



# State of West African marine protected areas 2022

Editors: Tanya Merceron, Thierry Clément, Catherine Gabrié, Francis Staub, Taibou Ba, Marie Suzanna Traore



INTERNATIONAL UNION FOR CONSERVATION OF NATURE



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#### Editorial

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The goal of OBAPAO is to improve the long-term maintenance of biodiversity in West Africa, through promoting the use of the best scientific knowledge and data, and strengthening capacities to support policy and decision-making on conservation issues of biodiversity and the management of protected areas.

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The Regional Network of Marine Protected Areas in West Africa, RAMPAO, the only regional network of marine protected areas (MPAs) in West Africa, is the result of a common will expressed by States and several conservation actors, in the face of the numerous pressures and threats on the region's marine and coastal ecosystems. The purpose of RAMPAO is to ensure the conservation of biodiversity for the well-being of local communities, through an operational regional MPAs network.

For almost two decades, RAMPAO has been strengthening the conservation system regionally, improving the conservation status of some key species and habitats, including several which are in decline or even seriously threatened. The network enabled the strengthening of regional coordination between different categories of actors around joint objectives of preserving biodiversity and the valorisation of natural capital. RAMPAO, which is in full expansion, has currently more than 50 member MPAs from West African coastal countries.

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### Countries represented in this report

Benin



Cabo Verde



Côte d'Ivoire



Gambia



Ghana



Guinea-Bissau



Guinea



Liberia



Mauritania



Nigeria



Senegal



Sierra Leone



Togo



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# Preface

The year 2022 marked a turning point for conservation as the world adopted the new Global Biodiversity Framework. As a result, conservation stakeholders have seized the momentum to address the resource management issue in marine and coastal areas, characterized by high biological and ecological importance, coupled with a crucial socio-economic role. The publication of the State of West African marine protected areas (EdAMP) is thus an important step in establishing the foundations on which decision-makers can base their analyses and measure progress in the region.

The following publication is the result of a participatory and inclusive development process involving experts, researchers and conservators in the field. It extends over the 13 coastal countries of West Africa, namely: Mauritania, Senegal, Gambia, Guinea, Guinea-Bissau, Sierra Leone, Liberia, Côte d'Ivoire, Ghana, Togo, Benin, Nigeria and Cabo Verde. This is a first in the region and was made possible thanks to the BIOPAMA programme, funded by the European Union and the Organization of African, Caribbean and Pacific States (OACPS).

This report is intended to serve as a tool to support decision-making regarding marine protected areas (MPAs) at the local, national and regional levels, while meeting operational needs. Furthermore, it presents a snapshot of several elements of marine conservation in West Africa and offers reflections on specific themes to better understand and tackle MPAs issue in West Africa.

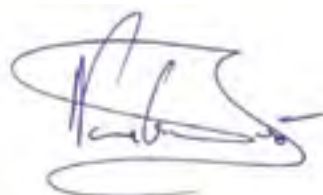
Indeed, the document deals both with the current situation of MPAs in the area, but also with issues common to all MPAs in the region regarding their governance, management, financing, uses and threats such as pollution, extractive and oil industry projects, and climate change. It also provides a diagnosis for what is missing, where the gaps are, and recommendations to address them.

One of the key activities behind the drafting of this work was the collection of data to map declared and recognized MPAs, but also considerable study that different experts carried out to complete and validate the databases. The EdAMP therefore offers the possibility of better taking into account efforts at the local and national levels to achieve the objectives of the Kunming-Montreal agreement, including the 30 x 30. Thus, this publication is an opportunity to move from the knowledge into action to better protect the planet.

The report therefore establishes a valuable baseline against which future progress can be measured. It contributes to regional and global reference information systems and partnerships that will support better-informed decision-making at national and global scales. It will help target areas of intervention and investment needed to improve both the governance and management of marine protected areas, while supporting the effectiveness of these systems as a foundation not only for life in marine and coastal areas, but also for the core human development objectives to the future of our planet.

IUCN and its partners urge national authorities, civil society organisations, multilateral development agencies, the private sector, and any expert or professional interested in the theme to make use of EdAMP in order to collectively work for the management and sustainable conservation of marine and coastal ecosystems in West Africa.

Enjoy your reading!



Nana TOURÉ-SY  
Regional Director  
IUCN West and Central Africa Regional Office (PACO)

# Executive summary

The coastal zone of West Africa covered by the State of marine protected areas (EdAMP - *État des aires marines protégées d'Afrique de l'Ouest*) extends approximately 6,000 km, from Mauritania in the north, passing through the deeply indented coasts of the islands and estuaries, then the lagoon coasts and the coastal strips of the Gulf of Guinea, up to Nigeria. The small island state of the Cabo Verde Islands, volcanic and mountainous, completes this geography.

These coastal areas are characterized by globally significant biodiversity: they include some of the most productive and diverse large marine ecosystems in the world, including significant upwelling areas, extensive mangrove forests, salt marshes, immense seagrass beds, seamounts and canyons, cold water coral reefs, and, more rarely (in Cabo Verde for example) areas of warm water (tropical) corals. The region brings together the largest colony of breeding monk seals on earth and an exceptional ornithological community. Several species are classified on the International Union for Conservation of Nature (IUCN) Red List as threatened with extinction (Vulnerable or Endangered). Thanks to the presence of seasonal upwellings, the region's marine waters are among the richest in fisheries resources on the planet, resources on which a significant part of the population depends.

But the marine ecosystem and coastal communities face many challenges, namely illegal, unreported and/or unregulated fishing, pollution, uncontrolled coastal development, etc., which harm habitats and species. The prospective reflections carried out on the region show the growing strategic importance of the West African coastal area, where most of the economic activity is concentrated, bringing together more than 40% of the total population and around 60% of the urban population of coastal states, dependent to varying degrees on these coastal and marine resources, often pillars of their economies. Climate change, with an already visible impact on the coastline, is exacerbating these many challenges.

The inventory work carried out within the framework of the EdAMP therefore identifies 141 marine and coastal protected areas, of which 84 are marine areas (with at least a small marine part), 55 are coastal only without marine part but with intrusions of salt water allowing the establishment of mangroves); 124 sites have been officially designated (by decree or order) and therefore have a national status while 15 do not have such national status, but have been designated of international interest (Ramsar sites), to which are added 7 biosphere reserves. These MPAs have very variable status, with managed natural resource protected areas (IUCN category VI) being the most numerous. But 50% of the MPAs identified have not been classified according to the IUCN categories by the authorities.

It is now established that MPAs, provided they are well managed, are effective tools for the conservation of biodiversity, the protection of marine and coastal environments and their resources, making it possible to strengthen the resilience of ecosystems.

EdAMP is a joint production of IUCN, RAMP AO and OBAPAO which takes stock of the situation, while offering in-depth analyses as well as recommendations on the opportunities and challenges in terms of MPAs in the region.

# Introduction

The marine protected areas of West Africa are located in an eco-region whose major characteristic is the presence of upwellings. Depending on the more or less strong influence of these upwellings and the terrigenous contributions of fluvial origin, these areas are linked to different coastal ecosystems which form a continuum with regard to their strong interactions. The eco-regional dimension of these protected areas is confirmed by the transboundary migrations of pelagic, turtles, marine mammals and waterbirds, not forgetting those of artisanal fishermen. On an administrative and institutional level, another eco-regional dimension is the colonial heritage, whether French, Portuguese or British, whose imprint on the legal frameworks and administrative practices of the countries concerned is manifest.

A regional challenge is required in terms of coastal zone management, not only with regard to the interactions between the different ecosystems and socio-systems but also the threats to which they are subject. In eco-regional management of the coastal zone, protected marine and coastal areas obviously have a determining role in the protection of species and habitats as well as in the regeneration of biodiversity. Another issue is regional integration to which the creation of a network of marine and coastal protected areas such as RAMPAO can contribute by participating in regional institutional strengthening.

However, a good perception of environmental awareness must be accompanied by a knowledge base and the production of tools likely to guide decision-making to integrate the environmental dimension into the strategic planning process of sectoral policies. It is in this perspective that the design and drafting of the first report on the State of marine protected areas (EdAMP) in West Africa falls, which includes a set of chapters addressing current and worrying environmental issues, as well as crucial management challenges to be met for sustainable development.

Being a reference document, it allows, on the one hand, to provide information on the state and evolving trends of marine and coastal ecosystems and human well-being in West Africa while assessing progress accomplished in the implementation of national environmental policies in this area.

We started designing the EdAMP in 2017, on the sidelines of the 7th edition of the General Assembly of the Regional Network of marine protected areas of West Africa (RAMPAO), which took place in Conakry (Republic of Guinea). The ambition expressed by the Steering Committee set up by the RAMPAO executive secretariat was to produce a document which meets three main objectives: including (1) to provide the most objective and exhaustive first overview possible of the efforts made in terms of governance and management of MPAs; (2) serve as a reference for monitoring the successes and challenges associated with the establishment and management effectiveness of MPAs in the region; and (3) present the social, environmental, political and economic stakes that West African MPAs will face in the years to come. Thus, in 2019, during the launch of the second phase of the BIOPAMA program, specific

and strategic actions were identified with the aim of bringing this regional project to fruition in 2022.

It therefore took no less than four years of reflection, discussion and above all co-construction between users, practitioners and experts in the conservation of marine and coastal resources to produce the first edition of the *State of marine protected areas* (EdAMP) of West Africa. From this angle, this publication presents itself as the result of a participatory and inclusive development process which benefits upstream from contributions from real conservation stakeholders, who have perfectly understood the responsibility of producing various relevant thematic articles valid for the entire region.

At first glance, EdAMP 2022 presents the national MPA networks of the 13 coastal countries of West Africa. By integrating factual information and current data, both in terms of typology, surface areas, distribution of these MPAs and the presentation of key species and habitats associated with them, the EdAMP immerses us in a kaleidoscopic mechanism of the system of networks of marine protected areas in the region.

In this first edition of EdAMP, best practices and innovative approaches in the creation, governance and management of MPAs in West Africa are also highlighted. From the contribution of RAMPAO through Sacred Natural Sites (SNS), shared governance with indigenous peoples and gender equity, the particularity of West Africa in the pursuit of conservation and of development at different scales, are illustrated. The tools and approaches in favour of a stronger contribution of MPA networks (national and regional) to the conservation of biodiversity are also developed by conservationists, who are at the heart of the daily management of MPAs.

At a time of the geographical extension of RAMPAO in line with the Kunming-Montreal Global Biodiversity Framework and the preparation of the additional protocol to the Abidjan Convention on MPAs, EdAMP also addresses the relevant question of creation of new MPAs, not without exposing the ecological shortcomings of the regional network of MPAs, the ZIEBs, which are identified to date without any protection status and the threats linked to pollution and the off-shore exploitation of petroleum and gas.

Faced with the financial vulnerability of the region's MPAs, the EdAMP also presents opportunities and suggests new approaches linked to new financing mechanisms such as blue economy, climate finance, but also to the different sustainable financing solutions tested in the region.

EdAMP 2022 finally addresses questions beyond the framework of MPAs to open a prospective look at the future of West African coastal zones in a context of socio-economic development and climate change, by encouraging readers to consider the place and contributions possibilities of MPAs for the sustainable development of marine and coastal areas of West Africa.

Marie Suzanna Traoré (RAMPAO) and Taibou Ba (CSE-OBAPAO)



# Acknowledgments

We would like to thank all those who have spared no effort, sometimes beyond their mandate, to ensure that the State of West African marine protected areas (EdAMP) is a publication of quality that can really serve as a working tool.

We particularly thank the national agencies teams from 13 countries concerned by the study as well as the consultants and non-state actors who were kind enough to share their data, studies, publications without which EdAMP would not be produced. A special thank you to the teams of the Observatory for Biodiversity and Protected Areas of West Africa (OBAPAO), UNEP-WCMC and the Joint Research Centre (JRC) of the European Commission who kindly supported the drafting of EdAMP.

There is still a long way to go but, together, we will get there.

Thank you to all of you!

BIOPAMA Team



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# Acronyms

ACCP	African Clean Cities Platform
AFD	French Development Agency
AIEB	<i>Aire marine d'importance écologique ou biologique</i> (ecologically or biologically significant marine areas, EBSA)
ANR	Assisted natural regeneration
ARIZ	Artificial Reef Immersion Zone
BACoMaB	Banc d'Arguin and Coastal and Marine Biodiversity
BIOPAMA	Biodiversity and Protected Areas Management Programme
CAFI	Central African Forest Initiative
CBD	Convention on Biological Diversity
CC	Climate change
CCLME	Canary Current Large Marine Ecosystems Project
COP	Conference of the Parties (to a Convention)
CSR	Corporate Social Responsibility
CTFs	Conservation Trust Funds
DAMCP	Department of Community marine protected areas (Senegal)
DMP	Development Management Plan
DOPA	Digital Observatory for Protected Areas
DRC	Democratic Republic of Congo
EAF	Ecosystem approach to fisheries
EBSAs	Ecologically or Biologically Significant Marine Areas
EBSAs	Ecologically or Biologically Significant Areas
EdAMP	State of marine protected areas ( <i>État des aires marines protégées</i> )
EEZ	Exclusive economic zone
EEZM	Mauritanian Exclusive Economic Zone
ESG	Environmental, Social and Governance
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FFEM	French Global Environment Facility
FIBA	Banc d'Arguin International Foundation
FR	Forest reserve
GBF	Global Biodiversity Framework

GD- PAME	Global Database on Protected Area Management Effectiveness
GDP	Gross domestic product
GHG	Greenhouse gas
GI- WACAF	Global Initiative for West, Central and Southern Africa
GMES	Global Monitoring for Environment and Security and Africa
HIPC	Highly indebted poor countries
IAEA	International Atomic Energy Agency
IBAP	Institute of Biodiversity and Protected Areas
ICCA	Indigenous and community conserved area
IMET	Integrated Management Effectiveness Tool
IUCN	International Union for Conservation of Nature
IUU fishing	Illegal, unreported and unregulated fishing
KBA	Key Biodiversity Areas
KfW	Kreditanstalt für Wiederaufbau
MEAs	Multilateral Environmental Agreements
MEEZ	Mauritanian EEZ
METT	Management Effectiveness Tracking Tool
MPA	Marine protected area
NGO	Non-governmental organisation
Nm	Nautical mile
NP	National Park
OA-ICC	Ocean Acidification International Coordination Centre
OBAPAO	Observatory for Biodiversity and Protected Areas in West Africa
ODA	Official development assistance
OECD	Organisation for Economic Co-operation and Development
OECMs	Other effective area-based conservation measures
PA	Protected area
PAH	Polycyclic aromatic hydrocarbons
PCPM	Monk Seal Conservation Program
PFA	Protected fishing areas
PFZs	Protected Fishing Zones
PIAP	People impacted or affected by projects
PIMFAO	Small initiatives and financial mechanisms for the conservation of marine and coastal biodiversity in West Africa ( <i>Petites initiatives et mécanismes financiers pour la conservation de la biodiversité marine et côtière en Afrique de l'ouest</i> )

PNBA	Banc d'Arguin National Park	TEV	Total economic value
PNBIMA	Baia do inferno y Monte Angra Natural Park	TPA	Terrestrial protected area
PND	Diawling National Park	TUA	Traditional use area
POWPA	Programme of Work on Protected Areas (CBD)	UNDP	United Nations Development Programme
PPP	Private-public partnership	UNEP	United Nations Environment Programme
PRCM	Regional Partnership for the Conservation of the Coastal and Marine Zone	UNESCO	United Nations Educational, Scientific and Cultural Organization
RAMPAO	Regional network of marine protected areas in West Africa	WACA	West African Coastal Management Program
RAPPAM	Rapid Assessment and Prioritization of Protected Areas Management	WACMP	West African Coastal Master Plan
RDV	Rose des Vents	WACOM	West African Coastal Observation Mission
REDD	Reducing greenhouse gas emissions from deforestation and forest degradation	WAEMU	West African Economic and Monetary Union
SDGs	Sustainable Development Goals	WCA	West and Central Africa
SRFC	Sub-regional Fisheries Commission	WCPA	World Commission on Protected Areas
STC	Scientific and Technical Council	WD-OECMs	Other effective area-based conservation measure
TBPA	Transboundary protected area	WDPA	World Database on Protected Areas
		WWF	World Wildlife Fund



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## Part 1 - West African marine protected areas

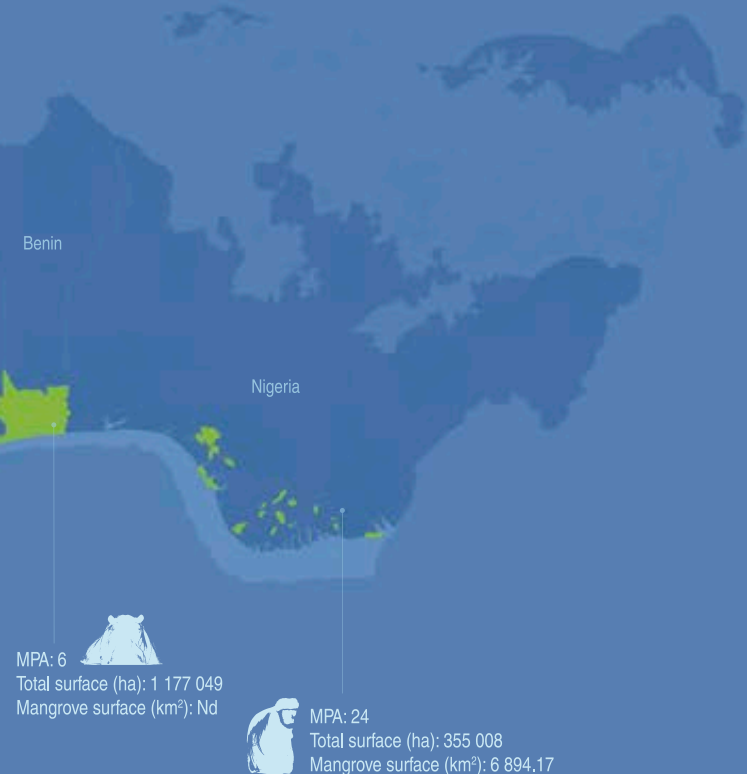
## Chapter 1

# Monograph of West African marine protected areas

*Vincent AYRAL*

This chapter deals with the structural elements for each of the 13 countries located in the area concerned by the publication, i.e. Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, Sierra Leone, Liberia, Côte d'Ivoire, Ghana, Togo, Benin, Nigeria and Cabo Verde. These elements include:

- Current MPAs in the country,
- National policy and regulatory contexts in relation to MPAs,
- Key habitats,
- Remarkable species,
- Pressures and threats,
- Management and governance of MPAs, and
- Maps locating the sites described in the publication.





© CBD-Habitat, monk seal

## 1.1 Mauritania

### Marine protected areas in Mauritania

Mauritania has 5 MPAs which represent more than 1,245,471 hectares protected. Most of these MPAs (97%) belong to the Banc d'Arguin National Park. The Baie de l'Étoile MPA is designated but does not have an official status yet.

### Transboundary MPAs

Senegal and Mauritania jointly created the Senegal River Delta Transboundary Biosphere Reserve (RBTDS) in 2005, with a UNESCO designation in 2012<sup>1</sup>. This includes the Djoudj National Bird Sanctuary (Senegal), the Diawling National Park (Mauritania) and the RAMSAR site Chat Tboul (Mauritania).

### Policy and regulatory framework

Apart from the Baie de l'Étoile MPA, Mauritania's MPAs were created between 1976 and 1991. The legal framework governing these marine areas is defined by Law No. 97-006 of 20 January 1997 repealing and replacing Law No. 75-003 of 15 January 1975 establishing the Hunting and Nature Protection Code, and Law No. 2000-045 of 26 July 2000 Law relating to environmental management and Law No. 2000/024 of 19 January 2000 relating to the Banc d'Arguin National Park. At the same time, Mauritania is involved in various regional programmes, particularly the Central and West Africa Programme

(PACO), and the regional programme for the conservation of the coastal and marine zone in West Africa. The country is a member of the Regional Network of Marine Protected Areas in West Africa (RAMPAO) and has also ratified several international conventions as shown in Figure 1.1. Furthermore, regarding the MPAs management in the country, the Mauritanian Coastal Master Plan was validated by the interministerial committee in 2005. The general objective of the Plan is to implement a sustainable development approach to the Mauritanian coast.

The Ministry of the Environment and Sustainable Development (MEDD) and in particular its Central Directorate called the Directorate of Protected Areas and the Coastline (DAPL) is responsible for MPAs.

### Key habitats

The Banc d'Arguin National Park offers a wide variety of habitats: mangroves, seagrasses, mudflats and channels. They are completed on the mainland by hills and rocky mounds, shrub beds and wadis as well as sandbanks. The Cap Blanc satellite reserve is mainly made up of limestone cliffs, while the Diawling National Park has floodplains, marshes and dunes suitable for birdlife. The Baie de l'Étoile completes these ecosystems with sandy or pebble beaches, rocky coasts, salt marshes and sea grass beds. In addition, the Chat Tboul Nature Reserve corresponds to an old mouth on very

<sup>1</sup> <https://en.unesco.org/biosphere/africa/delta-fleuve-senegal>

salty surfaces (known as “sebkhas”) and also has mudflats or intertidal marshes.

## Remarkable species

The habitats mentioned above are home to endemic sub-species (grey heron and spoonbill). Moreover, there are concentration sites of migratory avifauna (for instance *Phoenicopterus* flamingos, Platalea spoonbills, Ardea herons, *Phalacrocorax* cormorants; 107 species of migratory water birds in the PND). The Cap Blanc Reserve is a resting place for seabirds but above all is home to the last population of Mediterranean monk seals (about a hundred seals), an endangered species, although there are only 2 resident males left. The reserve also includes endemic plant species, associated with the foggy coastal desert: *Limonium chazeli*, *Lotus Chazeli*, *Teclion*, etc.

The marine wildlife is also very rich (dolphins, sea turtles, killer whales, etc.). The PND is a breeding site for reptiles including the Seba python (*Python Sebae*), the Nile Monitor (*Varanus niloticus*). As for the ichthyofauna, there are 87 species, including 47 freshwater species in the PND, and more than 140 species in the PNBA.

Baie de l'Étoile is characterized by the diversity of its benthic fauna with 3 species of crustaceans endemic to the bay. Forty species of birds are present there (white-breasted cormorant, pink flamingo, white pelican, etc.). As for the Chat Tboul Nature Reserve, it is home to a nesting population of lesser flamingos.

## Pressures and threats

Infrastructure (Nouakchott-Nouadhibou trans-Saharan road; construction of the Tanit port and port facilities, associated roads), and urban development (e.g. N'Diogo) have an impact on biodiversity (on shell mounds, for instance).

Increased fishing effort and catches lead to a reduction in stocks, aggravated by illegal fishing.

Mining activities are also a threat: the Cap Blanc Reserve is covered with red dust of iron ore from the unloading, at the port of Nouadhibou, of a train that brings the ore from a mine located 600 kilometres to the east. An industrial salt extraction activity is present in Chat Tboul and the exploration and exploitation of hydrocarbons offshore can constitute a threat.

There are natural phenomena of coastal erosion and the natural collapse of the cliffs which shelter the seals at Cap Blanc.

The hydraulic management of the PND is threatened by climate change which accentuates the rise in water levels, salinization and variations in water levels, modifying the coastline in particular. The development of agriculture and livestock farming upstream of the delta leads to water management issues and pollution related to inputs. Rice encroachment and the associated irrigation channels are also a pressure on the environment.

Finally, invasive alien species are also a real threat (*Typha domingensis* and *Tamarix senegalensis*).

**Table 1.1 List of MPAs in Mauritania**

MPA name	Surface (ha)
Banc d'Arguin National Park (1976) <sup>1</sup>	1 208 13
Cap Blanc Satellite Reserve (1986)	210
Diawling National Park (1991) <sup>1,2</sup>	18 769
Chat Tboul Nature Reserve (1991) <sup>1,2</sup> (pending validation)	15 500
Baie de l'Étoile (being formalized)	2 979

<sup>1</sup>Included in a RAMSAR site or constitutes a RAMSAR site

<sup>2</sup>Site included in a biosphere reserve or that constitutes a biosphere reserve

## Conventions ratified by Mauritania

- 📅 **22 February 1983**  
RAMSAR Convention
- 📅 **20 January 1994**  
United Nations Framework Convention on Climate Change (UNFCCC)
- 📅 **17 July 1996**  
United Nations Convention on the Law of the Sea (UNCLOS)
- 📅 **16 August 1996**  
Convention on Biological Diversity (CBD)
- 📅 **24 November 1997**  
MARPOL International Convention for the Prevention of Pollution from ships
- 📅 **11 June 1998**  
Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora
- 📅 **18 November 2010**  
Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones

**Figure 1.1 Conventions ratified by Mauritania**

## Management of marine protected areas

The majority of MPAs have a management plan that goes beyond 2021. The Chat Tboul RAMSAR site, which does not yet have a defined legal status, does not have a management plan. While for the MPA project around the Baie de l'Étoile, the Orientation and Monitoring Commission for the Directive for the Development of the Littoral of the Baie de l'Étoile (COS-DAL) proposed a validated version in 2013 of a development and management plan<sup>2</sup> but without a defined period. For more information see Chapter 4.

<sup>2</sup> <https://aires-marines.uqar.ca/id/eprint/84/1/PAG%20AMP%20Baie%20Etoile.pdf>



## Country summary



Surface  
(Km<sup>2</sup>)

**1 030 700**



Population  
(Millions)

**4,64**



Demography  
(% annual)

**2,7**



GDP (USD  
current Billions)

**7,77**



GDP growth in  
2019 (%/year)\*

**5,9**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



**Mangrove area (km<sup>2</sup>)**

2016 / variation 1996-2016

**Nd / Nd**

Source: Global Mangrove Watch

### Remarkable species and habitats

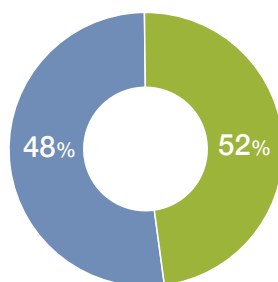


**Habitats:** mangroves, sea grass beds, mudflats, channels, rocky hills and mounds, shrub beds and wadis, sandbanks, limestone sandstone cliffs, sandy or pebble beaches, salt marshes, sebkhas.

**Species:** monk seals, dolphins, sea turtles, orcas, birds (white-breasted cormorant), lesser flamingos, flamingos, spoonbills and herons.

### Distribution between marine and terrestrial surface of MPAs in Mauritania (ha)

■ Marine area  
■ Surface area



### Pressures and threats

- ⊕ Anthropogenic infrastructure and urban development
- ⊕ Extractive activities (mines, salt, oil)
- ⊕ The natural phenomena of coastal erosion and the natural collapse of cliffs
- ⊕ Climate change
- ⊕ Overfishing

### Application period of management plans

MPA name	2018	2019	2020	2021	2022	2023	2024
Diawling National Park	■						
Banc d'Arguin National Park			■				
Cap Blanc Satellite reserve			■				
Chat Tboul Natural reserve			■				

### National designation of MPAs

National designation	Number
National Park	2
Satellite reserve	1
Ornithological reserve	1
MPA multiple uses	1

### IUCN MPA management category

Category	Number
Category Ia - Strict Nature Reserve	1
Category Ib - Wilderness area	0
Category II - National Park	1
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	0
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	1
Not specified	2

Figure 1.2 Overview of the state of MPAs in Mauritania



**Figure 1.3 Map locating of the MPAs in Mauritania** Source: OBAPAO: Reference geographic database



© Nathalie Cadot, Mauritania



## 1.2 Senegal

© Régis L'hostis, Langue de Barbarie National Park, Senegal

### Marine protected areas in Senegal

Senegal has 23 MPAs (see Table 1.2) which represent 699,523 hectares protected. Among these MPAs, six are classified as RAMSAR sites and two MPAs belong to the Saloum biosphere reserve created in 1980.

### Transboundary MPAs

Senegal and Mauritania have jointly created the Senegal River Delta Transboundary Biosphere Reserve (RBTDS) which represents 641,768 ha. The official UNESCO designation dates from 2012<sup>3</sup>. This includes in particular the Djoudj bird park (protected area in Senegal) and the Diawling National Park, an MPA in Mauritania.

### Policy and regulatory framework

These MPAs were created between 1970 and 2022. The legal framework governing these marine areas is defined by Law No. 86-04 of 24 January 1986 on the new hunting and wildlife protection lawcode, Law No. 98-03 of 8 January 1998 on the forestry code as well as law No. 98-32 of 14 March 1998 on the maritime fishing code. In addition, it should be noted that Senegal is engaged in various regional programmes, including the Central and West Africa Programme (PACO), the Regional Programme for the Conservation

of the Coastal and Marine Zone in West Africa, etc. Senegal is also a member of the Regional Network of Marine Protected Areas in West Africa (RAMPAO). It has also put in place a Letter of Sectoral Policy for Fisheries and Aquaculture as well as a policy for protected areas. This policy is co-managed by an inter-ministerial committee and by the National Parks Department. Community MPAs are managed by the marine protected areas Department (DAMP). In addition, Senegal has ratified several international conventions as shown in Figure 1.4.

This institutional mechanism should enable the country to sustainably manage the fishery resources present in these areas, and therefore preserve these ecosystems.

### Key habitats

Senegal has a great diversity of habitats along its coastal strip of approximately 718 km. Within its MPAs, in the marine environment, there are sea trenches, sea grass beds and underwater cliffs and volcanic islands. In coastal and continental environments, limestone cliffs, wooded and shrubby savannahs and dunes. At the interface between the marine and the continental, at the level of the estuaries in particular, there are mangroves and bolongs, mudflats and tannes, as well as coastal wetlands (Niayes).

3 <https://en.unesco.org/biosphere/africa/delta-fleuve-senegal>

## Conventions ratified by Senegal

<p><b>03 November 1977</b> Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora</p>
<p><b>11 November 1977</b> RAMSAR Convention</p>
<p><b>05 May 1984</b> Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones</p>
<p><b>25 October 1984</b> United Nations Convention on the Law of the Sea (UNCLOS)</p>
<p><b>17 October 1994</b> United Nations Framework Convention on Climate Change (UNFCCC) Convention on Biological Diversity (CBD)</p>
<p><b>16 January 1997</b> MARPOL International Convention for the Prevention of Pollution from ships</p>

Figure 1.4 Conventions ratified by Senegal

The coastal zone is very productive because it benefits from coastal upwelling<sup>4</sup> which is a source of nutrients, as well as terrigenous inputs from the watercourses.

## Remarkable species

MPA environments are habitats for migratory birds (e.g. bluebird, stagnatile sandpiper, etc.) and water birds (Great Cormorant, gray and white pelican, royal terns, etc.). They are also home to many marine mammals (dolphins, monk seals, manatees, white-day otters) and land mammals (spotted hyenas) as well as sea turtles (e.g. green turtle). Molluscs are also present in these MPAs (e.g. oysters, lobster, and cymbium), as far as fish is concerned, we find emblematic species such as: Thiof, red carp, barracudas, carrangidae, pompaneau.

## Pressures and threats

The environments are threatened by both anthropogenic and natural factors.

Overexploitation of marine resources by sometimes inappropriate capture techniques and poaching of endangered species (e.g. sea turtle) contribute to the depletion of stocks and biodiversity. Mangroves are threatened by illegal logging. The development of agriculture, irrigation infrastructure and the increasing use of agrochemicals result in ecological changes. The modification of upstream hydrological regimes by dams has an impact on coastal MPAs or those located in estuaries.

The development of invasive species, as well as the salinization of water and the acidification of soils are also factors of environmental degradation, in particular the mangrove, which is disappearing

Table 1.2 List of MPAs in Senegal

MPA name	Surface (ha)
Lower Casamance National Park (1970)	5 000
Madeleine Islands National Park (1976)	45
Saloum Delta National Park (1976) <sup>1,2</sup>	76 000
Langue de Barbarie National Park (1976) <sup>1</sup>	2 000
Ornithological Reserve of Kalissaye (1978) <sup>1</sup>	16
Gueumbeul Wildlife Reserve (1983) <sup>1,2</sup>	720
Popenguine Nature Reserve (1986)	1 009
Palmarin Nature Reserve (2001) <sup>1</sup>	10 430
MPA of Kayar (2004)	17 100
MPA of Joal-Fadiouth (2004)	17 400
MPA of Saint-Louis (2004)	49 600
MPA of Abéné (2004)	11 900
Community Marine Protected Area of Bamboung (2004)	7 000
Kawawana Community Indigenous Protected Area (2010)	9 930
APAC by Kapac Olal (2013) – now included in the MPA Ufoyaal Kassa bandial	22 280
MPA of Sangomar (2014)	87 437
MPA of Gandoul (2014)	28 121
MPA Niamone Kalounayes (2015)	66 032
MPA Kassa Balantacounda (2016)	23 200
Grande Niaye de Pikine and Dépendance Urban Nature Reserve (2019)	650
MPA of Somone - ex RNICS (2020) <sup>1</sup>	4 120
MPA of Gorée (2020)	52 517
MPA of Kaalolaal Blouf Fogny (2020)	83 853
MPA Ufoyaal Kassa-Bandial (2022)	123 163

<sup>1</sup>-Included in a RAMSAR site or constitutes a RAMSAR site

<sup>2</sup>-Site included in a biosphere reserve or that constitutes a biosphere reserve

in favour of tannes. Opening a breach in the Langue de Barbarie National Park could eventually; completely disrupt its environment.

Due to economic development in the coastal zone, there is strong anthropogenic pressure that causes pollution and degradation of marine ecosystems.

The development of invasive species, as well as the salinization of water and the acidification of soils are also factors in the degradation of the environment, particularly the mangrove, which is disappearing in favour of tannes. The opening of a breach in the Barbarie Language National Park could, in the long term, completely disrupt its environment.

<sup>4</sup> Rise of cold water from the bottom of the ocean to the surface

Due to economic development in the coastal zone, MPAs near urbanized areas experience strong anthropogenic pressure that causes pollution (e.g. solid waste, wastewater) and degradation of marine ecosystems. Hydrocarbon (gas, oil) exploration and exploitation activities represent threats to the environment.

Finally, climate change is weakening Senegal's MPAs by intensifying coastal erosion and the encroachment of the sea.

### Management of marine protected areas

MPAs in Senegal are national parks, indigenous and community heritage areas, marine protected areas, or nature reserves or wildlife reserves. Depending on the type of MPA, there are different types of governance. Some MPAs have set up management bodies including, for example: steering committee, management committee with an executive office, a permanent secretariat and a scientific

and technical committee. Community management is also highly developed in Senegal's MPAs.

According to the data collected, only 12 MPAs have a management plan that goes beyond 2021 (see Figure 1.6).

All MPAs in Senegal, except the Basse Casamance National Park and Ufoyaal Kassa-Bandial MPA, have a management plan. However, out of the 22 management plans, 12 end before 2022 or in 2022.

The management plan for the Ufoyaal Kassa-Bandial MPA created in 2022 is being developed, while some MPAs intend to update their management plans (Somone, Saloum Delta, Palmarin). For more information see Chapter 4.



© Régis L'hostis, spotted hyena (*Crocota crocuta*), Palmarin, Senegal

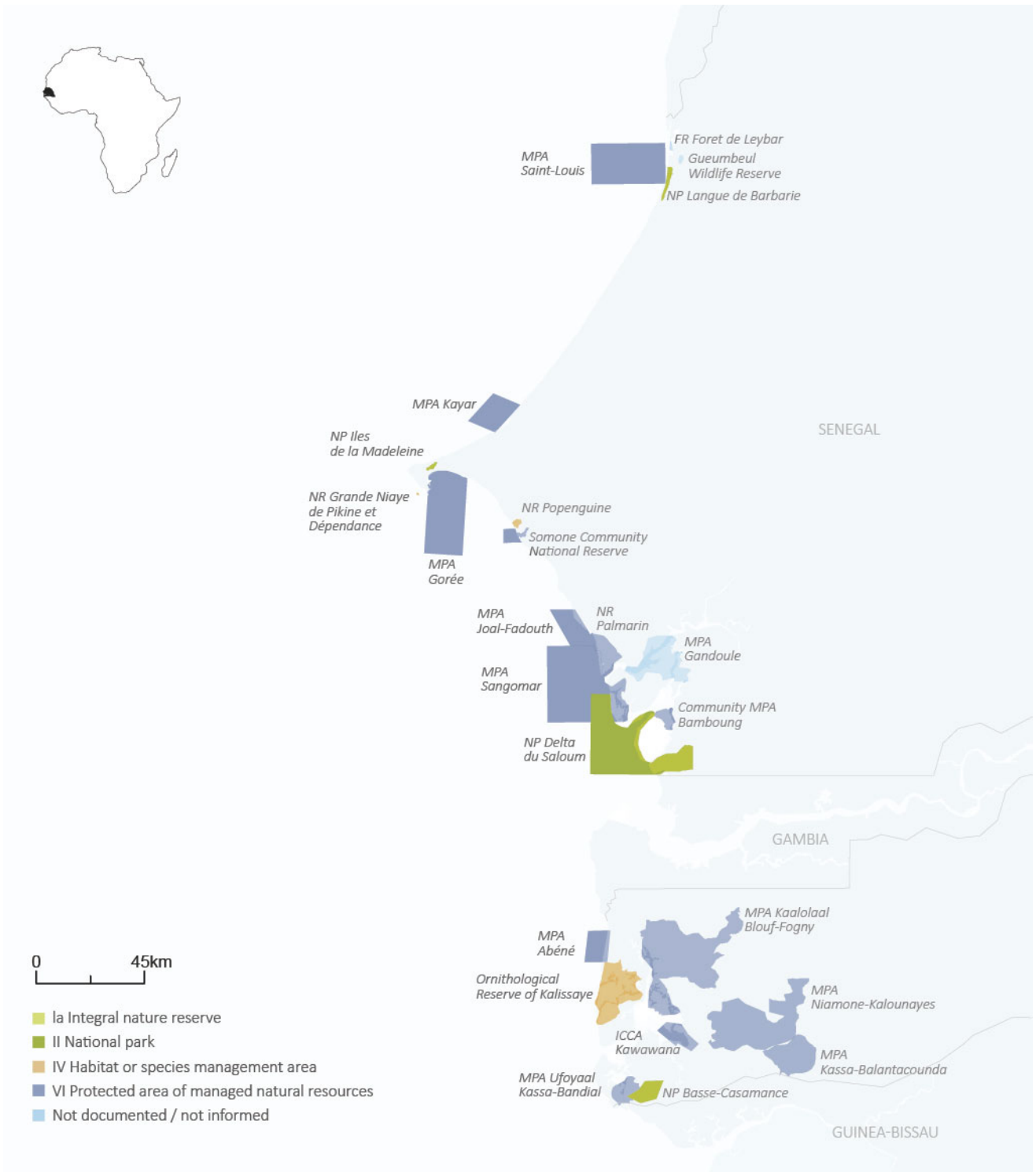


Figure 1.5 Map locating of the MPAs in Senegal Source: OBAPAO: Reference geographic database

## Country summary



Surface  
(Km<sup>2</sup>)

**196 710**



Population  
(Millions)

**16,74**



Demography  
(% annual)

**2,7**



GDP (USD  
current Billions)

**24,91**



GDP growth in  
2019 (%/year)\*

**4,4**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



### Mangrove area (km<sup>2</sup>)

2016 / variation 1996-2016

**1 247.84 / - 52.16**

Source: Global Mangrove Watch

### Remarkable species and habitats

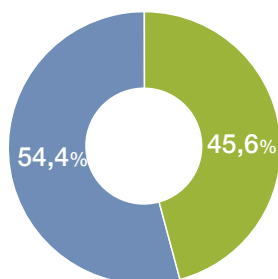


**Habitats:** mangroves, bolongs, marine canyon, seagrass beds, mudflats, tannes, niayes, cliffs, savannahs.

**Species:** dolphins, manatees, fish (thiof, red carp), hyenas, turtles, marine and migratory birds.

### Distribution between marine and terrestrial surface of MPAs in (ha)

■ Marine area  
■ Surface area



### Pressures and threats

- ⊗ Overfishing and illegal fishing
- ⊗ Exploitation of mangrove wood
- ⊗ Exploration and exploitation of hydrocarbons (gas, oil)
- ⊗ Agriculture (agricultural pollutants, modification of the water regime, etc.)
- ⊗ Modification of the environment potentially aggravated by climate change (salinization, soil acidification, erosion, rise in sea level) and human activities (hydraulic developments)

### National designation of MPAs

National designation	Number
Marine Protected Area	12
National Park	4
Indigenous and community heritage area	2
Nature reserve	1
Special wildlife reserve	1
Urban nature reserve	1
Community nature reserve	1
Ornithological Reserve	1

### IUCN MPA management category

Category	Number
Category Ia - Integral nature reserve	0
Category Ib - Wilderness Area	0
Category II - National Park	4
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	4
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	15
Not specified	1

Figure 1.6 Overview of the state of MPAs in Senegal

## Application period of management plans

MPA name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
NP langue de Barbarie	■	■	■	■	■												
NR Popenguine	■	■	■	■	■												
NP Iles de la Madeleine	■	■	■	■	■												
NP Delta du Saloum				■	■	■	■	■	■								
MPA Saint-Louis				■	■	■	■	■	■								
NR Palmarin				■	■	■	■	■	■								
MPA Somone (ex: RNICS)				■	■	■	■	■	■								
Apac Kapac Olal						■	■	■	■	■	■	■	■				
MPA Niamone Kalounayes							■	■	■	■	■	■	■				
MPA Autochtone communautaire Kawawana										■	■	■	■	■	■	■	■
MPA Communautaire du Bamboung											■	■	■	■	■	■	■
MPA de Kassa Balantacounda												■	■	■	■	■	■
MPA Kayar												■	■	■	■	■	■
MPA Joal-Fadiouth												■	■	■	■	■	■
MPA Abéné												■	■	■	■	■	■
MPA Gandoul												■	■	■	■	■	■
MPA Sangomar												■	■	■	■	■	■
Gueumbeul Wildlife Reserve																	■
MPA Kaalolaal Blouf Fogny																	■
MPA Gorée																	■
Kalissaye Ornithological Reserve																	■
NR Urban area of Grande Niaye de Pikine and Dependency																	■

Source: RAMPAO



© Régis L'hostis, Langue de Barbarie National Park, Senegal





## 1.3 Gambia

© Curiosa.Photography - stock.adobe.com, mangroves, Gambia

### Marine protected areas in t the Gambia

The Gambia has 15 marine protected areas (see Table 1.3) which represent 92,004 ha. Among these MPAs, 3 are registered on the list of RAMSAR sites. More than half of Gambia's MPAs were created recently, i.e in 2019. Officially designated as a reserve in 2001, the Tanbi site was classified on the RAMSAR list in 2007 and then designated a National Park in 2008.

### Transboundary MPAs

The governments of Gambia and Senegal applied in 2008 to register "Niimi-Saloum" as the first transboundary RAMSAR site in Africa<sup>5</sup>, which includes the RAMSAR sites of the Saloum Delta (Senegal) and Niimi National Park (Gambia). For the sites concerned, this is a participatory management arrangement and not a separate legal status.

### Policy and regulatory framework

The Gambia's MPAs were created between 1986 and 2019. The legal framework governing these marine areas is defined by the Biodiversity and Wildlife Management Law of 2002. In parallel, The Gambia is committed to various regional programmes, in particular the Central and West Africa Programme (PACO), and the regional programme for the conservation of the coastal and marine zone

in West Africa. The country is a member of the Regional Network of Marine Protected Areas in West Africa (RAMPAO). It has also ratified several international conventions as shown in the Figure 1.7. Furthermore, with regard to the management of MPAs in the country, it is centralized, and is directly developed and implemented by the Department of Parks and Wildlife Management, attached to the Ministry of Fisheries and Water Resources.

### Key habitats

The characteristic habitats of MPAs in The Gambia are mangroves, bolongs and sandy beaches or dune ridges. On the continental side, habitats correspond to tannes, wooded and shrubby savannah. Bijol Island is a nesting site for many species such as terns, gulls and seagulls. Data is missing for MPAs that were created in 2019.

### Remarkable species

MPAs are home to emblematic species such as the manatee (*Trichechus senegalensis*), sea turtles, dolphins (*Souza teuzsii*) and whales. 295 species of birds from 65 different families are listed in the Rives du Tanji and Bijol Island reserve.

Terrestrial mammals are also present such as the leopard *Panthera pardus*, the spotted hyena (*Crocuta crocuta*), the Buffon's cob *Kobus kob*, the patas monkeys or red colobus. Wetlands are also home to hippos, otters or the sitatunga (*Tragelaphus spekii*), a rare species of

5 <https://www.ramsar.org/fr/news/niimi-saloum-le-premier-site-ramsar-transfrontiere-dafrique>

marsh antelope. The Nile crocodile is also present. Eleven species of reptilians have been recorded in the Bolongfenyo community wildlife reserve.

## Pressures and threats

Overfishing, at inappropriate times, with destructive techniques (e.g. drag nets) and illegal fishing affects marine species.

The increase in the population and its needs for food and raw materials leads to an intensification of agriculture which does not leave time for regeneration and which can result in uncontrolled fires used to clean the land, or to the exploitation of importance of forests.

In addition, the reduction in rainfall has changed the seasonal flow of the various bolongs affecting the surrounding vegetation; the bolongs are further affected by erosion, siltation and sedimentation.

The exploitation of mangroves for food purposes (wood, roof) or commercial uses degrades this ecosystem. The lack of salt water due to blockages in the bolongs is a risk factor for the survival of mangroves.

Waste from Banjul is dumped on the coasts near Tanbi National Park causing pollution.

Urban expansion (e.g. Kanifing, Gunjur Village) is a threat to Tanbi National Park while construction of coastal roads (e.g. roads in Karanding) may alter watercourses.

## Management of marine protected areas

The five MPAs created before 2019 have management plans. But none of these management plans has a post-2021 application period. The MPAs created in 2019 are mostly ICCAs (indigenous and community conserved areas) which are managed by community representatives living in the MPA or nearby, but these MPAs do not currently have management plans. For more information see Chapter 4.

**Table 1.3 List of MPAs in Gambia**

MPA name	Surface (ha)
Niumi National Park (1986) <sup>1</sup>	7758
Kiang West National Park (1987)	23 621
Tanji Shores and Bijol Island Reserve (1993)	824
Bao Bolong Wetland Reserve (1993) <sup>1</sup>	29 650
Bolongfenyo community wildlife reserve (2008)	156
Tanbi National Park (2008) <sup>1</sup>	6 759
Bintang's APAC (2019)	1 184
APAC by Brefet (2019)	985
APAC of Kassagne (2019)	132
APAC by Tintiba & Dumbuto (2019)	172
Bambako APAC (2019)	1 032
APAC by Barrow Kunda (2019)	359
Chamen's APAC (2019)	32
Kanuma's APAC (2019)	47
Jokadu National Park (2019)	824

*1-Included in a RAMSAR site or constitutes a RAMSAR site*

*2-Site included in a biosphere reserve or that constitutes a biosphere reserve*

## Conventions ratified by Gambia

### 📅 24 November 1977

Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora

### 📅 05 May 1984

Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones.

### 📅 22 May 1984

United Nations Convention on the Law of the Sea (UNCLOS)

### 📅 10 June 1994

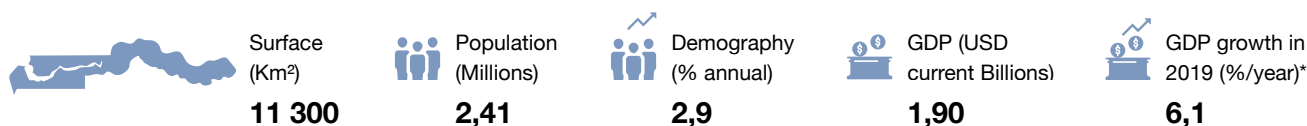
United Nations Framework Convention on Climate Change (UNFCCC)  
Convention on Biological Diversity (CBD)

### 📅 16 January 1997

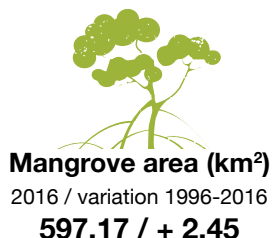
RAMSAR Convention

**Figure 1.7 Conventions ratified by Gambia**

## Country summary



\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



Source: Global Mangrove Watch

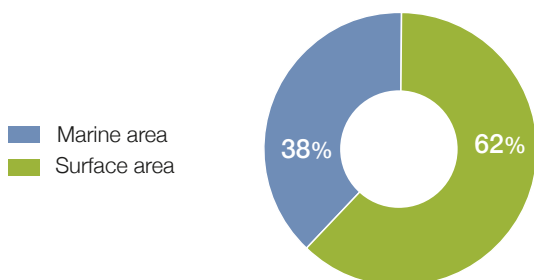
### