of the plan through the Strength-Opportunity (SO) strategy derived from the SWOT analysis. Based on this analysis, OBCA for the CWPA was articulated in the plan as follows:

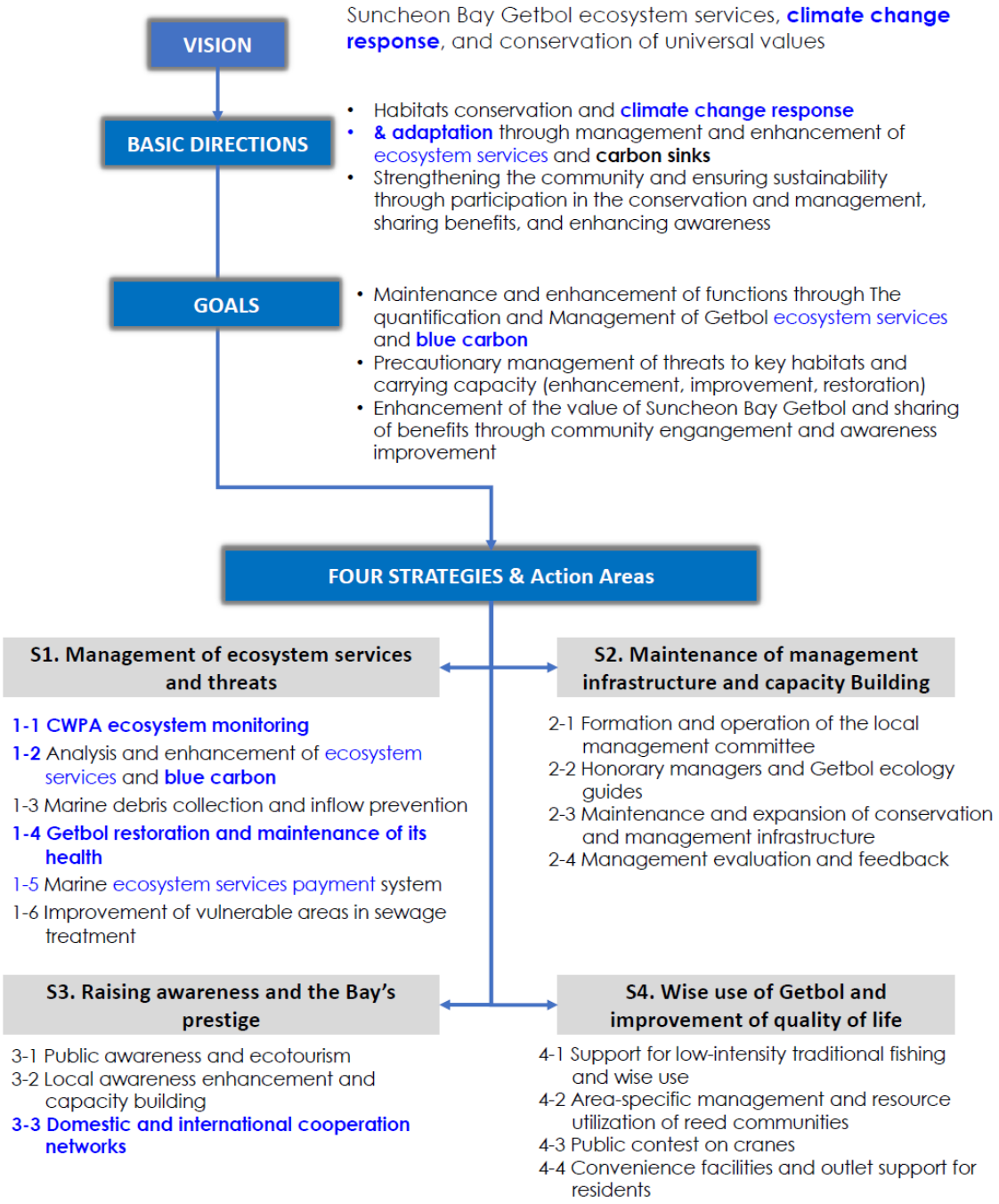

Figure 34. Outlines of the 3rd Suncheon Getbol CWPA Management Plan

Source: Adopted and restructured from Yeosu ROOF (2023)

Note: The blue-colored phrase indicates actions related to climate change

Strategies and Actions

The 3rd Suncheon CWPA Management Plan strengthens climate-related actions to address the climate change impact, focusing on the expansion of carbon sinks and the restoration of associated habitats. Climate change actions were mainly articulated under strategy 1 and strategy 3, as detailed below:

- Action 1-1 of Strategy 1: Vulnerability Assessment and Response Strategy Preparation

- Recognizing the importance of observing the ecological impacts of climate change, the following actions were prepared:
  - ✓ Monitoring of climate change-related parameters, especially sea water temperature, marine species, and habitats, and accumulation of observation data;
  - ✓ Risk assessment of climate change impacts on the marine ecosystem based on projected scenarios; and
  - ✓ Preparation of a long-term response strategy to climate change

- Action 1-2 of Strategy 1: Ecosystem Service Assessment and Blue Carbon
  - Assessment of marine ecosystem services provided by the Getbol, including:
    - ✓ Scientific assessment;
    - ✓ Application Rapid Assessment Method of Wetland Ecosystem Services (RAWER); and
    - ✓ Citizens' participation in the assessment process
  - Survey on blue carbon habitats, measurement of carbon sink capacity, and assessment of threats to the ecosystem services
  - Formulation and implementation of a restoration plan based on research and survey findings
- Action 1-4 of Strategy 1: Halophyte Restoration and Blue Carbon Expansion
  - Restoration of damaged halophyte habitats: the restoration plan has details on project locations and sizes.
  - Removal of oyster reefs and vegetation on the restoration sites
  - Expansion of blue carbon through halophyte habitats restoration
  - Restoration of freshwater wetlands in hinterlands and linking them with blue carbon habitats
  - Evaluation of performance effectiveness through monitoring
- Action 3-3 of Strategy 3: Enhancement of domestic and international cooperation on climate change and blue carbon
  - Positioning Suncheon Getbol as an arena for cooperative research and knowledge sharing on climate change and blue carbon
  - Enhancement of collaboration with international entities and domestic entities

Notably, the plan is characterized by detailed descriptions of project execution and the mainstreaming of climate change into the plan, enhancing its feasibility for practical implementation and increasing the likelihood of achieving its goals within the designated timeframe. Citizen monitoring and participation are strongly encouraged, and an evidence-based approach is adopted. The 3rd Plan represents a significant advancement in terms of climate action, compared to the 2nd Plan, which did not address climate change issues.

5.2.3 Review of the Gochang CWPA Management Plan

The first Management plan for the Gochang CWPA was implemented from 2010 to 2014; and the 2nd Plan was formulated in 2013 and implemented until 2018. The 3rd Plan was established in 2019 and is being implemented for the period 2020-2024. The two-year gap between the 2nd and the 3rd Plans

does not imply a lack of conservation efforts for the CWPA. During this period, regular projects and activities such as survey, monitoring, and operation of the local CWPA committee, were continued. Furthermore, long-term restoration projects requiring investment over five years were executed across the respective temporal scopes of each plan.

The 3rd Plan consists of (1) introduction, (2) cases of domestic and international management, (3) evaluation of implementation performance of the 2nd Plan, (4) analysis of management conditions, (5) strategies and actions, and (6) output assessment and feedback. Key points of the plan are outlined below.

SWOT Analysis of Management Condition

The conditions surrounding the management of the CWPAs were analyzed using a SWOT framework. The analysis identified the following elements:

- Strength: valuable biodiversity within the CWPA
- Weakness: overlapping duties among relevant ministries and insufficient management capacity
- Opportunities: recommendation for Man and the Biosphere (MAB) and World Heritage nominations; and
- Threats: reduced fishery production affecting local livelihoods.

The planner did not consider the impact of climate change on the ecosystem as a threat, nor did the analysis include climate response capacity under the strengths or weaknesses categories. Consequently, the resulting SO, ST, WO, and WT strategies did not appropriately indicate strategies or policy directions for climate change-related actions.

