FEBRUARY 2025

Ramsar & Marine Protected Areas Conservation Management Plan *2025 – 2029*

Aruba Conservation Foundation

Together for *Nature.*

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Foreword

The **Aruba Conservation Foundation (ACF)** is an independent, non-profit conservation management organization (CMO), mandated by the government of Aruba through a service level agreement (SLA) to manage the legally designated terrestrial and marine protected areas, associated ecosystems, biodiversity, and habitats. ACF works together with the public and private sectors and our diverse community of stakeholders, taking an integrated approach to delivery of our mandate of protecting, preserving, and restoring the island's natural heritage and broader goals of contributing to the sustainable development of Aruba.

ACF protects, preserves, and restores Aruba's valuable heritage, seen from an ecological, environmental, geological, cultural, archaeological, and historical perspective, with the ultimate aim to secure a measurable improvement in the overall biodiversity, health, and (climate) resilience of Aruba's terrestrial, coastal, and marine ecosystems.

As a custodian of the protected areas of Aruba and the biodiversity they harbor, ACF promotes sustainable practices that integrate environmental, social, cultural, and economic objectives, and that address long-term concerns in meaningful ways, to ensure that our natural resources remain relevant for present and future generations. Whenever and wherever necessary, ACF applies the Precautionary Principle (a principle of environmental law) as a strategy to cope with possible risks and potential harm to nature, where scientific understanding is yet incomplete - as is still largely the case for Aruba.

ACF operates within the national and international legal frameworks and environmental policies, and according to the principles of Biodiversity Conservation and Ecosystem-Based Management (EBM), applying best practices and the Conservation Standards (Theory of Change) to deliver high conservation performance and tangible results.

ACF's Multi Annual Corporate Strategy 2023 – 2032 (ACF MACS 2023 – 2032) articulates a clear ambition and direction for the organization in its transition from a traditional park management organization to a modern conservation management organization. Guiding the development of conservation management and action plans is ACF's Conservation Management Framework and Priorities for 2024 – 2033, which lays a strong foundation for stability and growth of biodiversity and ecosystem-based conservation, and ecological sustainability, within a broader context of the sustainable development goals (SDGs) and biodiversity conservation priorities for the protected areas, as indicated in the ACF MACS 2023 – 2032. As such, ACF has clustered the protected areas according to ecosystems, associated biodiversity and habitats, resulting in three Protected Areas Conservation Management Plans (PACMPs), each following a 5-year cycle as of 2025: a Terrestrial PACMP, a Coastal PACMP, and a Marine PACMP.

This document was developed through a process of field observations, literature research and extensive stakeholder engagement with key stakeholders, including nature experts and NGOs, authority representatives, fishers, tourism representatives, tour operators, government representatives, institutions, and social NGOs. As ACF applies adaptive management as a systematic approach to decision-making and planning in nature conservation, ACF emphasizes flexibility, learning, and continuous improvement. This involves consistently monitoring the outcomes of conservation actions, assessing their effectiveness, and adjusting management strategies based on new information and changing circumstances. This means that priorities and actions may be revised annually, also based on available resources.

Executive summary

This **Marine Protected Areas Conservation Management Plan** (PACMP) for Parke Marino Aruba outlines a comprehensive 5-year strategy to protect, enhance, restore, and sustainably manage Aruba's marine ecosystems, including coral reef and seagrass ecosystems, key biodiversity areas (KBAs) and important Ramsar sites. This plan serves as a blueprint for conserving the island's marine biodiversity, ensuring climate resilience, and promoting sustainable use of marine resources through collaboration with local and international stakeholders.

Vision and Objectives

The Marine PACMP is driven by a long-term vision to safeguard Aruba's rich marine biodiversity, enhance ecosystem resilience, and integrate climate adaptation strategies.
Key objectives include:

- Protecting, restoring and managing critical marine habitats such as coral reefs and seagrass meadows.
- Integrating climate resilience into the management of marine ecosystems to mitigate the effects of rising sea levels and temperatures, ocean acidification, and extreme weather events.
- Promoting research, monitoring, and stakeholder engagement to ensure informed and supported conservation efforts.
- Strengthening legal frameworks and governance for marine protection while ensuring sustainable tourism and fisheries management.
- Fostering partnerships and collaborations for enhanced conservation impact.

Key Threats and Challenges

This plan identifies significant pressures on marine ecosystems, including pollution, unsustainable tourism, invasive species, and the effects of climate change. Human activities such as unregulated access, coastal development, and illegal fishing, exacerbate these threats. Additionally, data deficiencies related to ecosystem health and species populations present a challenge for adaptive management.

Fundamental Conservation Strategies

This Marine PACMP emphasizes fundamental conservation strategies, including:

- Zoning and Boundary Demarcation: Establishing protected zones to minimize human impacts on sensitive ecosystems like coral reefs and seagrass meadows.
- Sustainable Visitor Recreation Management: Implementing regulations to control access and reduce impact and physical damage from tourism and recreational activities.
- Enforcement of Protection Measures: Enhancing patrolling and legal enforcement to prevent illegal fishing, pollution, and habitat degradation.
- Sustainable Natural Resource Management: Promoting sustainable practices in tourism, fisheries, and coastal development, while balancing ecological and socio-economic needs.

Thematic Conservation Focus

To support ecosystem restoration and species protection, the plan focuses on:

- Coral Reef and Seagrass Restoration: Initiating projects to restore damaged habitats, enhance species diversity, and reduce the impacts of invasive species.
- Marine Megafauna Protection: Strengthening protections for vulnerable species, such as sea turtles, sharks, whales, and dolphins[1], through monitoring and enforcement, habitat conservation and international collaboration.

Monitoring and Evaluation

Regular monitoring is essential for assessing progress and adapting conservation strategies. The plan outlines a robust framework for biodiversity monitoring, climate vulnerability assessments, and socio-economic evaluations to ensure effective management and timely response to emerging threats.

Partnerships and Governance

Collaboration with local communities, NGOs, and international conservation organizations is central to the PACMP. The plan promotes inclusive governance, stakeholder involvement, and transparent decision-making processes to build support for long-term conservation efforts. Sustainable financing mechanisms, such as eco-tourism levies, will ensure ongoing resources for marine conservation.

The Marine PACMP provides a detailed roadmap for safeguarding Aruba's marine ecosystems, ensuring they remain resilient and thrive for future generations. By integrating science-based conservation with stakeholder engagement and climate adaptation, the plan aims to create a sustainable and balanced future for Aruba's marine environments.

Acknowledgements

The Aruba Marine Protected Areas Conservation Management Plan 2025 – 2029 was developed by Natural Dialogue and the Aruba Conservation Foundation, through numerous stakeholder consultation sessions, and funded by the Dutch Caribbean Nature Alliance (DCNA).

This Marine PACMP 2025-2030 has been approved by the Minister of Nature and is published through the official government channel *Landscourant* and on the website of the Aruba Conservation Foundation.

[1] Conservation actions in relation to seabirds, also considered marine megafauna, have been incorporated into the Coastal PACMP 2025-2029.

Parke Marino Aruba (MPAs and Ramsar)

1. Introduction

1.1 Vision

This vision has been derived through combining stakeholder engagement sessions, the ACF perspective as defined in the ACF Multi Annual Corporate Strategy 2023 – 2032 (ACF MACS 2023 – 2032), and the ACF Conservation Management Framework and Priorities for 2024 – 2033. The 2023 Ramsar designation of additional protected areas (which overlap with the MPAs) highlights the need for focused regeneration and rehabilitation. This enhanced scope is pivotal in preserving our rich biodiversity and resilient ecosystems, emphasizing the regeneration of critical, yet vulnerable habitats such as coral reefs, seagrass meadows and other significant marine features:

Parke Marino Aruba, now embracing the comprehensive marine Ramsar sites surrounding the island, operates and is managed through an integrated and inclusive framework to conserve thriving biodiversity and resilient ecosystems. This approach prioritizes the restoration of key habitats and the protection of our celebrated heritage, ensuring a sustainable Aruba. In response to the additional challenges posed by climate change, Parke Marino Aruba's management focuses on enhancing ecosystem resilience, safeguarding the island's marine biodiversity, and adopting adaptive strategies that align with global conservation goals.

1.2 Objectives

These strategic and operational objectives are designed to create a robust framework for managing Aruba's marine environments, ensuring both their ecological integrity and their contribution to local and global biodiversity conservation efforts. They address the complex challenges facing Aruba's marine environments, ensuring a focused and coordinated approach to marine conservation.

Aruba's marine environments harbour a rich array of habitats, from coral reefs and seagrass meadows to lagoons, inland bays and open ocean. These ecosystems are home to diverse marine life, including crucial breeding grounds for sea turtles, marine mammals, sharks, bony fish and marine invertebrates. The following strategic and operational objectives are based on the thematic marine conservation priorities set out in the ACF Nature Conservation Framework and Conservation Priorities 2024-2033, and the priorities identified in the stakeholder engagement process.

Objective 1: Protect, Rehabilitate and Enhance Marine Biodiversity

To protect, rehabilitate[2] and enhance Aruba's marine species, habitats, and ecosystem resilience for sustainable ecosystem health, incorporating environmental, ecological, and anthropogenic

[2] Rehabilitation emphasizes functionality and improvement, aiming to repair damage and enhance ecological and social benefits without necessarily replicating the original state and is chosen here instead of restoration, which strives for historical accuracy and ecological integrity, aiming to replicate the original ecosystem. Both approaches are essential in conservation and are often chosen based on the feasibility, extent of degradation, and specific conservation objectives. Restoration specifically remains challenging in the Aruban context.

data to identify and address knowledge gaps in marine biodiversity; upholding commitments to local policies[3] and international agreements[4].

This objective aims to ensure the long-term vitality and resilience of marine ecosystems and their associated species, benefiting both local communities and global biodiversity[5]. It will include protocols for monitoring and evaluation, with indicators of management success, and will integrate measures for enforcement and recovery of key habitats and species. This will be achieved through improved management and protection, through targeted restorative efforts and the mitigation of threats and impacts.

Objective 2: Increase Climate Resilience and Reduce Pollution

To uphold commitments to local policies[6] and international agreements[7] and to integrate climate resilience and adaptation into the management of marine and coastal environments and combat land-based and other sources of marine pollution.

This objective focuses on supporting Aruba's marine ecosystems to handle the impacts of climate change and pollution, ensuring their function and services are maintained. Nature-based solutions and ecosystem-based approaches will be prioritized, addressing stressors such as ocean acidification and rising sea temperatures. Monitoring and evaluation frameworks will assess the effectiveness of nature-based solutions and ecosystem-based approaches, addressing stressors such as ocean acidification and rising sea temperatures.

Objective 3: Implement Research and Monitoring

To collect and analyse environmental, ecological, and anthropogenic data on MPAs and adjacent marine environments, identifying and alleviating knowledge gaps; integrating indicators of ocean, marine ecosystem and biodiversity health into monitoring and evaluation programmes, promoting research, monitoring, and stakeholder and community engagement in marine conservation, and enabling informed decision-making through scientific data.

This objective supports sustained conservation efforts through science and public participation, fostering a deeper understanding of marine ecosystems and their vulnerabilities. Additionally, the evaluation framework will include detailed indicators of management success and protocols for adaptive management and enforcement.

Objective 4: Develop Policy, Governance and Finance

To advocate for and implement policy measures that support sustainable marine and coastal management, ensuring governance is financially secure and supports ecosystem health.

[3] Directie Natuur en Milieu, 2024.
[4] United Nations, 1982; United Nations Environment Programme, 1983; United Nations Environment Programme, 1990; United Nations, 1992; Convention on Biological Diversity, 2022.
[5] In alignment with GBF Target 3, this includes a commitment to protect at least 30% of marine and coastal areas by 2030.
[6] CCCCC, 2009; Government of Aruba, 2011and 2018.
[7] Paris Agreement, 2015; UN Global Plastics Treaty, 2022; Convention on Biological Diversity, 2022 (With particular reference to Target 7: Reduce Pollution to Levels That Are Not Harmful to Biodiversity and Target 8: Minimize the Impacts of Climate Change on Biodiversity and Build Resilience).

This objective seeks to influence policy and regulatory frameworks to better protect marine environments while supporting sustainable economic practices. Rules and regulations will be developed and enforced to mitigate threats and manage activities, with clear zoning for human use in MPAs. It also includes the development of robust financial management strategies to ensure the ongoing effectiveness and sustainability of governance efforts. Education and awareness initiatives will be integrated to ensure policy measures are understood and supported by the community.

Objective 5: Strengthen Partnerships and Collaboration

To foster and strengthen strategic partnerships and collaborations for enhanced conservation impact, leveraging collective action from local and international partners. Recognizing the power of collective action, this objective aims to forge strong alliances with various stakeholders to bolster conservation efforts. Institutional relationships, roles, and sources of funding for PACMP implementation will be clarified to ensure a unified approach.

Objective 6: Promote Marine Conservation Education and Awareness

To enhance public understanding and appreciation of Aruba's marine environments through targeted education and awareness initiatives.

This objective aims to build a culture of stewardship among local communities, stakeholders, and visitors[8]. By promoting knowledge about the ecological, cultural, and economic importance of marine ecosystems, it supports broader conservation efforts and fosters long-term community involvement in marine conservation initiatives. Education programs will also include socio-economic aspects of marine conservation to ensure community buy-in and support for enforcement measures.

2. What the MPAs and Ramsar sites are protecting

Description of the Marine Protected Areas

Aruba's marine environments harbour a rich array of habitats, from coral reefs and seagrass meadows to lagoons, inland bays, and open ocean. These ecosystems are home to diverse marine life, including crucial breeding grounds for sea turtles, marine mammals, sharks, bony fish and marine invertebrates such as sea urchins, crabs, lobster and conch. Parke Marino Aruba is composed of four Marine Protected Areas (MPAs) that together cover 6,020 hectares, as detailed in Table 1 and the figure below.

[8] Specific metrics will be developed to measure the reach and impact of education and outreach initiatives, ensuring alignment with GBF Target 19.

Table 1: Aruba's Marine Protected Areas (MPAs)

MPA name	Location	Size (ha)	Natural Values	Cultural/Heritage Values	Socio-Economic Values
MPA Arikok	The coastal waters adjacent to Parke Nacional Arikok (PNA) Located on the eastern coast and runs along an 8 km coastal stretch of the national park, Parke Nacional Arikok (PNA). The border starts at Daimari beach and runs south to Vaderpiet. The MPA extends 2 km seawards and covers a total area of approximately 16.5 km2.	1650	This MPA is connected to the intertidal Sawah banks, sea turtle nesting beaches and shore birds nesting grounds. It encompasses coral reefs, is a dolphin nursery and marine mammal corridor.	Historical significance tied to indigenous use and natural heritage of Parke Nacional Arikok. Offers eco-tourism opportunities, including guided tours and education on local biodiversity.	Supports eco-tourism and local livelihoods through guided tours and recreational activities. Contributes to biodiversity conservation, benefiting fisheries and tourism.

MPA Sero Colorado	The coastal water around the "Eastern Cape" of Sero Colorado Located on the eastern tip of the island and covers a coastal stretch of approximately 9.4 km from Bachelor's Beach to the Refinery of Aruba. The MPA extends 2 km seawards and covers a total area of approximately 18.7 km2.	1870	This MPA is connected to sea turtle nesting beaches and includes sea turtle foraging and resting areas, conch habitat, shark nursery, and marine mammal corridor. Key ecosystems of coral and seagrass (the reef islets and historically red mangroves are included in the Coastal PACMP) are characteristic of this MPA.	Key area for artisanal fishing practices and linked to historical narratives about Aruba's coastal ecosystems. Popular for diving, snorkelling and eco-recreational activities.	Provides critical ecosystem services such as fisheries support, recreational diving, snorkelling, and eco-tourism. Enhances local economic activities through marine-related tourism.
MPA Mangel Halto	The coastal water of Spaans Lagoen, and along Mangel Halto, Isla di Oro, Santo Largo. Located on the southwest coast and covers a coastal stretch of approximately 8 km from Santo Largo to Spaans Lagoen. The MPA extends 2 km seawards and covers a total area of approximately 16 km2.	1600	This MPA is adjacent to Aruba's mangrove forests (included in the Coastal PACMP), and this ecosystem is complemented to form 'the power of three' with seagrass and coral ecosystems. Sheltered by reef islands, this MPA has a coastal lagoon area that is a refuge for many species in fragile life stages or rough weather conditions and an inland lagoon (Spaans Lagoen). The MPA is known to be a conch habitat, crustacean nursery, fish and shark nursery, dolphin nursery and marine mammal refuge.	Cultural ties to artisanal fishing, kayaking, and community-led mangrove restoration projects and reef recreation (covered in the Coastal PACMP). Features educational programs on coastal ecosystems.	Key area for eco-tourism and education on marine biodiversity. Offers economic value through recreational fishing and water sports.
MPA Oranjestad	In the capital city, from the lagoon next to Governor's Bay Beach up to Punta Brabo, excluding the cruise ship passage channel. The smallest of the MPA and located on the southwest coast next to the Oranjestad harbour area. The MPA border circles around the Oranjestad reef islands and	900	This MPA includes coral and seagrass ecosystems. It is an important habitat for conch and octopus and a marine mammal corridor and dolphin nursery. The MPA is connected to sea turtle nesting beaches and the seagrass meadows are sea turtle foraging grounds.	Popular site for local and tourist recreation, including snorkelling and diving. Represents historical and cultural ties to marine life around the Oranjestad harbour area.	Supports eco-tourism, snorkelling, and diving. Provides ecosystem services vital for local fisheries and marine-based recreation.

	extends 2 km seawards, covering a total area of approximately 9 km2.				

On November 10, 2023, the scope of protected wetland areas under the Ramsar Convention of Wetlands were significantly expanded in Aruba[9]. The Aruban Minister of Nature announced the official designation of four new Ramsar sites, and an extension of Spaans Lagoen[10], which has been Aruba's sole Ramsar site since 1980. With these additions, the total area now safeguarded under the Ramsar Convention is 14,408 hectares.

Aruba's Marine Protected Areas (MPAs) and Ramsar sites, together, now fully align with the requirements set out in Article 4 of the SPAW Protocol, pertaining to the establishment of protected areas. The MPAs in Aruba, which encompass critical coastal and marine ecosystems such as coral reefs, seagrass meadows, lagoons, and open ocean, serve as representative examples of the region's biodiversity and marine habitats. These areas are integral to the conservation of vital species, including marine megafauna such as sea turtles, marine mammals, bony fish, and sharks, while simultaneously providing essential breeding, feeding, and migratory routes for these species.

With the expansion of the Ramsar sites in Aruba, which now cover a total of 14,408 hectares, the country has effectively created a network of protected areas that not only meet but exceed the ecological and conservation criteria outlined by the SPAW Protocol. This network serves to preserve and restore the natural ecosystems within Aruba's territorial waters, ensuring the long-term sustainability of marine resources. The inclusion of these areas under both the Ramsar Convention - and in the future also the SPAW Protocol - strengthens the protection of representative coastal and marine habitats, while promoting ecologically sound use of these resources.

Additionally, the collaborative management and protection of Aruba's MPAs and Ramsar sites support the development of a comprehensive and representative system of protected areas. The establishment of cooperative agreements with regional and international conservation organizations further enhances the effectiveness of these protected areas, contributing to the broader network of marine conservation efforts in the Caribbean. These measures ensure that Aruba's marine environments will not only be protected for their intrinsic ecological value but also contribute to the sustainable enjoyment and use of these resources by future generations, as advocated by the SPAW Protocol. The continuous monitoring, adaptive management, and inclusion of local communities in conservation efforts further solidify the comprehensive management strategies for these protected areas, aligning with the UNEP-CEP guidelines for protected area evaluation under the SPAW Protocol.

Among the newly designated Ramsar sites in Aruba, three include marine components that collectively account for 8,388 hectares (see Appendix 4 for detailed descriptions). These marine areas not only completely encompass the existing Marine Protected Areas within Parke Marino Aruba but also significantly extend their boundaries. This expansion underlines a strategic effort

[9] Summary of Ramsar legislation: https://www.dcceew.gov.au/water/wetlands/ramsar

[10] Note that the open water body of Spaans Lagoen is included in this PACMP; mangroves and wetlands are included in the Coastal PACMP.

to integrate and enhance the conservation of Aruba's marine and coastal ecosystems, ensuring a larger, contiguous protected area that provides critical habitats with broader, more effective management and protection under international conservation standards.

The West Point Ramsar site measures 2,185 hectares and comprises varying coastal habitats including beaches, limestone terraces, coral reefs, seagrass meadows, sand dunes, seasonal wetlands, and shallow and deeper marine waters. These varied environments support a host of wildlife, including species that are locally or globally endangered.

The South Coast Ramsar site measures 3,975 hectares and comprises the islands largest stand of mangrove forest, dense cover seagrass meadows, fairly healthy coral reefs, sea turtle nesting beaches and the islands main chain of reef islets. A 2019 coral reef baseline study (Vermeij, et al, 2019) revealed that this site is the most important coral recruitment area of Aruba.

The East Point Ramsar site measures 7,597 hectares. It is a mainly marine site that curves around the eastern tip of Aruba. A substantial part of the terrestrial Arikok National Park is incorporated within its boundaries as it represents the water catchment area of Fontein, the island's only substantial, natural and permanent freshwater source. The site also encompasses reef islands with breeding colonies of no less than 10 tern species[11].

Aruba's five Ramsar sites, covering 14,408 hectares in total.

[11] Note that reef islands, mangrove and seabird conservation are included in the Coastal PACMP.

Biological Description

The Caribbean, including the waters surrounding Aruba, is home to a diverse array of marine life that plays a critical role in maintaining healthy ocean ecosystems. Vibrant coral reefs, lush seagrass meadows, and dynamic open waters provide habitat for a wide variety of species, ranging from iconic invertebrates to charismatic megafauna. By integrating the protection of coral reefs, seagrass meadows, and other ecosystems within Parke Marino Aruba with the extended areas covered by the Ramsar sites, Aruba has established a comprehensive approach to conserving its marine biodiversity. These combined protections support vital species and habitats while offering significant economic benefits through coastal protection, tourism, and fishing activities.

The Ramsar sites—East Point, South Coast, and West Point—expand the reach of conservation efforts beyond the marine park's boundaries, safeguarding a wide range of ecosystems crucial for maintaining biodiversity, promoting genetic exchange, and supporting sustainable activities like snorkelling, diving, and small-scale fishing. This interconnected network of protected areas enhances both the ecological and economic resilience of Aruba's marine environments by preserving critical habitats, from coral reefs and seagrass meadows to deeper offshore ecosystems and ensuring the long-term survival of species and their migratory routes.

Coral Reefs (approx. 20km^2)

The coral reefs within Parke Marino Aruba cover approximately 20km^2 and are essential to the island's marine ecosystem. These shallow fringing reefs along the leeward coast host 68 species of reef-building corals, including *Acropora palmata* (elkhorn coral) and *Millepora complanata* (blade fire coral), surpassing many other Caribbean nations in biodiversity. The reef systems are interconnected with seagrass meadows, enhancing ecological function. Fewer corals, however, are found on the historically sandy flats of the southwest coast. A continuous forereef runs along much of the leeward coast, interrupted by channels between barrier islands.

The South Coast Ramsar Site (NL2526) protects coral recruitment areas, home to species such as the near-threatened *Aetobatus narinari* (spotted eagle ray) and *Galeocerdo cuvier* (tiger shark). The West Point Ramsar Site (NL2527) also supports coral conservation with large patches of critically endangered *Acropora palmata* (elkhorn coral) and habitats for species like *Lobatus gigas* (the queen conch) and various parrotfish species (subfamily *Scarinae*). The East Point Ramsar Site (NL2525) features diverse coral and seagrass habitats, supporting *Tursiops truncatus* (bottlenose dolphins) and *Stenella coeruleoalba* (striped dolphins).

Seagrass meadows (approx. 11km^2)

Seagrass meadows cover 11km^2 in Aruba and serve as critical nursery and foraging grounds for species such as *Chelonia mydas* (green sea turtle), *Lobatus gigas* (queen conch), and various fish. Threats include pollution, anchoring, and the invasive seagrass species *Halophila stipulacea*, which has displaced native species such as *Thalassia testudinum* (turtle grass). Despite these pressures, all known native seagrass species have been legally protected since 2017, including *Syringodium filiforme* (manatee grass) and *Halodule wrightii* (shoal grass). The Ramsar sites play a key role in safeguarding these ecosystems.

At West Point (NL2527), extensive *Thalassia testudinum* (turtle grass) beds support marine megafauna such as sea turtles, while the South Coast Ramsar Site (NL2526) is vital for *Eretmochelys imbricata* (hawksbill turtle) and *Caretta caretta* (loggerhead turtle). The East Point

Ramsar Site (NL2525) provides important seagrass habitats for herbivorous fish, sea turtles and marine mammals, contributing to overall ecosystem resilience.

Bays and Lagoons

Aruba's bays and lagoons are important features of Parke Marino Aruba, offering calm, sheltered environments between the mainland and nearby reef islets. These areas support *Chelonia mydas* (green sea turtle), *Lobatus gigas* (queen conch), and other protected species, while also providing essential birthing and nursing grounds for larger marine species like *Tursiops truncatus* (bottlenose dolphins). These ecosystems function as nurseries during vulnerable life stages, making their protection critical.

The Ramsar sites, especially East Point (NL2525) and the South Coast (NL2526), enhance the conservation of bays and lagoons. These areas support dolphin species such as *Stenella frontalis* (Atlantic spotted dolphins) and migratory species like *Megaptera novaeangliae* (humpback whales). At West Point (NL2527) the turtle grass beds provide nursing and feeding grounds for many marine organisms.

Open Sea

Parke Marino Aruba extends up to two kilometres offshore, covering predominantly open sea. This area plays a key role in the migratory routes of species such as *Dermochelys coriacea* (leatherback sea turtle) *Chelonia mydas*, *Aetobatus narinari*, and *Thunnus albacares* (yellowfin tuna). It is also critical for genetic exchange among species dispersed as plankton in their larval stages.

Ramsar sites, particularly the South Coast (NL2526), safeguard open sea habitats along a 19-kilometer stretch, supporting *Chelonia mydas*, *Eretmochelys imbricata*, and *Caretta caretta*, as well as marine mammals like dolphins and whales. West Point (NL2527) and East Point (NL2525) offer additional protection, supporting nesting grounds for *Dermochelys coriacea* and *Acropora palmata* reefs. East Point also serves as a habitat for *Stenella longirostris* (spinner dolphins) and *Physeter macrocephalus* (sperm whales), contributing to regional marine biodiversity and ecological connectivity.

Species

Many of the significant species are mentioned in the general text above. Aruba's marine environment is home to keystone species like the long-spined sea urchin and Caribbean king crab, alongside marine megafauna such as dolphins, sea turtles, sharks, and rays. These species are vital to ecological balance and biodiversity. Details of their conservation and related research are provided in Section 6, highlighting their importance to marine ecosystems. Of particular importance are:

Long-spined Sea Urchins (*Diadema antillarum*), Queen Conch (*Lobatus gigas*) and other keystone marine invertebrates such as the Caribbean king crab (*Mithrax spinosissimus*), which are integral to seagrass and coral ecosystems.

Marine Megafauna – Sea Mammals and Sea Turtles: Several dolphin species breed in Aruban waters and their protection is becoming more complex with the increase in marine-based recreation. Moreover, coastal development and recreation is impacting sea turtle nesting and foraging habitats of the four species of sea turtle frequenting Aruba. ACF will continue to actively

support the Aruba Marine Mammal Foundation and Turtugaruba in their conservation efforts, both within the protected areas and beyond.

Marine Megafauna - Sharks and Rays (Elasmobranchs): Declining reef health, the loss of reef fish and sport fishing pose significant threats to sharks and rays in Aruban waters. ACF will support necessary research to learn more about shark and ray populations and how best to conserve them.

Physical Description

Aruba, the smallest and westernmost of the Dutch Leeward Islands, is part of the Aruba-La Blanquilla chain, which consists of small islands and atolls along the Venezuelan continental border. Situated just north of Venezuela's Paraguana Peninsula, Aruba differs from Bonaire and Curaçao in that it lies on the Venezuelan continental shelf (Van den Oever, 2000). The island is predominantly flat, with its highest point being Mount Jamanota in the Arikok National Park, at 189 meters.

The geological foundation of Aruba is composed of folded metamorphosed sedimentary and igneous rocks from the Cretaceous period, which are sometimes overlain by limestone deposits from the Eocene, Neogene, and Quaternary periods. The island's geology can be divided into three main units: the Aruba Lava Formation (ALF) located in the central and northeastern regions, a central tonalite/batholith complex, and Neogene and Quaternary limestone deposits. These formations shape the island's unique landscape and contribute to its natural, rugged beauty.

Social Context

Aruba's economy remains heavily reliant on its coastal and marine ecosystems, with tourism accounting for over 90% of the island's GDP in 2023, making it one of the most tourism-dependent economies globally. The economic contribution of nature-based tourism is estimated at approximately US$ 269 million annually, highlighting the vital role these ecosystems play in attracting visitors. The government of Aruba recognizes the connection between a healthy environment and a thriving tourism sector, as coastal and marine ecosystems serve as primary attractions for visitors. However, like many other island nations, the relationship between the benefits provided by nature and sustainable development is not yet fully integrated into policymaking (Palacios, et.al., 2021). This highlights the importance of the Marine Protected Areas (MPAs) and Ramsar sites in securing long-term environmental and economic health (International Monetary Fund ,2023; IMF).

Human Population

While no one lives directly within the marine protected areas and the marine areas within the Ramsar sites of Parke Marino Aruba (although it should be noted that the reef islands do have domestic properties that are temporarily occupied and there is one holiday resort), the island's small size means that its entire population of 112,803 (as of June 2022) is in close proximity to these protected zones. With a terrestrial area of 193 km^2, and an average of 585 inhabitants per square kilometre, Aruba has one of the highest population densities globally. In addition, Aruba welcomes around 2 million tourists each year—1.2 million arriving by air and 800,000 by cruise, based on pre-pandemic data from 2019. This significant human and tourist presence underscores the importance of sustainable resource management.

Socio-Economic Information

Several studies have assessed the socio-economic and cultural value of Aruba's natural environment. One prominent study, the TEEB Aruba report (Wolfs, et. al., 2018), focused on the economic and ecological services provided by the island's ecosystems, especially its marine resources. Ecosystem services including tourism, fisheries, and non-use values such as cultural appreciation were evaluated. Tourism-related marine activities such as swimming, snorkelling, diving, kiting, surfing and boating continue to significantly contribute to Aruba's tourism and recreational economy, with an estimated value of US$ 269 million annually (International Monetary Fund, 2023; IMF).

The small-scale fishing industry, while less prominent than tourism, still contributes US$ 4.45 million to the island's natural capital. However, the potential for environmental degradation poses a major threat, with the possibility of reducing visitor numbers by as much as 50%, underscoring the importance of preserving these ecosystems (International Monetary Fund, 2023; IMF).

Surveys indicate that a large portion of Aruba's local population is aware of the significance of nature, with residents showing strong support for expanding marine protected areas and prioritizing the restoration of fish stocks and natural spaces. Approximately 80% of locals advocate for more government investment in nature conservation and believe natural history and cultural heritage should be taught in schools. In the Caribbean, seagrass ecosystems provide services valued at around $255 billion annually, including significant carbon storage (Shayka, et al., 2023). While specific data for Aruba is limited, the island's coastal waters host seagrass species such as *Thalassia testudinum* (turtle grass) and *Syringodium filiforme* (manatee grass). These species contribute to carbon sequestration, coastal protection, and support for marine biodiversity. Illegal fishing activities remain a concern, particularly from foreign industrial fleets, which are estimated to contribute US$ 2.1 million in natural capital value, significantly outpacing the 36% contribution from local recreational fishing (International Monetary Fund, 2023; IMF).

Culturally, nature plays an integral role in the well-being of Aruba's population, with around 70% visiting natural environments to relax and destress, and 25% engaging in nature-based activities with family and friends at least once a week (Wolfs, et. al., 2017). Key cultural heritage sites such as Seroe Colorado, Baby Beach Bay, and Arikok National Park, all of which overlap or are adjacent to the MPA and Ramsar sites, are valued for their natural and historical significance. These sites foster a sense of identity and continuity with the past, offering a deep connection to Aruba's cultural landscape.

Fishing and Cultural Value

While Aruba's fishing sector is considered to be relatively small, it is a vital local food source and holds high cultural and recreational value, contributing to social cohesion by strengthening family and community bonds. Despite the perceived limited scale of the industry, fishing plays an essential role in both local food security and the island's cultural fabric, with many Arubans engaging in fishing as a meaningful recreational activity. Cultural heritage hotspots along Aruba's coastline are not only vital for marine conservation but also serve as important symbols of identity and continuity for the local population. Protecting these areas ensures the preservation of both natural and cultural heritage for future generations (International Monetary Fund, 2023; IMF).

Existing knowledge gaps in data collection and strategies to address them.

While this Marine PACMP provides a comprehensive baseline assessment of ecosystems such as coral reefs and seagrass meadows and integrates species-specific data for marine megafauna (sea turtles, sharks, marine mammals), there are notable gaps in long-term studies on climate change impacts like coral bleaching and sea-level rise. Additionally, more data collection is needed on species population dynamics, ecosystem health, and visitor impacts. To address these gaps, the PACMP proposes the implementation of a long-term monitoring program that includes biodiversity surveys, habitat assessments, and socio-economic monitoring (see Appendix 1). Annual evaluations are planned to track the success of conservation efforts, using biodiversity trends, water quality metrics, and visitor use data. This approach aims to fill existing data gaps and enhance the effectiveness of conservation strategies.

3. Key Pressures, Threats and Drivers for the Marine Protected Areas and Ramsar Sites

Aruba's marine ecosystems, including its Marine Protected Areas (MPAs) and Ramsar sites, face a variety of pressures, threats, and underlying drivers that impact their ecological integrity and biodiversity. These marine environments are essential to supporting a wide range of species and providing ecosystem services such as coastal protection, carbon sequestration, and resources for fisheries and tourism. However, growing anthropogenic and natural stressors are placing these ecosystems at risk, necessitating a comprehensive understanding of the key challenges to inform effective management and conservation strategies.

Table 2 sets out and summarizes the key pressures, threats, and drivers for the marine protected areas and marine areas within the Ramsar sites. The list and its contents are based on the previous management plan, field observations, a situation analysis following the Conservation Standards (Conservation Measures Partnership, 2020 & 2021) and by integrating stakeholder-derived pressures, threats, and drivers into the previously established list. The key concerns for Aruba's MPAs and Ramsar sites are therefore comprehensive, reflecting both environmental challenges and socio-economic factors.

Summary of Pressures and Threats

Table 2: Key Pressures, Threats and Drivers for the MPA and Ramsar Sites. Pressures refer to direct human activities or natural processes that stress the ecosystem; threats encompass the resulting impacts of these pressures on marine ecosystems; and drivers are the underlying socio-economic, political, and cultural factors that perpetuate these pressures and threats.

Threat	Specific Issue	Description
Pollution	*Marine Debris and Plastic Pollution*	Littering, especially plastic waste from land-based sources and marine activities, severely impacts marine ecosystems, with consequences for both wildlife and habitats.
	Noise Pollution	Noise from marine traffic and recreational activities disrupts marine mammals and other sensitive species.

	Discharge of Pollutants	Industrial waste, sewage, fuel spills, and ballast water discharge cause water contamination, leading to habitat degradation.
Lack of Protection (Legal)	*Weak Enforcement of Existing Laws*	Despite legal frameworks, enforcement of environmental protection regulations, especially concerning illegal fishing and pollution, remains a challenge. ACF currently has no enforcement authority.
	Gaps in Legal Frameworks	Environmental pollution and certain activities, such as unregulated coastal development and recreational tourism, and invasive species management, require more robust legal protection to safeguard the marine environment.
Human Access	*High Levels of Visitation*	Unregulated human visitation, particularly to sensitive areas, leads to increased habitat degradation from trampling, littering, and disturbance to marine wildlife.
	Unregulated Activities	Activities like water sports, snorkelling, diving, and boat tours are often unregulated, contributing to physical damage to coral reefs and seagrass meadows.
Tourism	*Tourism Pressure*	The influx of tourists puts pressure on marine environments, particularly from high-traffic activities like snorkelling, diving, and boat tours.
	Recreational Facilities	Coastal recreational facilities disturb wildlife habitats, particularly during foraging, mating and nesting seasons for species like sea turtles.
Coastal Recreation	*Sunscreens Harmful to Marine Life*	Chemicals from sunscreens and other cosmetics used by beachgoers contribute to coral bleaching and other forms of ecosystem degradation.
	Physical Damage from Recreational Activities	Walking on coral reefs and trampling on seagrass meadows cause direct physical damage to sensitive species and their ecosystems.
Coastal Development	*Construction and Urbanization*	Hotels, residential buildings, and other infrastructure developments lead to habitat destruction and pollution, increasing runoff and sedimentation into marine ecosystems.
	Erosion and Sedimentation	Coastal land clearing leads to erosion, which causes sedimentation in nearby marine areas, smothering coral reefs and seagrass meadows.
Marine Traffic	*Anchoring and Mooring*	Anchoring in sensitive areas, such as seagrass meadows and coral reefs, causes physical damage to these habitats.
	Fuel Spills and Maintenance Activities	Fuel spills, cleaning, and maintenance activities from marine traffic introduce harmful chemicals and pollutants into the water.
Unregulated Fisheries	*Illegal and Overfishing*	Illegal, Unregulated and Unreported (IUU) fishing practices, including trawling and poaching for the aquarium trade, deplete marine populations and disrupt ecosystems.

	Bycatch and Habitat Destruction	Destructive fishing practices like trawling damage coral reefs and lead to bycatch, which negatively impacts non-target species.
Invasive Species & Diseases	*Lionfish*	The invasive lionfish threatens native fish populations by outcompeting them for resources, disrupting local ecosystems, and increasing predation pressure on juvenile fish and other native species.
	Invasive Seagrass	*Halophila stipulacea*, an invasive seagrass species, outcompetes native species, altering the balance of seagrass ecosystems and impacting biodiversity.
	Invasive Coral (Unomia stolonifera)	*Unomia stolonifera*, a fast-growing soft coral species present in nearby Venezuela, poses a potential threat to Aruba's reefs. If introduced, it could outcompete corals and seagrass, inhibiting reef growth and altering the structural integrity of the ecosystem.
	Coral Diseases	Coral reefs in Aruba are threatened by coral diseases like Stony Coral Tissue Loss Disease (SCTLD), which rapidly degrades coral structures. In addition, coral bleaching, exacerbated by rising sea temperatures and climate change (see also below), weakens coral reefs, making them more vulnerable to disease and environmental stressors. These diseases and bleaching events are major contributors to coral decline in the Caribbean region.
Lack of Awareness	*Public Unawareness*	Many residents and tourists are unaware of how their actions contribute to environmental degradation, from pollution to physical damage to habitats. Education is needed to promote responsible behaviour.
	Limited Environmental Education	There is a lack of comprehensive environmental education initiatives that could foster sustainable marine conservation practices.
Climate Change	*Coral Bleaching*	Rising sea temperatures cause coral bleaching, which weakens coral reefs and threatens their survival.
	Sea Level Rise	Sea level rise contributes to coastal erosion and loss of critical habitats, including mangroves and seagrass meadows.
	Ocean Acidification	Increased CO2 absorption by oceans leads to acidification, weakening coral skeletons and other calcifying organisms.
	Increased Storm Activity	Tropical storms, hurricanes, and related storm surges damage both coastal and marine ecosystems, eroding shorelines, and disrupting habitats.
Natural Forces	*Sargassum Influxes*	Large blooms of sargassum seaweed disrupt coastal ecosystems and impact tourism through beach fouling.
	Tropical Storms, Hurricanes, and Storm Surge	Natural disasters can cause widespread physical damage to marine ecosystems, including coral reefs and coastal habitats.

Species Loss	*Biodiversity Decline*	Loss of biodiversity, particularly from overfishing, habitat destruction, and pollution, creates a cascade of effects that destabilize marine ecosystems.
	Endangered Species at Risk	Key species, such as sea turtles and parrotfish, are increasingly at risk due to habitat loss, pollution, wildlife feeding and illegal fishing.
Data Deficiency	*Inadequate Research and Data Collection*	Insufficient data on species populations, ecosystem health, and human impacts hinders effective conservation.
	Limited Monitoring of Marine Ecosystems	Lack of consistent and detailed monitoring programs makes it difficult to track changes in biodiversity and identify emerging threats.
	Impact of Climate Change on Marine Ecosystems	There is a significant lack of data regarding how climate change and other environmental factors are impacting marine ecosystems in Aruba. The absence of long-term studies on the frequency and consequences of events such as coral bleaching, rising sea temperatures, and ocean acidification limits our understanding of their effects on critical marine habitats, including coral reefs and seagrass meadows.

Note that some regulations require a transition phase to be implemented, either to allow stakeholders the time to adapt their uses and dependencies or to allow ACF to arrange the necessary alternative (such as moorings) or demarcation before prohibiting the activity.

Specific notes on:

Governance

The formulation and communication of clear rules and regulations governing the use of and conduct within the marine protected areas is essential. These regulations address human activities to minimizing negative impacts on biodiversity and ecosystem health. Visitors to the marine protected areas are required to follow these specific codes of conduct to minimize their impact on nature and the environment. Some activities that could harm nature, the environment or wildlife severely are prohibited within the marine protected areas. While some rules and regulations are only applicable to a specific zone within an MPA, others may also be applicable on a national level also outside of the MPAs as they are determined by national laws.

Cultural Significance of Marine Ecosystems to Aruban Communities

Marine ecosystems in Aruba are deeply intertwined with the island's cultural heritage and community practices. Historically, the coastal and marine environments have been vital for local communities, providing resources for sustenance, economic activities, and cultural traditions. Fishing, for instance, has been a cornerstone of Aruban livelihoods, with traditional fishing methods passed down through generations. These practices not only support the local economy but also reinforce community bonds and cultural identity. In addition to fishing, marine ecosystems play a significant role in cultural and recreational activities that enhance the well-being of Arubans. According to TEEB Aruba, 70% of Arubans visit natural environments to destress and unwind, and 68% find urban and peri-urban green spaces "very and extremely important" for improving social cohesion. This underscores the importance of preserving marine and coastal areas for cultural and recreational purposes. Recognizing and integrating the cultural

values associated with marine ecosystems into conservation strategies is essential for fostering community support and ensuring the sustainability of these vital resources (UNEP, 2018; Wolfs Company, 2018).

Data Collection Needs for Species Population Dynamics and Climate Impacts

To effectively address the pressures and threats identified in this section, it is imperative to enhance data collection on species population dynamics and the impacts of climate change. Long-term monitoring of species abundance, distribution, and health is essential to detect trends and inform conservation strategies. Additionally, assessing the effects of climate change, such as ocean warming, acidification, and sea-level rise, on marine ecosystems is crucial. Implementing standardized monitoring protocols, including biodiversity surveys, habitat assessments, and socio-economic monitoring, will provide comprehensive data to evaluate the success of conservation efforts and adapt management practices accordingly. This approach aligns with recommendations from the National Academies of Sciences, Engineering, and Medicine, which emphasize the importance of monitoring in marine area management to evaluate changes in ecosystems and determine the effectiveness of Marine Protected Areas (National Research Council, 2001) By prioritizing these data collection efforts, we can develop a robust understanding of the factors influencing species populations and ecosystem health, thereby enhancing the effectiveness of conservation measures.

4. Legal Framework

Context

In 2016 the Government of Aruba in partnership with TNO Caribbean was awarded the BEST 2.0 Program grant to establish Marine Protected Areas (MPAs) in Aruba, thereby entering the process of establishing Aruba's first national marine park. The Nature Protection Ordinance (*Natuurbeschermingsverordening*, AB 1995 no. 2, article 10) provided the legal basis for establishing Marine Protected Areas (MPAs) through national decree. Parke Marino Aruba was officially established by law AB 2018 no. 77 on 21 December 2018 (see Appendix 7) and ACF was appointed to develop and execute the management of Parke Marino Aruba on 16 April 2019.

Since then, ACF has operated Parke Marino Aruba based on the Preliminary Management Plan 2019-2021. In 2023 a Multi-Annual Corporate Strategy 2023-2032 was published, to align with the increased conservation management demands. Then, on 10 November 2023, the Aruban Minister of Nature announced the official designation of four new Ramsar sites, and an extension of Spaans Lagoen, which has been Aruba's sole Ramsar site since 1980. With these additions, the total area now safeguarded under the Ramsar Convention is 14,408 hectares. Details of the five component sites can be found on the website of the Ramsar Convention[12]:

- West Point: https://rsis.ramsar.org/ris/2527;
- Western Wetlands; https://rsis.ramsar.org/ris/2528;
- South Coast: https://rsis.ramsar.org/ris/2526;
- Spanish Lagoon: https://rsis.ramsar.org/ris/198;

[12] https://www.dcceew.gov.au/water/wetlands/ramsar

- East Point: https://rsis.ramsar.org/ris/2525.

Three of the sites include marine components that collectively account for 8,388 hectares. These marine areas not only completely encompass the existing Marine Protected Areas within Parke Marino Aruba but also significantly extend their boundaries.

Under the terms of the Ramsar Convention (Article 3.1) contracting parties shall formulate and implement their planning so as to promote conservation of the wetlands included in the list, as well as promoting the wise use of all the wetlands in their territory. Furthermore (according to resolution 5.7 and resolution VIII.14), there is a call "for management plans for all Ramsar sites, with appropriate support and funds for implementation and training of staff and including a monitoring program with indicators on the sites ecological character".

The development of this management plan is therefore a fundamental requirement of the Ramsar Convention and has been accompanied by extensive stakeholder engagement and consultation, input of field observations, and literature research. The plan should have as its objectives: the maintenance of the ecological character of the site; and the integration of various activities, termed "technological developments, pollution or other human interference". It is vital that the 'activities' represented by technological developments, pollution or other human interference referred to above are listed and categorised in the management plan (see Section 3: Prohibited, restricted and permitted activities; and section 4: Threats and drivers).

The management plan can also clarify issues around the boundaries of the five sites. In some cases, beaches and harbours are excluded but, where the boundary extends inland (for example East Point) the entire coastal area is included. For normal, day-to-day operations related to harbours and the use and management of beaches, it is not desirable to have regular interactions with the relevant authorities. Such activities should quickly be signed off via the conclusion and agreement to the management plan.

There is strong support for the establishment of an island-round marine park in Aruba, reflecting widespread recognition of its importance for marine conservation and sustainable management. The formal establishment of the island-round marine park is now expected by 31 December 2025[13]. This timeline allows for the necessary groundwork to be laid, ensuring a robust and well-planned framework for its implementation.

The island-round marine park will offer significant benefits compared to the current system of marine protected areas. By encompassing essential ecological corridors and biodiversity hotspots, the park will provide enhanced connectivity between critical habitats, supporting the resilience of marine ecosystems and the species that depend on them. It will also facilitate more cohesive and effective spatial planning, guided by the best available science and informed by national, regional, and global expertise. An island-round approach will not only bolster biodiversity conservation but also strengthen the ecosystem services provided by marine habitats, such as coastal protection, fisheries sustainability, and carbon sequestration. This initiative represents a pivotal step toward safeguarding Aruba's marine resources for future generations while aligning with global commitments to marine conservation.

Finally, under the United Nations Environment Programme (UNEP), the Caribbean Environment Programme (CEP) was established in 1981 as one of its Regional Seas Programmes. Countries of the region then adopted an Action Plan, also in 1981, that led to the development and adoption

[13] Expansion of Aruba's current Marine Park to Island-Round | Department of Economic and Social Affairs

of the Cartagena Convention[14] on 24 March1983. This plan is written to comply with the Specially Protected Areas and Wildlife (SPAW) protocols[15], a regional agreement for the protection and sustainable use of coastal and marine biodiversity in the Wider Caribbean Region[16], that is part of the Convention, adopted in 1990, which entered into force in 2000.

The plan also aligns with Aruba's National Biodiversity Strategy and Action Plan (NBSAP), which sets out national priorities for biodiversity conservation and sustainable use, emphasizing the protection of marine and coastal ecosystems. Furthermore, it supports the objectives of the Convention on Biological Diversity's Global Biodiversity Framework (CBD-GBF), including the 2030 goals for biodiversity conservation, sustainable use, and equitable sharing of benefits. These frameworks collectively guide Aruba's commitments to global and regional biodiversity targets while addressing local conservation challenges.

Community Engagement and Benefit-Sharing in Marine Conservation

It is fully recognised that effective marine conservation requires active community engagement and equitable benefit-sharing to ensure sustainable outcomes. Incorporating local communities into the decision-making process fosters stewardship and compliance with conservation measures. In relation to the delivery of the legal framework, the following strategies are proposed to enhance community involvement and ensure fair distribution of benefits:

Inclusive Decision-Making Processes: Establish processes for including local stakeholders such as fishermen, tourism operators, and indigenous groups, in the decision-making, planning and management of the Marine Protected Areas (MPAs). This approach ensures that conservation strategies align with community needs and cultural values.

Capacity Building and Education: Implement training programs to enhance local knowledge and skills related to sustainable resource management, eco-tourism, and environmental monitoring. Educational initiatives can empower communities to actively participate in conservation efforts and benefit from sustainable practices.

Equitable Benefit-Sharing Mechanisms: Develop frameworks that ensure local communities receive tangible benefits from conservation activities. This may include revenue-sharing from eco-tourism, employment opportunities in conservation projects, and support for sustainable livelihoods. Transparent mechanisms are essential to build trust and ensure that benefits are distributed fairly.

Cultural Integration in Conservation Practices: Recognize and incorporate traditional ecological knowledge and cultural practices into conservation strategies. Engaging with local communities to understand their cultural connections to marine ecosystems can lead to more effective and culturally sensitive conservation approaches.

Conflict Resolution and Grievance Mechanisms: Establish clear procedures for addressing conflicts arising from conservation measures. Providing accessible channels for grievances ensures that community concerns are heard and addressed promptly, maintaining positive relationships between stakeholders and conservation authorities.

[14] Cartagena Convention | The Caribbean Environment Programme (CEP) (unep.org)
[15] SPAW Protocol Text | The Caribbean Environment Programme (CEP) (unep.org)
[16] https://www.unep.org/cep/what-we-do/specially-protected-areas-and-wildlife-spaw

These aspects will be seen to have been embedded in the objectives of the plan and their delivery. Through equitable implementation of the plan, the legal framework can promote a collaborative approach to marine conservation, ensuring that local communities are integral partners in preserving marine ecosystems and that they share in the benefits derived from these efforts.

Enforcement Measures Timeline

To ensure the effective implementation of the Marine Protected Areas (MPAs) Conservation Management Plan 2025–2029, a structured timeline for enforcement measures is essential. The proposed timeline is as follows:

Year	Quarter	Action
2025	Q1	Finalize and publish the MPA regulations and zoning plans.
	Q2	Conduct training sessions for enforcement personnel on new regulations and monitoring techniques.
	Q3	Deploy surveillance equipment and establish monitoring stations within MPA zones.
	Q4	Initiate regular patrols and monitoring activities; commence public awareness campaigns.
2026	Q1	Evaluate the effectiveness of enforcement strategies and adjust as necessary.
	Q2	Implement community engagement programs to encourage local participation in enforcement efforts.
	Q3	Expand surveillance coverage to include remote areas using advanced technologies.
	Q4	Review and update enforcement protocols based on collected data and feedback.
2027	Q1	Conduct comprehensive assessments of MPA health and enforcement effectiveness.
	Q2	Host stakeholder meetings to discuss progress and gather input for ongoing improvements.
	Q3	Integrate adaptive management practices into enforcement strategies.
	Q4	Publish an annual report detailing enforcement activities, outcomes, and future plans.

Zoning Regulations

The MPA zones will be delineated based on ecological significance, biodiversity value, and socio-economic considerations. The proposed zoning categories are:

1. **No-Take Zones**: Areas where all extractive activities, including fishing and mining, are strictly prohibited to allow ecosystems to recover and thrive.
2. **Limited-Use Zones**: Areas where certain activities, such as sustainable fishing or tourism, are permitted under strict regulations to balance conservation with local livelihoods.
3. **Buffer Zones**: Transitional areas adjacent to no-take zones where human activities are monitored and regulated to prevent negative impacts on core conservation areas.

4. **Special Purpose Zones**: Areas designated for specific conservation objectives, such as protecting endangered species habitats or conducting scientific research.

Transition Phase and Stakeholder Communication

A clear transition phase is crucial to ensure stakeholders are informed and prepared for the implementation of new regulations. The transition plan includes:

- **Stakeholder Consultations**: Engage with local communities, fishermen, tourism operators, and other relevant stakeholders through workshops and meetings to discuss proposed zoning and enforcement measures.
- **Public Awareness Campaigns**: Launch educational programs to inform the public about the importance of MPAs, the benefits of conservation, and the specifics of new regulations.
- **Feedback Mechanisms**: Establish channels for stakeholders to provide feedback and express concerns, ensuring their perspectives are considered in finalizing the plan.
- **Implementation Support**: Offer resources and support to help stakeholders adapt to new regulations, including training programs and assistance with compliance.

By adhering to this timeline and maintaining transparent communication with stakeholders, the MPA management plan aims to achieve effective conservation outcomes while respecting and integrating the needs and rights of local communities.

5. Governance

MPA and Ramsar Management Plan

The management of protected areas begins with identifying, designating, and establishing a legal and institutional framework. This includes assessing ecological, biological, cultural, and socio-economic values, defining boundaries, and zoning. It also involves setting management objectives and developing policies to govern the use, conservation, and management of natural and cultural resources. Zoning regulations, visitor policies, habitat protection, and wildlife management strategies are essential to meet conservation objectives.

ACF, under legal obligations (see Section 4 above), must develop and execute management plans for Aruba's MPA and Ramsar sites, integrating ecosystem-based and adaptive management approaches. Stakeholder engagement is a key component, ensuring inclusivity, transparency, and support for conservation initiatives[17].

[17] Note that presently, the Aruba Conservation Foundation (ACF) currently manages the Marine Protected Areas (MPAs) but has not yet been officially designated as the manager of the Ramsar sites. Where these areas overlap, it is therefore imperative to apply the necessary guidelines, translating them into actionable steps within this PACMP. Beyond the MPA boundaries, ACF's role is primarily to monitor and, when necessary, inform government authorities. This delineation of responsibilities ensures that conservation efforts are both effective and aligned with legal frameworks.

Guiding Principles

Ecosystem Based Management

Ecosystem-Based Management (EBM) considers the interactions within an ecosystem, including human influences. It focuses on cumulative impacts and fosters cross-sectoral management that balances species and habitat conservation with sustainable resource use. EBM promotes non-destructive activities, minimizing negative human impacts, and supports conservation of ecosystem services. Key features of EBM include adaptability, place-based strategies, cross-sectoral approaches, and inclusivity in decision-making. Regular evaluations and adjustments based on scientific data ensure that management strategies remain effective.

Conservation targets

Defining conservation targets has been based on following the Open Standards for the Practice of Conservation[18], which involves a systematic and structured approach to ensure effective conservation planning and management. Conservation targets are specific elements of biodiversity (species, habitats, ecosystems) or ecological processes that we aim to conserve.

Based on stakeholder engagement, literature research, field observations and alignment with ACFs Conservation Framework and Priorities for 2024-2033 the following conservation targets have been identified as highest priority for the coming 5 years:

1. Seagrass Ecosystems
2. Seagrass Biodiversity
3. Coral Reef Ecosystems
4. Reef Biodiversity
5. Marine Megafauna (marine mammals, sea turtles, sharks, and rays)

Supporting strategies, resources, and targets

In addition to its conservation efforts, this plan incorporates several other targets to ensure effective management and long-term sustainability. These focus on building internal capacity, securing financial resources, promoting public awareness, and fostering collaboration. The targets, guided by ACF's broader framework, aim to support conservation through research, stakeholder engagement, and sustainable resource use:

6. Research and Monitoring.
7. Communications and Advocacy (incl. Sustainable Fisheries).
8. Learning and Outreach.
9. Conservation Co-Creation.
10. Conservation Advice and Consultancy.
11. Human Resources, Staff Development and Capacity Building.
12. Financial Resources and Sustainability.

Marine Conservation

The conservation efforts for Parke Marino Aruba, guided by ACF's Conservation Framework and Priorities for 2024-2033, are divided into **Fundamental Conservation** and **Thematic Conservation**. Fundamental Conservation focuses on protecting the essential components of ecosystems, such as habitats, species, and ecological processes, to ensure their long-term

[18] Open Standards for the Practice of Conservation version 4.0 PACMP-Open-Standards-for-the-Practice-of-Conservation-v4.0.pdf (conservationstandards.org)

integrity and resilience. Thematic Conservation targets specific conservation priorities or challenges, such as protecting particular species, addressing climate impacts, or promoting sustainable resource use, often tailored to regional or societal needs. This holistic strategy ensures that conservation efforts are scientifically informed, engage stakeholders, raise awareness, and promote sustainable use and protection of marine resources.

Fundamental conservation

Boundaries & zoning

Conservation strategies include boundary demarcation and zoning to designate areas for specific purposes like coral and seagrass restoration, no-take zones, and maritime channels. Zoning ensures protection of sensitive ecosystems from human impact, while also allowing sustainable use where appropriate. Certain activities, such as research or organized events, require permits to manage human interactions within MPAs.

Managing pressures & threats

Effective management mitigates pressures like unregulated activities, pollution, and habitat degradation. Monitoring human activities and external factors is essential to address threats while promoting sustainable use of MPA resources. Regular enforcement ensures compliance with conservation regulations.

Visitor recreation management

Recreational activities are regulated to minimize environmental impact. Access is limited in certain areas, with restrictions on visitor numbers, parking, and mooring buoys. Collaboration with government agencies ensures sustainable recreation management, especially in coastal areas.

Enforcement of protection measures

Enforcing rules within MPAs involves regular patrols, surveillance, and collaboration with law enforcement. ACF's marine conservation rangers will patrol from land and from sea. Through patrolling, deploying surveillance technologies, and collaborating with law enforcement authorities offenders will be deterred or prosecuted. Violators face fines, equipment confiscation, or legal charges. Regular offenders may be blacklisted.

Sustainable Natural Resource Management (SNRM)

Effective protected area management involves promoting sustainable resource use practices that balance conservation objectives with socio-economic needs, not only within the protected areas but also beyond them, at a national level. ACF will therefore advocate for practices that balance conservation goals with economic and social needs, promoting sustainable use beyond the MPA and Ramsar sites. Sustainable resource management focuses on tourism, fisheries, pollution control and agriculture.

Climate change adaptation

Climate change poses a major threat to marine ecosystems by altering species distributions, reducing biodiversity, and degrading habitats. Marine Protected Areas and Marine Ramsar sites play a key role in mitigating these impacts, but to remain effective, they must adapt through comprehensive strategies. Expanding and connecting MPAs enhances the protection of diverse

species and habitats, creating safe havens and allowing species to move between areas, ensuring genetic flow and resilience. Restoration efforts like coral and seagrass recovery bolster ecosystem health, helping marine environments withstand climate-related impacts.

Adaptive management is crucial, involving continuous research and monitoring to adjust strategies based on emerging data and changing conditions. Effective governance and international cooperation are also necessary, as many climate-related marine challenges are transboundary. Investing in research and modelling future climate impacts will support proactive adaptation, focusing on vulnerable species and habitats to maintain ecological balance and resilience in the face of ongoing climate change.

Thematic conservation

Seagrass ecosystems

Seagrass ecosystems provide essential services like nutrient cycling, habitat and nursery functions for marine species, and carbon sequestration. They also photosynthesize, which increases the oxygen levels in the water for other marine life (Larkum, A.W.D. et al. (2018). Their vast root system stabilizes the bottom sediments, keeping the waters clear for all marine life that is dependent on sunlight. Besides continuous pressures from human activities and developments, the native seagrass species are also being outcompeted by an invasive seagrass, *Halophila stipulacea*. This invasive seagrass seems to be better adapted to grow in human impacted areas but is of less nutritional and shelter value to the species that depend on the native seagrasses.

ACF is already actively involved in seagrass management through its regulatory role. Research is needed to understand restoration techniques, monitoring, and invasive species mitigation. Collaboration with regional networks will enhance the effectiveness of both in-situ and ex-situ seagrass conservation through ACF's Marine Conservation Centre. Restoration efforts focus on areas where human impacts are minimized to allow the natural resettlement of the native seagrasses and researching effective management techniques. Further research will determine whether the active removal of the invasive seagrass and propagation of the native seagrass would be effective in the context of the Aruban marine environment. The assessment of keystone species for seagrass ecosystems could indicate the possibility of restoring, repopulating, or enhancing keystone species populations that contribute to the health of seagrass, for example through natural grazing.

Seagrass biodiversity

Seagrass biodiversity refers to the variety of native seagrass species and the ecological roles they play within marine ecosystems. Native species, such as *Thalassia testudinum* (turtle grass) and *Syringodium filiforme* (manatee grass), are crucial for maintaining ecosystem balance by providing shelter and sustenance for a wide range of marine organisms, including fish, invertebrates, and sea turtles. These species also contribute to nutrient cycling and sediment stabilization, ensuring the overall health and productivity of the ecosystem.

The introduction of invasive species like *Halophila stipulacea* poses a significant threat to native seagrass biodiversity. While it may thrive in degraded environments, this invasive species fails to replicate the full ecological functions of native seagrasses. The loss or reduction of native biodiversity can weaken the resilience of marine ecosystems, impacting dependent species and reducing ecosystem services.

Conservation of seagrass biodiversity is a key priority for ACF. Efforts include monitoring the distribution and health of native species, researching effective restoration and propagation techniques, and mitigating the spread of invasive species. Enhancing biodiversity not only strengthens ecosystem resilience but also supports the broader goals of marine conservation, such as sustaining fisheries and improving carbon sequestration capacity. Collaboration with regional and international networks will be vital in addressing these challenges and protecting Aruba's unique seagrass ecosystems.

Coral reef ecosystem (including coral rescue)

Aruba's coral reefs are under significant stress from both natural and human-induced factors. Coral cover in Aruba is naturally low due to the high abundance of sandy areas, which limits the available benthic space for coral growth. Hard coral cover throughout the Caribbean, including Aruba, has been declining due to large-scale disturbances such as coral bleaching, coral disease, and the decline in sea urchin populations. Local stressors like coastal water pollution and eutrophication further exacerbate this decline. A significant recent threat to Aruba's coral reefs is the outbreak of stony coral tissue loss disease (SCTLD), first reported in December 2022. This disease has affected several key reef-building coral species, including *Montastraea cavernosa*, *Dendrogyra cylindrus*, and *Pseudodiploria strigosa*.

Coral restoration, including artificial reefs and ex-situ conservation such as coral propagation and outplanting, aims to preserve coral diversity for future restoration efforts. The SCTLD epidemic means it is vital to safeguard the genetic diversity of Aruba's unique coral, by combining in-situ efforts with ex-situ coral rescue, banking and propagation.

Reef biodiversity

Reef biodiversity is crucial for the health of coral ecosystems, supporting about 25% of all marine species despite occupying less than 1% of the ocean floor. This biodiversity underpins marine food webs, stabilizing ecosystems and contributing to Aruba's tourism and fisheries, making its conservation essential both ecologically and economically.

Efforts to restore reef biodiversity focus on coral restoration and the recovery of keystone species like urchins and crabs, which play important roles in ecosystem functions such as grazing. Monitoring fish and invertebrate populations can help address imbalances through targeted conservation actions.

Invasive species management is also vital. The lionfish (*Pterois volitans/miles*), which threatens native fish populations, requires active control through scuba-based targeted removal. Lionfish hunting is regulated within Aruba's MPAs, with hunters required to share catch data. Additionally, early detection and prevention of disease or new invasive species, like the coral *Unomia stolinifera*, are key to maintaining reef health, though regional currents make some introductions inevitable.

Marine megafauna (marine mammals, sea turtles, sharks & rays)

Marine megafauna are large ocean-dwelling animals, such as whales, dolphins, sharks, rays and sea turtles. They are often migratory species that depend on large marine protected areas, sanctuaries, or transboundary conservation for their survival. Marine megafauna often depend on the coastal waters during specific vulnerable life stages.

Marine megafauna conservation in Aruba is supported by international treaties such as CITES, CMS, and SPAW, and benefits from collaboration with local and regional organizations. Key local NGOs like the Aruba Marine Mammal Foundation (AMMF) and Turtugaruba Foundation, alongside regional networks such as CARIMAM, CAMAC, CWOP, WIDECAST, CCS, and CSC, actively contribute to these efforts. ACF works closely with these organizations to safeguard marine mammals, turtles, and sharks in the MPAs during vulnerable life stages, while advocating for broader protection and conservation strategies.

Stakeholder Roles and Responsibilities

Effective governance is critical to the success of the PACMP, as it ensures that all stakeholders are aligned, responsibilities are clearly defined, and efforts are coordinated efficiently. The roles and responsibilities of each stakeholder, along with clear mechanisms for coordination, will ensure that no overlaps occur, and the program is managed effectively. The roles and responsibilities of stakeholders in the PACMP are therefore outlined below. This includes details on their specific duties, areas of contribution, and associated funding sources to promote transparency and avoid duplication of efforts.

Stakeholder	Role & Responsibility	Funding Sources
Government (National/Regional)	Provide overall policy direction, regulatory frameworks, and coordination across different sectors. Ensure local implementation of programs, resource allocation, and community engagement.	National budget, international aid, EU funding
Private Sector	Facilitate technology transfer, investments, and innovation in sustainable practices.	Private investments, corporate partnerships
NGOs and Civil Society	Support community-based initiatives, advocacy, and capacity-building for sustainable practices.	Donations, grants, partnerships
Academia & Research Institutions	Conduct research, provide expertise, and monitor the effectiveness of implemented strategies.	Research grants, academic funding
International Organizations	Provide technical assistance, capacity-building, and potential funding support for large-scale projects.	Multilateral funding, donor agencies

Mechanisms for Stakeholder Coordination

To ensure effective coordination and avoid overlapping roles or duplication of efforts, the following mechanisms will be implemented:

1. **Stakeholder Sounding Board**: A stakeholder sounding board will be formed with representatives from each stakeholder group. This group will meet twice a year to assess progress, address any challenges, and advice changes to the implementation strategies as needed.

2. **Clear Communication Channels**: Regular workshops, meetings, and a shared online platform will be used to ensure that all stakeholders are well-informed about developments, funding opportunities, and responsibilities.
3. **Annual Review Process**: An annual review of the governance structure and stakeholder roles will be conducted to ensure that coordination remains efficient and that roles are still relevant to the program's goals.
4. **Conflict Resolution Mechanism**: A conflict resolution protocol will be established to address any disputes regarding roles, responsibilities, or resource allocation, ensuring that all stakeholders can voice concerns and find solutions in a timely manner.

Funding and Financial Management (See Appendix 2)

The ACF structure will also ensure transparent management of funding sources. A central database will track the allocation and utilization of funds across different components of the Marine PACMP and, by detailing roles, responsibilities, and funding sources in this manner, the Marine PACMP will align with SPAW criteria and improve overall governance for more effective program implementation.

6. Monitoring and evaluation

Regular monitoring and evaluation (M&E) are essential for assessing the effectiveness of management actions, tracking changes in biodiversity and ecosystem health, and identifying emerging threats and challenges. To enhance the Monitoring and Evaluation (M&E) framework of this Marine PACMP 2025–2029, it is therefore essential to establish detailed evaluation frameworks, success indicators, and specific methodologies for data collection. A structured approach to these components is presented below:

1. Biodiversity Monitoring

Indicator	Methodology	Data Collection Tools
Species Richness and Abundance	Conduct regular biodiversity surveys using standardized transects and quadrats.	Underwater visual census, remote underwater video systems, and environmental DNA (eDNA) sampling.
Population Trends of Key Species	Implement mark-recapture studies and population modelling.	Tagging and tracking devices, photographic identification, and genetic analysis.
Habitat Condition and Coverage	Perform habitat mapping and assess habitat quality through direct observation and remote sensing.	GIS mapping, aerial drone surveys, and habitat suitability indices.

2. Water Quality Monitoring

Indicator	Methodology	Data Collection Tools
Nutrient Levels (e.g., Nitrogen, Phosphorus)	Conduct water sampling at multiple depths and locations	Water sampling bottles, spectrophotometers, and nutrient analysers.

	to assess nutrient concentrations.	
Turbidity and Sediment Load	Measure water clarity and sediment deposition rates.	Secchi disks, turbidity meters, and sediment traps.
Pollutant Concentrations (e.g., Heavy Metals, Pesticides)	Analyse water samples for specific pollutants.	Chemical analysis kits, mass spectrometers, and chromatography equipment.

3. Visitor Use Monitoring

Indicator	Methodology	Data Collection Tools
Visitor Numbers and Demographics	Conduct surveys and install automated counters at access points.	Visitor questionnaires, electronic counters, and GPS tracking.
Impact on Sensitive Habitats	Monitor physical disturbances and behavioural changes in wildlife due to human activities.	Habitat condition assessments, wildlife behaviour observations, and disturbance frequency records.
Effectiveness of Management Strategies	Evaluate the implementation and compliance of visitor management plans.	Compliance audits, visitor feedback forms, and management action logs.

4. Socio-Economic Assessments

Indicator	Methodology	Data Collection Tools
Fisheries Yield and Biodiversity	Analyze catch data and assess species composition in local fisheries.	Fisher interviews, catch records, and biodiversity indices.
Tourism Revenue and Employment	Evaluate economic contributions from tourism and related employment opportunities.	Economic surveys, financial records, and employment statistics.
Community Engagement and Benefits	Assess local community participation in conservation activities and distribution of benefits.	Community surveys, participation logs, and benefit-sharing agreements.

5. Management Actions and Enforcement

Indicator	Methodology	Data Collection Tools
Compliance with Regulations	Conduct regular patrols and inspections to monitor adherence to MPA rules.	Patrol logs, enforcement reports, and compliance checklists.
Effectiveness of Restoration Projects	Monitor ecological indicators before and after restoration efforts.	Pre- and post-restoration surveys, habitat assessments, and species monitoring.

Outreach and Education Activities	Evaluate the reach and impact of educational programs and materials.	Attendance records, pre- and post-program surveys, and feedback forms.

6. Threat Identification and Adaptive Management

Indicator	Methodology	Data Collection Tools
Emergence of New Threats	Implement early detection systems and rapid response protocols.	Monitoring reports, incident logs, and threat assessment tools.
Climate Change Impacts	Analyse long-term environmental data to detect climate-related changes.	Climate models, temperature and salinity records, and species distribution maps.
Adaptive Management Effectiveness	Review management actions and outcomes to determine necessary adjustments.	Management reviews, performance evaluations, and stakeholder feedback.

By systematically applying these methodologies and utilizing appropriate data collection tools, the M&E framework will provide comprehensive insights into the effectiveness of management actions, facilitate adaptive management, and ensure the conservation objectives of the MPAs are achieved.

7. 5-year Operational Targets and Prioritised Actions

The following targets, grouped under the objectives listed in Section 1.2, deliver a holistic approach which ensures that Parke Marino Aruba's objectives are both operationally achievable and well-supported by necessary resources and governance structures.

Objective 1: Protect, Enhance and Rehabilitate Marine Biodiversity

To protect, enhance and rehabilitate Aruba's marine species, habitats, and ecosystem resilience for sustainable ecosystem health, incorporating environmental, ecological, and anthropogenic data to identify and address knowledge gaps in marine biodiversity; upholding commitments to local policies and international agreements.

5-Year Operational Targets	Action	Key Stakeholders and Partners
Achieve a 30% improvement in the health and resilience of coral reefs and seagrass meadows within the marine protected areas. [Where: Health refers to reduced human-induced impacts, and resilience to the initial rescue and rehabilitation efforts to maintain some level of (genetic) diversity for continued restorative efforts.]	Launch coral reef and seagrass restoration projects in priority areas, focusing on outplanting nursery-grown corals and protecting existing seagrass meadows.	ACF, local communities, marine conservation NGOs, local businesses (e.g. ScubbleBubbles, Turtugaruba Foundation, government ministries, international conservation organizations).
Successfully reduce the impact of invasive species in key habitats by 50%	Implement targeted removal of invasive species (e.g., lionfish and *Halophila stipulacea*) through regular community-led	Fisheries, local dive centres, research institutions, ACF, Caribbean-wide initiatives, local and regional conservation NGOs.

	removal efforts and research-driven mitigation strategies.	
Support the recovery and protection of marine species populations by 20%	Enhance species-specific protection measures for endangered and vulnerable species such as sea turtles, sharks, and marine mammals by creating no-take zones, reducing bycatch, and strengthening anti-poaching enforcement.	Turtugaruba Foundation, Aruba Marine Mammal Foundation, ACF, regional conservation networks, local and international fisheries, law enforcement agencies.
Monitor and maintain the ecological complexity and abundance of species in marine protected areas	Develop a comprehensive biodiversity monitoring framework that includes periodic assessments of coral reef and seagrass health, species abundance, and habitat conditions using technologies such as remote sensing and underwater surveys.	Research institutions, ACF, government agencies, universities, local stakeholders, international marine research programs.
Stakeholder and Community Engagement	Involve local communities, fishers, tourism operators, and NGOs in coral reef and seagrass restoration, invasive species control, and species monitoring.	Local communities, tourism associations, ACF, NGOs, government ministries, international partners like SPAW, WIDECAST, and other regional networks.
Integration target: Research & Monitoring is addressed by continuous monitoring of habitat and species conditions	Establish a long-term monitoring program to assess the health of coral reefs, seagrass meadows, and key marine species. This includes tracking species abundance, biodiversity, and ecological complexity to detect ecosystem trends and identify emerging threats.	ACF**, and** academic and research institutions like the University of Aruba. Local and regional NGOs, the Government of Aruba**,** through its Ministries of Environment and Infrastructure. International conservation bodies (e.g. UNEP, SPAW-RAC).

Objective 2: Increase Climate Resilience and Reduce Pollution

To uphold commitments to local policies and international agreements and to integrate climate resilience and adaptation into the management of marine and coastal environments and combat land-based and other sources of marine pollution.

5-Year Operational Targets	**Action**	**Key Stakeholders and Partners**
Implement Nature-Based Solutions for Climate Adaptation	Initiate projects that focus on the restoration and enhancement of natural marine ecosystems like coral reefs and seagrass meadows to improve resilience to climate-related impacts such as storm surges, erosion, and sea-level rise.	ACF, Ministry of Environment, Ministry of Infrastructure and Planning, local coastal communities, international climate adaptation organizations, local and international NGOs (e.g. The Nature Conservancy), regional climate change research institutions.
Complete Climate Vulnerability Assessments for All Key Marine Habitats	Conduct comprehensive climate vulnerability assessments of Aruba's coral reefs, seagrass meadows, and other marine habitats to evaluate their sensitivity to climate-related risks such as rising sea temperatures, ocean acidification, and coastal erosion.	Research institutions (e.g., universities, climate research centres), ACF, environmental NGOs, international climate resilience programs, regional government bodies, and conservation agencies.
Develop and Implement Strategies to Mitigate the Impacts of Sea-Level Rise and Coastal Development	Collaborate with urban planners, developers, and policymakers to create and enforce coastal development regulations that mitigate the effects of sea-level rise. This may include implementing coastal setbacks, sustainable building practices, and the use of green and blue infrastructure in coastal areas.	Urban planners, Ministry and Directorate of Infrastructure, Ministry and Directorate of Environment, construction industry stakeholders, ACF, international climate adaptation bodies (e.g., UNFCCC), local communities.
Strengthen Capacity through Staff Development and Training	Ensure staff are equipped with knowledge on climate change impacts, adaptive management, and nature-based solutions. Provide training on integrating climate resilience into management plans and policy recommendations.	ACF, international training and conservation organizations, universities, Ministry and Directorate of Education, capacity-building NGOs (e.g., CANARI).

Promote Stakeholder Engagement in Climate Adaptation Strategies	Engage local communities, stakeholders, and regional partners in climate adaptation discussions and initiatives, including through community-based adaptation programs, citizen science, and public workshops on climate impacts.	Local communities, ACF, Ministry and Directorate of Environment, NGOs, regional climate networks, schools and universities, citizen science programs.

Objective 3: Implement Research and Monitoring

To collect and analyse environmental, ecological, and anthropogenic data on MPAs and adjacent marine environments, identifying and alleviating knowledge gaps; integrating indicators of ocean, marine ecosystem and biodiversity health into monitoring and evaluation programmes, promoting research, monitoring, and stakeholder and community engagement in marine conservation, and enabling informed decision-making through scientific data.

5-Year Operational Targets	Action	Key Stakeholders and Partners
Expand Research on Ecological Roles of Key Species and Habitat Interactions	Initiate focused studies on the behaviour, roles, and interactions of key marine species (e.g., reef fish, sea turtles, and invertebrates) within their habitats. Research will involve understanding predator-prey dynamics, species competition, and their influence on habitat health.	ACF, University of Aruba, international marine biology institutions, NGOs (e.g., Turtugaruba), Government of Aruba (Ministry of Environment), regional academic and research networks.
Establish a Permanent Monitoring Network with Annual Reporting [Including to monitor outside MPAs to compare effectiveness of conservation mitigation measures.]	Develop a long-term, standardized monitoring system to track habitat conditions, biodiversity, and population dynamics. Regular monitoring reports will be produced to track progress and adjust management practices.	ACF, University of Aruba, international conservation organizations (e.g., UNEP), Ministry of Environment, citizen science groups, regional monitoring bodies.

Objective 4: Develop Policy, Governance and Finance

To advocate for and implement policy measures that support sustainable marine and coastal management, ensuring governance is financially secure and supports ecosystem health.

5-Year Operational Targets	Action	Key Stakeholders and Partners
Advocate for Five New Policies or Regulations for Marine and Coastal Management (Target 4a)	Collaborate with the Government of Aruba and environmental stakeholders to develop and introduce at least five new or improved policies or regulations aimed at protecting marine and coastal ecosystems, with a focus on areas like fishing regulations, pollution control, and habitat protection.	ACF, Ministry and Directorate of Environment, Government of Aruba, , local NGOs, academic institutions, regional regulatory bodies, international environmental law consultants.
Lead a Coalition to Regulate Sustainable Tourism Practices in Marine Areas (Target 4b)	Form a coalition of tourism operators, environmental organizations, and government agencies to establish sustainable tourism guidelines for Aruba's marine areas. This will include the development of regulations for boat tours, diving, and other recreational activities to minimize their environmental impact.	ACF, Ministry of Tourism, Aruba Tourism Authority, AHATA, local tour operators, NGOs (e.g., The Nature Conservancy), international eco-tourism advisors.
Ensure Policies and Practices Contributing to Marine Decline Are Addressed (Target 4c)	Review and identify existing policies or industrial practices that are contributing to the decline of marine ecosystems. Work with government and industry leaders to modify or replace these harmful practices with sustainable alternatives.	ACF, Ministry of Environment, local industries (e.g., fishing and tourism), policy advisors, NGOs, international environmental organizations.
Establish a Sustainable Financing Mechanism for	Develop a financial strategy that includes the creation of an environmental trust fund or eco-tourism levy to generate consistent funding for marine conservation	ACF, Ministry of Finance, private sector donors, international

Marine Conservation (Target 4d)	efforts. This will ensure long-term financial support for conservation management, projects, and research initiatives.	conservation finance organizations, NGOs.
Enhance Governance Structures for Transparency, Accountability, and Stakeholder Participation (Target 4e)	Strengthen governance frameworks within ACF and across marine conservation projects to improve transparency and ensure active stakeholder participation in decision-making processes. This includes establishing regular stakeholder consultations and enhancing reporting mechanisms.	ACF, Ministry of Environment, local communities, NGOs, international governance advisors, academic institutions.

Objective 5: Strengthen Partnerships and Collaboration

To foster and strengthen partnerships and collaborations for enhanced conservation efforts, leveraging collective action from local and international partners.

5-Year Operational Targets	Action	Key Stakeholders and Partners
Form or Enhance Partnerships with at Least Five International Conservation Organizations (Target 5a)	Engage and formalize partnerships with leading international conservation organizations, such as UNEP, IUCN, and the World Wildlife Fund (WWF), to collaborate on marine conservation projects, research, and policy development.	ACF, UNEP, WWF, IUCN, Ministry of Environment, Ministry of Foreign Affairs, international marine conservation NGOs and agencies.
Initiate an Annual Conservation Symposium to Review Progress and Strategies (Target 5b)	Organize an annual conservation symposium that brings together local and international stakeholders to review marine conservation progress, share insights, and update conservation strategies for Parke Marino Aruba.	ACF, local NGOs (Turtugaruba, AMMF), Ministry of Environment, Ministry of Tourism, regional and international conservation bodies (e.g., DCNA, CARIMAM, UNEP).
Coordinate with Regional Initiatives and Share Best Practices for Habitat Restoration and Species Protection (Target 5c)	Collaborate with regional conservation initiatives and networks, such as CARIMAM and SPAW under the Cartagena Convention, to exchange best practices for marine habitat restoration and species protection.	ACF, DCNA, CARIMAM, SPAW, Ministry of Environment, regional research institutions, local conservation groups.
Establish Regular Collaborative Meetings with Local NGOs, Ministries, and Key Stakeholders (Target 5d)	Organize regular collaborative meetings between ACF, local NGOs (Turtugaruba, AMMF), ministries (e.g., Environment, Tourism), and key stakeholders to develop co-created solutions for marine conservation, ensuring alignment with national policies.	ACF, Ministry of Environment, Ministry of Tourism, Turtugaruba, AMMF, local business associations, academic institutions.
Ensure 70% Stakeholder Involvement in Key Decision-Making Processes for Marine Conservation (Target 5e)	Establish processes that ensure local stakeholders are actively involved in at least 70% of the key decision-making processes for marine conservation initiatives in Parke Marino Aruba, including through public consultations, advisory committees, and collaborative project design.	ACF, Ministry of Environment, local communities, academic institutions, local NGOs, business associations.
Reach 70% of the Local Population with Marine Conservation Awareness Campaigns (Target 3c)	Launch public awareness campaigns via social media, educational programs, and public events to promote marine conservation and the importance of protecting Aruba's marine resources.	ACF, Ministry of Education, local schools and universities, NGOs, local media outlets, community groups.
Conduct Workshops, Training and Volunteering Opportunities for Over 300 Community Members and Stakeholders (Target 3d)	Organize regular workshops, hands-on training and volunteering sessions on marine conservation, sustainable fishing practices, and habitat monitoring, protection and restoration for local communities, fishers, tourism operators, and government officials.	Key Stakeholders and Partners: ACF, Ministry of Environment, Turtugaruba, AMMF, regional conservation NGOs, community groups, local businesses.

Objective 6: Promote Marine Conservation Education and Awareness

To enhance public understanding and appreciation of Aruba's marine environments through targeted education and awareness initiatives.

5-Year Operational Targets	Action	Key Stakeholders and Partners
Develop and implement a marine education curriculum for schools (primary and secondary levels)	Collaborate with the Ministry of Education and local schools to design and incorporate a curriculum focusing on marine ecosystems, biodiversity, and conservation challenges.	Ministry of Education, local schools, teachers, NGOs, ACF, marine scientists, and conservation educators.
Launch a public awareness campaign highlighting the importance of marine conservation and the role of MPAs.	Use social media, community events, local media, and eco-tourism platforms to disseminate information on marine conservation and the benefits of MPAs.	Aruba Tourism Authority, local media outlets, community organizations, ACF, and eco-tourism businesses.
Organize hands-on community engagement activities, such as citizen science projects and beach clean-ups.	Develop programs that invite residents and visitors to participate in seagrass monitoring, coral reef surveys, and coastal clean-ups.	ACF, local NGOs, community groups, volunteers, and marine research organizations.
Establish a Marine Conservation Visitor Centre to educate tourists and locals on Aruba's marine biodiversity.	Create an interactive visitor centre with exhibits, educational materials, and workshops to highlight the island's unique marine ecosystems.	ACF, Aruba Tourism Authority, eco-tourism operators, and local businesses.
Develop and distribute multilingual educational materials, including brochures, videos, and interactive digital resources.	Produce accessible, visually engaging content in Papiamento, Dutch, English, and Spanish to reach diverse audiences.	ACF, local graphic designers, media production companies, NGOs, and government agencies.

8. Supporting strategies

Research & Monitoring

A key supporting strategy, research and monitoring will focus on continuously gathering data on marine biodiversity, habitat conditions, and species health to inform adaptive management practices. This strategy is essential for tracking progress, detecting emerging threats, and ensuring evidence-based decision-making in conservation efforts.

Communications & Advocacy (incl. Sustainable Fisheries)

Communication involves effectively conveying information and raising awareness about the importance of protecting and preserving Aruba's natural marine environments and biodiversity fostering a deeper understanding and appreciation for nature. Advocacy efforts will promote policies and practices that align with sustainable fisheries management, emphasizing the protection of marine ecosystems and the sustainable use of resources. These efforts will focus on influencing local and international policies to support conservation objectives while engaging with the fishing industry to minimize harmful practices.

Learning & Outreach

This strategy aims to raise public awareness about marine conservation through educational programs, workshops, and community engagement initiatives. Learning and outreach efforts will target schools, local communities, and tourists to foster environmental stewardship and inspire support for marine protection.

Conservation Co-creation

Co-creation involves collaboration with stakeholders such as local communities, NGOs, and government to develop and implement conservation solutions. By involving stakeholders in decision-making and planning processes, this strategy ensures that conservation efforts are inclusive, locally relevant, and more likely to succeed.

Conservation Advice & Consultancy

Consultancy services and advice will be offered to support sustainable development practices across various sectors, including tourism and fisheries. ACF will provide expert advice to local businesses and government agencies, ensuring that their activities align with conservation goals and promote the long-term health of marine ecosystems.

9. Resources

Effective implementation of the Marine Protected Areas Conservation Management Plan (PACMP) for 2025–2029 requires a strong foundation of human and financial resources to support its objectives. This chapter briefly outlines the strategies for building capacity, fostering staff development, and securing sustainable funding to ensure the long-term success of Aruba's marine conservation initiatives. These efforts align closely with the goals and strategies set forth in Appendix 1, the Business Plan for Parke Marino Aruba, which provides a detailed roadmap for operational and financial planning.

The resources required to manage marine protected areas (MPAs) effectively encompass not only technical skills and expertise but also robust financial mechanisms that can sustain conservation actions over time. By addressing existing gaps in staffing, skills, and funding, the PACMP aims to strengthen the foundation for adaptive management, stakeholder engagement, and community outreach—core pillars of the plan's success.

Appendix 1 offers a comprehensive summary of operational and financial strategies that support these goals, including targeted recruitment, professional development, and diverse funding mechanisms such as eco-tourism levies, environmental trust funds, and partnerships with international conservation organizations. Together, these strategies will equip Parke Marino Aruba with the necessary tools to achieve its conservation objectives while building resilience against emerging challenges such as climate change and invasive species.

The following sections provide an overview of the human and financial resource strategies needed to realize the vision of Aruba's MPAs, linking directly to the business plan outlined in Appendix 1.

Human Resources, Staff Development and Capacity Building

Building the necessary human resources for a successful marine strategy involves both staff development and targeted recruitment. Skills in marine biology, ecological monitoring, environmental law, and adaptive management are essential to support conservation efforts. Staff should also be trained in stakeholder engagement, conflict resolution, and community outreach to ensure effective collaboration with local communities and partners. Recruitment should focus on bringing in specialists in areas like marine habitat restoration, invasive species management, and climate resilience. Building a strong team with expertise in research methodologies, GIS mapping, and data analysis will also enhance the effectiveness of the monitoring and adaptive management strategies.

Financial Resources and Sustainability

Developing sustainable finance mechanisms is critical for the long-term viability of marine conservation efforts. A diversified funding strategy should include government grants, international conservation funds, and partnerships with private sectors. Additionally, income streams could be generated through eco-tourism initiatives, such as guided snorkelling tours or

conservation-based tourism, as well as eco-certifications for businesses that support sustainable practices. Establishing an environmental trust fund or implementing eco-levies on tourism-related activities can provide a consistent financial reserve to fund marine protection and restoration projects, ensuring ongoing support for the management of marine areas.

References

Bubalo M. (2016) Capturing spatial distribution of cultural ecosystem services in Aruba. Master Thesis Research Project. MSc Environment and Resource Management 2015/2016. Vrije Universiteit Amsterdam.

CARMABI (2021). Aruba Coral Reef Report 2021. CARMABI. https://dnmaruba.org/wp-content/uploads/2023/08/Aruba-Coral-Reef-Report_2021-compressed.pdf

Caribbean Community Climate Change Centre. (2009). Regional Framework for Achieving Development Resilient to Climate Change (2009-2015) (https://caribbeanclimate.org/)

Conservation Measures Partnership (CMP). (2020). Open Standards for the Practice of Conservation: Version 4.0. *Conservation Standards*. https://conservationstandards.org/wp-content/uploads/sites/3/2020/10/CMP-Open-Standards-for-the-Practice-of-Conservation-v4.0.pdf

Conservation Measures Partnership (CMP). (2021). Effectiveness and Impact: How Conservation Standards Enhance Outcomes. https://conservationstandards.org/wp-content/uploads/sites/3/2022/02/Conservation-Standards-Effectiveness-Impact_Final-Product_CMP-Learning-Initiative_Dec-2021.pdf

Convention on Biological Diversity. (2022). Kunming-Montreal Global Biodiversity Framework. Adopted at the Fifteenth Meeting of the Conference of the Parties (COP 15), Montreal, Canada, December 2022. (https://www.cbd.int/gbf); [With particular reference to Target 7: Reduce Pollution to Levels That Are Not Harmful to Biodiversity (https://www.cbd.int/gbf/targets/7?utm_source=chatgpt.com); and Target 8: Minimize the Impacts of Climate Change on Biodiversity and Build Resilience (https://www.cbd.int/gbf/targets/8?utm_source=chatgpt.com)]

Directie Natuur en Milieu. (2024). Aruba NBSAP 2024: Harmonizing People and Nature. (https://dnmaruba.org/pa/publicacion/aruba-nbsap-2024/?utm_source=chatgpt.com)

Dutch Caribbean Biodiversity Database (DCBD) (2019). Coral Reefs Baseline Study for Aruba 2019. Dutch Caribbean Biodiversity Database. Available at: https://www.dcbd.nl/resource/3028?utm_source=chatgpt.com

International Monetary Fund (2023) Kingdom of the Netherlands – Aruba. Technical assistance report – financial stability diagnostic and scoping mission. IMF Country Report No. 23/170 (1ABWEA2023001.pdf)

Larkum, A.W.D. et al. (2018). Photosynthesis and Metabolism of Seagrasses. In: Larkum, A., Kendrick, G., Ralph, P. (eds) Seagrasses of Australia. Springer, Cham. https://doi.org/10.1007/978-3-319-71354-0_11

National Research Council. (2001). Marine Protected Areas: Tools for Sustaining Ocean Ecosystems. Washington, DC: The National Academies Press. https://nap.nationalacademies.org/catalog/9994/marine-protected-areas-tools-for-sustaining-ocean-ecosystems?utm_source=chatgpt.com

Palacios, E., van Beukering, P. P. J. H., van Zanten, B., Laclé, F., Schep, S., & Soellner, I. (2021). Linking ecosystem services and the Sustainable Development Goals in Small Island

Developing States: the case of Aruba. *One Ecosystem*, *6*, 1-23. Article e71033. https://doi.org/10.3897/oneeco.6.e71033

Polaszek, T., Lacle, F, van Beukering, P., Wolfs, E. (2019) The Economics of Ecosystems and Biodiversity, Aruba - Main report. Institute for Environmental Studies VU University

Perk, J.P. van der, (2002). Towards sustainable development of Aruba: Indicators for Ecological Quality. Development of an environmental assessment method for Aruba. VROM Aruba.

Pols, R. (2016). Nature valuation on Aruba: a perspective from the local community. A valuation study of cultural ecosystem services and environmental management. Master Thesis Research Project. MSc Environment and Resource Management 2015/2016. Vrije Universiteit Amsterdam.

Shayka, Bridget F., Hesselbarth, Maximilian H. K., Schill, Steven R., Currie, William S. and Allgeier, Jacob E. 2023The natural capital of seagrass meadows in the Caribbean: evaluating their ecosystem services and blue carbon trade potential. Biol. Lett.19: 20230075. https://doi.org/10.1098/rsbl.2023.0075

http://doi.org/10.1098/rsbl.2023.0075United Nations. (1982). United Nations Convention on the Law of the Sea. (https://www.cambridge.org/core/journals/american-journal-of-international-law/article/four-treaties-in-one-the-biodiversity-beyond-national-jurisdiction-agreement/9AAFCE1E5F60EF1ABF83AC8DB3829605?utm_source=chatgpt.com)

United Nations. (1992). Convention on Biological Diversity. (https://www.cbd.int/convention/text)

United Nations: Department of Economic and Social Affairs (2019) Localizing SDGs through Ecosystem Services in Aruba (https://sdgs.un.org/partnerships/localizing-sdgs-through-ecosystem-services-aruba - accessed 15-9-2024)

United Nations Environment Assembly. (2022). Resolution 5/14: End plastic pollution: Towards an international legally binding instrument. (https://www.unep.org/inc-plastic-pollution?utm_source=chatgpt.com)

United Nations Environment Programme. (1983). Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention). (https://www.unep.org/cartagena-convention)

United Nations Environment Programme. (1990). Protocol Concerning Specially Protected Areas and Wildlife (SPAW Protocol). (https://wedocs.unep.org/bitstream/handle/20.500.11822/27271/SPAW%20Protocol-en.pdf?sequence=1&isAllowed=y)

United Nations Environment Programme (UNEP). (2018). The Economics of Ecosystems and Biodiversity (TEEB) Aruba Final Report. Retrieved from https://www.dcbd.nl/sites/default/files/documents/TEEB-Aruba-Main-Report.pdf

United Nations Framework Convention on Climate Change. (2015). Paris Agreement. (https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf?utm_source=chatgpt.com)

Vermeij, M., Marhaver, K., Estep, A., & Sandin, S. (2019*).* Coral Reefs Baseline Study for Aruba. Government of Aruba: Directorate of Nature and Environment. (https://dnmaruba.org/wp-

content/uploads/2023/08/Aruba-Coral-Reef-Report_2021-compressed.pdf?utm_source=chatgpt.com)

Wolfs Company. (2018). Aruba's Value of Nature. Retrieved from https://www.wolfscompany.com/wp-content/uploads/2018/10/Arubas-Value-of-Nature.pdf

Wolfs, E., Laclé, F. Bubalo, M. van Beukering, P., & Pols, R. (2017). Cultural Ecosystem Services (CES) for Local Community in Aruba. Institute for Environmental Studies VU University

Zanten, B. van, Laclé, F., van Duren, S., Soberon, V., & Beukering, P. van, (2018). The Value Natural Capital for the Tourism Industry of Aruba. IVM - Institute for Environmental Studies VU University Amsterdam, Wolfs Company & YABI.