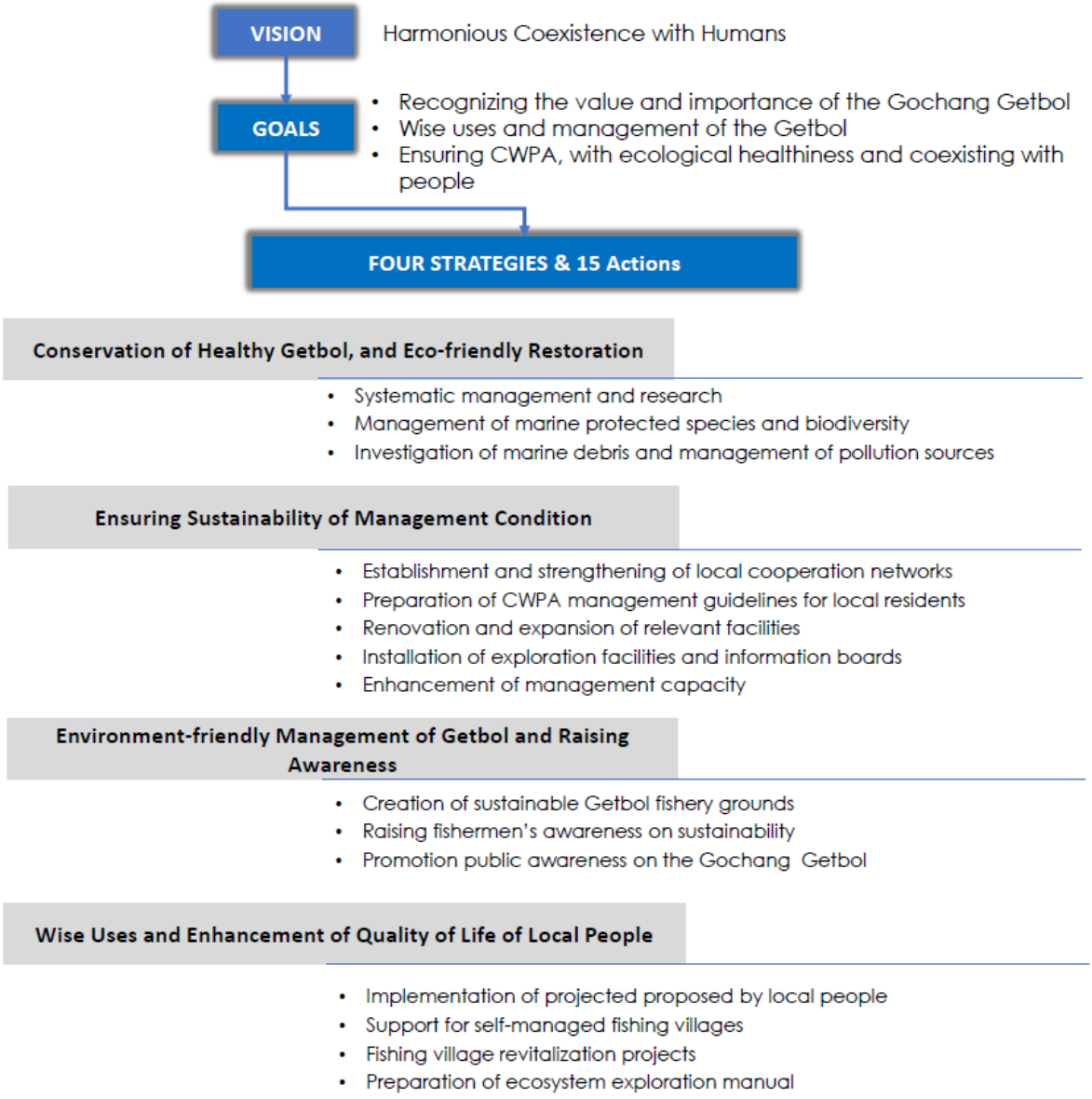

Figure 35. Outlines of the 3rd Gochang Getbol CWPA Management Plan
Source: adopted and restructured from Yeosu ROOF (2023)

5.3 Summary and Discussion

The Government of the Republic of Korea recognizes the need to address both anthropogenic threats and climate change impacts to ensure effective conservation of marine biodiversity. At the national level, policies and strategies have increasingly incorporated climate change considerations, while challenges remain at the local implementation level, where climate change concerns are not consistently or adequately integrated into management plans. For example, while the MOF acknowledges the importance of climate change in marine ecosystem management, this recognition is not always clearly reflected in the local CWPA management plans, as evidenced by the review of the three NEAMPAN sites.

Effective biodiversity conservation in CWPAs requires integrated approaches that address both immediate anthropogenic impacts and long-term climate change impacts. The following section provides a comparative summary of the three CWPA management plans from a climate change perspective and discusses key consideration for incorporating climate change concerns into future planning efforts.

5.3.1 Summary of Three CWPA Plans

Muan CWPA has experienced several management cycles since its designation in 2001, culminating in the fourth plan (2022-2026), developed by the Mokpo Regional Office of Oceans and Fisheries (ROOF). This plan incorporates a SWOT analysis that identifies strengths, weaknesses, opportunities, and threats in management conditions. However, it lacks comprehensive focus on climate change, instead prioritizing local capacity-building and the sustainable use of the Getbol environment. Key strategies emphasize strengthening the sustainability of the Getbol ecosystem, diversifying its utilization, and enhancing cooperation. Actions include monitoring marine biodiversity and expanding blue carbon ecosystems through vegetation.

Suncheon CWPA, designated in 2003, has demonstrated significant evolution in its management plans. The 3rd Plan (2024-2028), prepared by the Yeosu ROOF, integrates climate change considerations more comprehensively than its predecessors. It includes actions to assess vulnerability to climate change, monitor related parameters, and implement long-term response strategies. The plan focuses on expanding carbon sinks, restoring habitats, and fostering domestic and international cooperation on climate change and blue carbon issues, providing a comprehensive model for addressing the climate crisis.

Gochang CWPA management has evolved through continuous planning, starting with its first plan in 2010. The 3rd Plan (2020-2024), prepared by the Gunsan ROOF, prioritized local economic improvement through sustainable fishery practices. However, it lacks clear focus on climate change actions, underscoring the need for future plans to incorporate climate resilience strategies. The strategies in the Gochang plan include recognizing the ecological value of Gochang Getbol, maintaining ecological health, and promoting wise use led by local communities.

Among the three CWPA plans, the Suncheon CWPA stands out as an exemplary case in preparing and implementing actions to address climate change impacts. The other two plans, Muan and Gochang, need to prioritize proactive climate actions based on enhanced awareness of the role that CWPAs or MPAs can play a role in mitigating climate change impacts.

Plans	Description on OBCA
Muan: 4th Plan (2022-2026)	Highlights capacity-building for local authorities, sustainable conservation strategies, and utilization of Getbol resources, but lacks comprehensive climate change actions.

Suncheon: 3rd Plan (2024-2028)	Advanced integration of climate actions, focusing on carbon sink expansion, ecosystem service assessments, and detailed project execution plans, making it a robust model for climate adaptation in CWPA management.
Gochang: 3rd Plan (2020-2024)	Focuses on improving local livelihoods through productive fisheries and wise use of Getbol, but lacks prioritization for climate change issues, indicating a need for better incorporation of climate strategies in future plans.

Table 8. Summary and OBCA-related Description of the Three CWPA Plans

5.3.2 Discussions

A crucial question arises: why do certain plans incorporate climate-related actions into CWPA management, while others do not, despite the Government's emphasis on climate change in marine biodiversity conservation policies? This subsection explores factors influencing this discrepancy.

Institutional Mechanism at the Local Level

The three CWPAs have municipal ordinances supporting Getbol conservation and education hubs for visitors. Surprisingly, the Gochang Plan does not include climate actions, despite the existence of three ordinances related to Getbol conservation: the Coastal Wetland Commission Ordinance (2012), the Heritage Ordinance (2015), and the Ramsar Ordinance (2018). Similarly, Muan County, despite two ordinances, shows limited implementation of climate-related actions. In contrast, the Suncheon CWPA Plan successfully mainstreams climate actions into the management of Suncheon Bay's Getbol. In support, Jeollanam-do Province has also enacted provincial-level ordinances such as the Getbol Ordinance (2022) and the Wetland Conservation and Management Ordinance (2023).

Local Governments	Ordinances on Getbol Conservation
Gochang County	· Coastal Wetland Management Commission (2012) · Heritage Management (2015) · Ramsar Site (2018)
Muan County	· Getbol Ordinance (2003) · Yellow Ocher Getbol Lands (2017)
Suncheon City	· Management Support of Suncheon Bay's Wetland · Wetland Management Commission (2015)
Jeollanam-do Province	· Getbol Ordinance (2022) · Wetland Conservation & Management Ordinance (2023)

Table 9. Ordinances related to Getbol Conservation and Management

The institutional mechanism at the local level does not inherently ensure the integration of climate actions into CWPA management plans. While the existing ordinances focus on establishing management commissions and outlining mandatory tasks for CWPA conservation, they often lack comprehensive guidelines for formulating management plans that address emerging issues such as climate change. This gap highlights the need for more detailed directives and an emphasis on incorporating adaptive measures to effectively respond to evolving environmental challenges.

Getol Restoration and Climate Action

Although the management authorities for Muan and Gochang CWPAs did not explicitly classify restoration as a component of ocean-based climate actions, several restoration projects have been undertaken over the past decade. Recently, the recognition of Getbol restoration as a contributor to blue carbon expansion has gained traction among public, governmental and private sectors, particularly those adopting environmental, social and governance (ESG) principles. The shift underscores the growing awareness of Getbol's significant potential for carbon absorption and storage. However, the connection between ongoing restoration efforts and climate action through blue carbon expansion remains absent in the management plans of these CWPAs.

Securing budgets for restoration remains a critical challenge for local governments, especially in financially constrained areas such as Gochang and Muan. While Muan CWPA achieved a successful restoration project in 2013, the county recently withdrew a planned Getbol restoration project due to financial and administrative hurdles. The restoration project, initially approved by MOF, included a national fund allocation of USD 28.6 million and a matching fund of USD 5.7 million from Muan County. However, the county expressed concerns over additional costs for compensating landowners, estimated at USD 35.7 million, which exceeded the available funding. Despite the setback, it is hoped that Muan and Gochang Getbol management authorities will prioritize climate change response actions, including blue carbon initiatives, in their future plans. Suncheon CWPA serves as an exemplary case, demonstrating how proactive measures and integrated planning can effectively address climate challenges while promoting conservation and sustainable use.

County/City	Site name	Period	Budget (million USD)	Restoration Areas
Muan	-	2013	0.3	0.01 km^2
	Tando	withdrawal	34.2	1.71 km^2
Gochang	Simwon	2010-2013	5.1	0.96 km^2
	Simwon	2017-2020	3.3	0.39 km^2
Suncheon	Nongju-ri	2010-2011	1.4	0.12 km^2
	Jangsan	2016-2018	5.0	0.42 km^2
	NS	2024-2027	NA	2.1 km^2

Table 10. Restoration of Getbol in Three CWPAs

Source: adopted from MOF (2021), and news articles

Note: NS = sites are not specified; and NA = information is not available.

Umbrella Effect of the National Policy Regime

Actions and practices at the local level are largely governed by the national policy regime, which serves as the foundation for financial and administrative support from relevant ministries to local

governments. Ordinances of local governments are prepared and implemented only when related national laws are enacted. Detailed guidelines for managing individual CWPAs are often linked to specific articles within these laws and national plans. For example, the Wetlands Conservation Act outlines the key elements that must be included in CWPA management plans (Article 11). These include: the basic direction for wetlands conservation; the installation of facilities for conservation and use; the management and restoration of wetlands; the maintenance of water flow in riverine areas; biodiversity conservation; and improving the quality of life for local communities. However, the current Wetlands Conservation Act does not explicitly mandate the inclusion of climate action in CWPA management plans.

The Framework Plan for Wetlands Conservation, as a more detailed instrument than the Act, is expected to guide site-specific planning. The 4th Framework Plan, established in 2022 and implemented from 2023 to 2027, sets a major goal of "Creating Sustainable Wetlands Ecosystems to Address the Climate Crisis". Core policies under this plan include: scientific assessment of wetlands to address climate change; enhancement of conservation, restoration, and management of wetlands; expansion of local community engagement in protected area management; increase of carbon sinks through wetland restoration; and ecosystem service assessment and encouragement of wise use. In contrast, the 3rd Framework Plan did not explicitly address climate action, indicating a progressive shift in national priorities.

It remains unclear whether the 4th Framework Plan for Wetlands Conservation influenced the inclusion of climate actions in the 3rd Suncheon CWPA Management Plan (2024-2028) as part of an umbrella effect. While changes in legal and institutional mechanisms at higher levels undoubtedly impact on-site practices and planning, it is uncertain if the Suncheon Plan's integration of climate actions resulted directly from this influence. Nonetheless, the alignment of national goals with site-specific management plans highlights the potential for stronger linkages between national policy frameworks and local-level implementation in the future.

Limited Implementation of Guidelines from Internationally Recognized MPA systems: "Crown Effect" or "Paper Sites"?

The three CWPAs – Suncheon, designated as a Ramsar site in 2006 to protect migratory birds and their habitats; Muan in 2008 for milky fiddler crabs and migratory birds; and Gochang in 2010 for coastal biodiversity – serve as notable examples of sites under international conservation frameworks. However, the World Heritage Convention mechanism, recently applied to these areas, appears to have had less influence on the management direction of these CWPAs compared to the Ramsar Convention mechanism. Consequently, it is plausible that climate change considerations under the World Heritage Framework have not been fully integrated into the management plans for these CWPAs.

The Ramsar Convention, through its "New Guidelines for Management Planning for Ramsar Sites and Other Wetlands (Resolution VIII.14, 2002)" explicitly incorporated climate-related actions years before these sites were designated as Ramsar sites. The guidelines also highlight other critical issues, such as the management of invasive species under Resolution VIII.18. Despite this, the three CWPAs do not fully reflect these considerations in their respective management plans. This raises an important question: why did the 2002 Ramsar Guidelines not significantly influence the management plan

directions concerning climate change issues?

Three possible explanations emerge:

1. **Site designation leadership and readiness at the local level:** The designation of these sites as Ramsar sites was likely driven by central government initiatives and advocacy from environmental groups, aiming to enhance protection by aligning with international frameworks. However, local authorities and communities may have had limitations in understanding of the implications of these designations. Without sufficient preparedness or institutional capacity to incorporate international guidelines into site-specific management, the focus may have remained limited to achieving the designation rather than its full operationalization.

2. **Limited attention from international leadership:** The Secretariats of Ramsar and World Heritage Conventions may not have provided specific attention to ensuring that the climate-related guidelines were effectively adopted in the management of these sites. Consequently, the expected leadership and direction from these international bodies may not have been fully realized at the local level. Instead, the management practices continued to align with national legal systems, which did not strongly mandate climate change responses within CWPA management plans during that period.

3. **CWPA policy in the ROK before the 2020s:** Prior to the 2020s, CWPA policies were more centered on addressing anthropogenic stressors, such as habitat destruction, and on promoting local economic benefits, particularly in areas adjacent to the CWPAs. Adaptation and response strategies for climate change have not yet been mainstreamed into management planning. Climate change was more often cited as a general cause or external factor rather than being addressed as a central component of conservation and management actions.

CHAPTER 6. RECOMMENDATIONS

Oceans have been gaining increased attention from the global community, particularly since the adoption of the "Oceans for Climate Declaration: A Healthy and Productive Ocean for a Resilient, Natura-Positive and Net-Zero Future" at the 25th session of the Conference of Parties (COP25) to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2019. Later, at the G20 Summit in November 2022, global leaders adopted the "Recommendation on Promoting Ocean-based Solutions to Climate Change", which highlights ocean-based solutions, blue carbon as a nature- and ecosystem-based solution, and policy-science communication, among other priorities.

In line with these global developments, ESCAP member States advanced ocean-based climate actions by adopting a resolution entitled "Regional Cooperation to Accelerate Climate Action on Oceans in Asia and the Pacific for Sustainable Development" in May 2023. The resolution encourages actions including capacity building, innovation, and the development and transfer of technology. As requested in the resolution, ESCAP convened dialogues on ocean-based climate action (OBCA) and outlined the scope of a Regional Initiative, identifying four key areas to promote OBCA:

(1) protecting and enhancing blue carbon ecosystems;

(2) decarbonizing shipping and marine connectivity;

(3) accelerating the deployment of ocean-based renewable energy; and

(4) enhancing ocean-climate resilience.

Specifically, the first area, "protecting and enhancing blue carbon ecosystems" underscores the critical role of marine protected areas (MPAs) through proposed actions such as increasing MPA coverage and investing in marine conservation and protection, including the expansion of MPAs. Prior to the adoption of the 2023 Resolution, NEAMPAN had already initiated discussions on climate change and MPAs, organizing two webinars on the topic in 2022 and 2023 under NEASPEC. ESCAP thus continues to take significant steps toward unified efforts to address climate-related ocean risks. The absence of clear, MPA-centered climate actions may help explain the limited implementation of climate-resilient practices in the Republic of Korea and more broadly across the Asia-pacific region.

This report serves as an initial step for NEAMPAN to address ocean-based climate actions for marine ecosystem and biodiversity protection in North-East Asia. The following recommendations are targeted at the Government of the Republic of Korea, NEAMPAN member States, and NEASPEC Secretariat. They propose four strategic areas to advance OBCAs focusing on MPAs:

- Enhancing site-specific knowledge on climate change impact on MPAs;
- Strengthening institutional capital through "umbrella" and "crown" effects;
- Enhancing comprehensive ocean climate capacity; and
- Establishing functional MPA networks at national and regional levels.

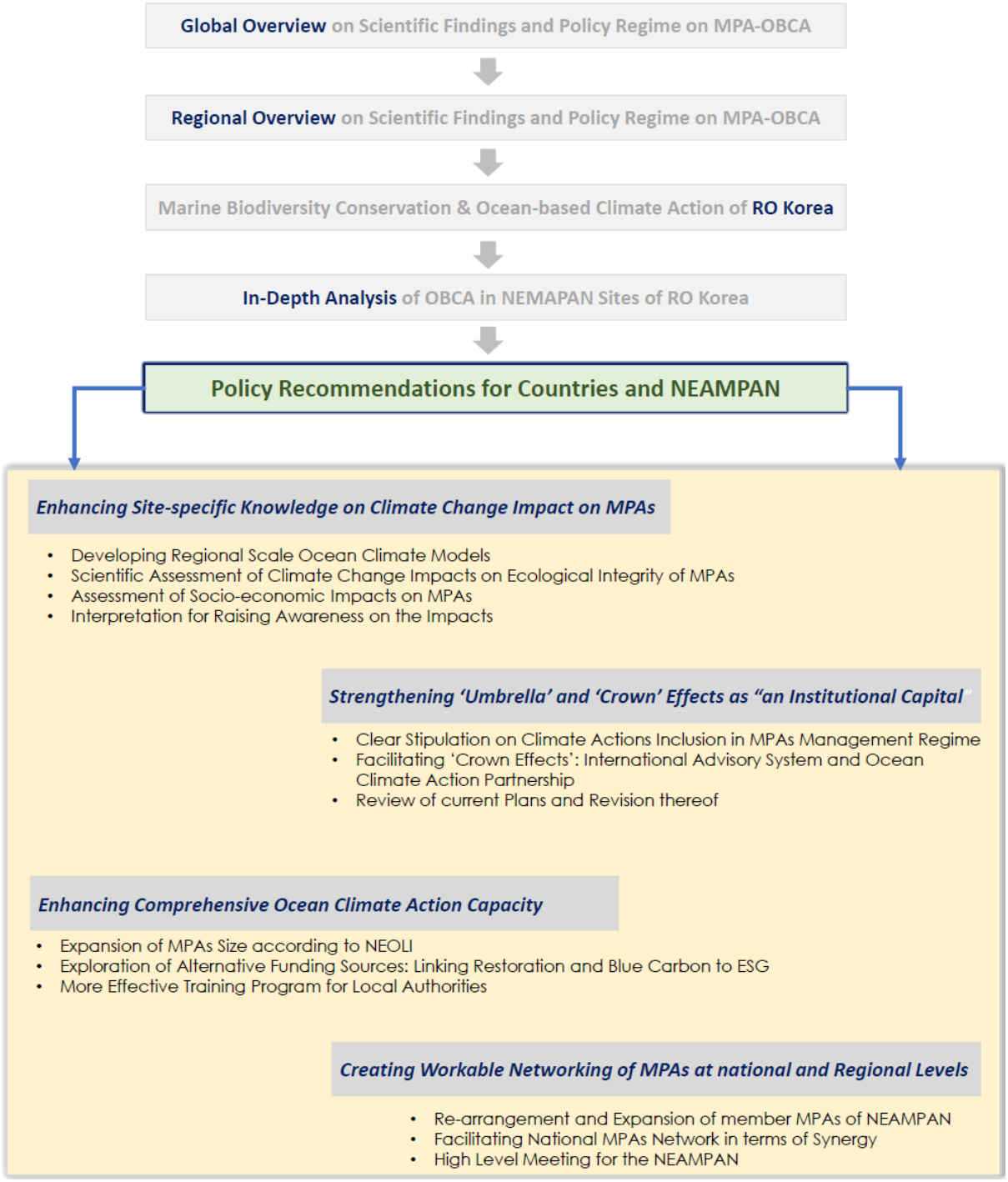

Figure 36. Outline of Policy Recommendations for Countries and NEAMPAN

6.1 Enhancing Site-specific Knowledge on Climate Change Impact on MPAs

Scientific findings indicate that climate change affects the ecological functions, structure, and processes of marine ecosystems. While some findings suggest that climate change may bring certain benefits to specific ecosystems or communities, most research projects identify negative impacts on marine biodiversity and ecosystem services. However, limited research has focused on the specific

impacts of climate change on MPAs, resulting in insufficient understanding among MPA managers and authorities. This knowledge gap may weaken the emphasis on integrating climate actions into MPA planning and management. Moreover, due to the lack of site-specific evidence of climate impacts, MPA planners and managers often have limited rationale to justify the incorporation of ocean-based climate actions into the management of MPAs under their jurisdiction. Addressing this gap requires a targeted approach through four key strategies:

Developing Regional-Scale Ocean Climate Models

The Sixth Assessment Reports (AR6) of the Intergovernmental Panel on Climate Change (IPCC, 2021-2023) provide valuable insights into mitigation and adaptation strategies based on marine ecosystem vulnerability assessments. However, global climate models (GCM), with grid sizes between 250 and 600 km, currently have low resolution and limited predictive accuracy for environmental and ecosystem changes at regional and local scales. Given that the largest MPA in the Republic of Korea is significantly smaller than GCM grid sizes, the application of these models to ocean ecosystems is ineffective.

To enhance accuracy, regional climate models (RCMs), developed and operated by the Government of the Republic of Korea for terrestrial and atmospheric environments, will be further elaborated with finer grids and high resolution to simulate oceanic environments. Scheduled for completion by 2026, this research aims to improve predictions of ocean climate change. Although RCMs may still face challenges in predicting ecological changes specific to MPAs, they could serve as a foundational tool for integrating climate considerations into MPA management.

Scientific Assessment of Climate Change Impacts on Ecological Integrity of MPAs

For climate-resilient decision-making, robust scientific assessment of climate change impacts on MPAs is essential. Such assessments should dive deep into each MPA at a granular level: for instance, simulations using 1 km grids could help forecast changes in ecological functions and processes. The identification and monitoring of climate indicator species within MPAs would also support adaptation efforts by providing insights into ecosystem changes observable through these species.

Assessment of Socio-economic Impacts on MPAs

Climate-induced changes in marine ecosystems will directly affect the socio-economic dynamics and livelihoods of local communities, especially those dependent on fisheries. Sophisticated modeling of future changes can support more informed strategies for MPA planning and management. Comprehensive assessment of both ecological and socio-economic conditions in MPAs can motivate policymakers, local managers, and stakeholders to re-evaluate and reform MPA policies at national and local levels.

Interpretation for Raising Awareness on Impacts

Scientific reports and management plans are often not easily accessible or understandable to the public due to the technical language used. The IPCC addresses this challenge by publishing the Summary for Policymakers (SPM) alongside its scientific reports, aimed at informing policymakers of key findings on climate change. A similar approach in MPA-related climate action could enhance public

awareness and stakeholder engagement. In this context, science translators – individuals skilled in interpreting and communicating scientific findings – could play a critical role. These translators, ideally with expertise in both natural and social sciences, could summarize regional model simulations and link the results to site-level MPA planning and management. Using clear, accessible language and actively involving local residents and managers in the process could further strengthen public understanding and support for climate actions in MPAs.

6.2 Strengthening Institutional Capital Through "Umbrella" and "Crown" Effects

The three Coastal Wetlands Protected Areas (CWPAs) examined in this study are not merely "paper parks"; each has established and implemented management plans since its designation. The conservation and management of these coastal wetlands were initiated by their designation as MPAs, thereby creating "institutional capital" for protecting valuable "natural capital". However, an in-depth analysis review of these MPAs indicates that high-level government policies and international MPA guidelines have had minimal influence on their MPA planning and management, particularly from an ocean climate action perspective. Strengthening the "Umbrella" and "Crown" effects can help the incorporation of climate actions effectively into MPA management. Two strategic options are proposed to achieve this goal.

Clear Inclusion of Climate Actions in the MPA Management Regime

In principle, CWPA planning and management should align with the Framework Plan on Wetlands Conservation, a higher-level, legally-binding regime governing wetlands management. One reason for the absence of climate actions in CWPA plans is the lack of climate-related directions in the third Framework Plan. However, the fourth Framework Plan explicitly emphasizes climate actions to conserve wetlands in both terrestrial and coastal areas. Nonetheless, simply adding climate actions to the Framework Plan does not ensure their implementation at individual sites. Two steps are necessary to ensure meaningful site-level action: (1) clearly defining local planning requirements within the Framework Plan, and (2) formulating actionable guidelines for local planners and managers.

The second Framework Plan on Conservation and Management of Marine Ecosystems (2019-2028) acknowledges climate change risks to marine ecosystems and suggests various policy directions and actions to address them. While this plan could legally influence CWPA management at a national level, it does not directly govern CWPA site plans. Consequently, climate actions contained in national-level frameworks may not yet be effectively translated into local-level CWPA planning and implementation.

Facilitating "Crown Effects": International Advisory System and Ocean Climate Action Partnership

As discussed in Chapter 5, designating CWPAs as internationally recognized MPAs bestows a "Crown" effect, which enhances their conservation status. However, practical support from international entities, such as NEAMPAN, the Ramsar Convention, the World Heritage Convention, and EAAFP, remains limited in relation to OBCAs, despite the stated emphasis on climate response in their mandates.

Currently, international protected area systems have yet to offer practical support for climate action at the local MPA level, but they hold strong potential for future contributions. Two suggestions are offered to realize this potential: (1) establishing an advisory system under each international framework to support pilot sites recommended by member States, thereby accelerating climate action at these sites; and (2) formulating a climate action partnership among Ramsar, World Heritage, EAAFP and NEAMPAN to support coordinated climate action efforts across MPAs in member States.

Review and Revision of Current Plans

A final step to strengthen the "Umbrella" and "Crown" effects is to promote the review and revision of existing plans based on the advisory activities of the proposed "MPAs Climate Action Partnership". The process could begin with pilot cities, in consultation with member States, to develop revised plans that serve as models for replication. Success stories could be shared and expanded through international MPA networks.

6.3 Enhancing Comprehensive Ocean Climate Action Capacity

Building capacity remains a critical and ongoing priority for the sustainable management of natural resources and the protection of ecological integrity, particularly within MPAs. Though the term "capacity building" is often considered a buzzword, its importance cannot be overstated. Capacity takes multiple forms: for instance, the size of an MPA may be viewed as a form of "physical capacity" or "nature-based capacity". The section addresses both physical and broader capacity-building measures.

Expansion of MPA Size based on NEOLI Criteria

Edgar et al. (2014) suggested that successful MPAs meet at least three of five NEOLI criteria: no-take, enforcement, old age (over 10 years), large size (> 10 km^2), and isolation. Currently, the three CWPAs in the Republic of Korea do not meet the criteria of no-take, large size and isolation. Implementing no-take and isolation measures remains challenging due to the proximity of urban areas, socio-economic activities, and the dependence of local communities on fisheries.

One potential solution is to expand MPAs to an area greater than 100 km^2. For reference, four of six NEAMPAN sites in China are smaller than 100 km^2. However, it must be emphasized that MPA size alone does not guarantee success. Given the variation of enforcement, proximity to exploitation zones, MPA age and resource use, size expansion should not be viewed as a core solution.

Exploration of Alternative Funding Sources: Linking Restoration and Blue Carbon to ESG

Marine ecosystem restoration is a highly effective strategy for conserving ecological integrity and enhancing ecosystem health, which is one of the popular actions for MPAs. In the Republic of Korea, coastal wetlands restoration in CWPAs, such as the Getbol restoration, is emblematic of such efforts. However, restoration efforts require substantial funding, and most projects currently rely on public financing, with minimal involvement from the private sector. In some cases, local governments with limited financial autonomy have been forced to cancel approved restoration projects due to funding constraints.

Given the growing global interest in environmental, social, and governance (ESG) goals and carbon offsetting, private sector investment in restoration should be encouraged. Highlighting the carbon sequestration benefits of Getbol restoration and other blue carbon ecosystems could help attract corporate partners aiming to meet environmental criteria. These multi-purpose projects can also generate social benefits such as local employment, improved livelihoods, and enhanced ecosystem services such as water purification and flood control.

More Effective Training Programmes for Local Authorities

Local stakeholders, including MPA authorities and residents, can play a substantial role in achieving the goals of MPA designation and integrating climate action into site management plans. While various training programmes exist for MPA managers and local communities, most are short-term and focus on knowledge-sharing rather than meaningfully improving management capabilities. Although useful, these sessions often do not lead to improved long-term capacity. Acknowledging budget constraints, the current training modalities tend to generate output, but not outcomes.

To address this gap, innovative training approaches are needed. One option is to introduce short-term secondments or internships at international entities for representatives of pilot sites. For instance, selected representatives from pilot sites could undertake one or two-month placements at the NEASPEC secretariat in Incheon, Republic of Korea. During this period, they could develop skills for preparing and implementing site-specific management plans and enhance practical MPA management skills. Although language barriers may pose challenges, candidates with English proficiency could be prioritized to maximize the effectiveness of these placements.

6.4 Creating Workable Networking of MPAs at National and Regional Levels

NEAMPAN serves as a subregional network to promote conservation and improve MPA management. Its activity modalities include research and monitoring projects, information and experience sharing, capacity building, and networking with regional and global mechanisms.[18] With nominated 12 MPAs, NEAMPAN currently functions more as a human network than an ecological interconnected one. This limitation hinders its effectiveness in representing the MPAs of each member State and reduces its operational efficiency, resulting in less coordinated network development. To enhance its effectiveness, additional measures are needed.

Rearrangement and Expansion of NEAMPAN sites

Considering the current MPA coverage within the jurisdictions of NEMAPAN member states and their eco-geographic diversity,[19] NEAMPAN faces limitations in representing the full ecological diversity of the subregion. These constraints affect the network's capacity to fully achieve its objectives, in part due to a lack of the "law of scale", a concept analogous to the economy of scale.

Since NEAMPAN was established in 2013, the total number and area of nominated MPAs have

[18] https://www.neaspec.org/our-work/marine-protected-areas/overview

[19] 2.46% for the ROK, 5.48 % for China, and 13.89 % for Japan (available at https://www.protectedplanet.net/en/thematic-areas/marine-protected-areas),

remained unchanged. While the number of MPAs should not be viewed as the sole criterion for measuring success, and expansion alone does not guarantee greater effectiveness, expanding the network could signal increased engagement and operational dynamism. A larger number of MPAs may also help mobilize resources and elevate NEAMPAN's visibility and priority within NEASPEC activities.

To that end, NEASPEC could adopt a more proactive approach in encouraging member States to nominate additional MPAs, particularly those with distinct eco-geographic characteristics that complement the current sets. To maximize the law of scale, it is proposed that up to 18 more MPAs be integrated into the network. Notably, while the expansion of individual MPAs to more than 100 km^2 remains challenging, a larger, well-distributed network could compensate for this limitation. A geographically diverse network, including subtropical and arboreal regions, could also enhance ocean-based climate action by enabling broader knowledge and information exchange across varied ecological contexts.

Facilitating National MPA Networks to Create Synergy

Member States operate national MPA networks in accordance with their own policies and management contexts. For instance, the ROK Government runs citizen education programmes and hosts two national events annually: (1) National Wetlands Day, jointly organized by MOF and MOE, and (2) the National Fair on MPAs, hosted by MOF. While such event-based networking promotes public awareness, its potential to create synergy remains limited without well-established modalities for such as knowledge sharing, lessons-learned processes, communication channels, and the exchange of information and personnel.

For member States without existing national MPA networks, establishing one would serve as a foundational step in fostering synergy. For those with existing networks, enhancing facilitation modalities and diversifying collaboration tools are recommended to maximize the value of network engagement.

High-Level Meeting for NEAMPAN

In institutional governance systems, laws and institutions are major drivers for policy development and implementation. An integrated approach that combines top-down and bottom-up approaches can be effective, provided that the legal system supports a two-way interaction in agenda-setting and implementation. Despite the benefits of such integration, sustained high-level commitment remains essential to ensure a workable and sustainable mechanism. To further activate and institutionalize NEAMPAN, it is recommended that regular high-level meetings be convened, involving at least director-general-level officials from each member State. Once sufficient output has been generated from these high-level meetings, the possibility of convening a ministerial-level meeting may be considered.

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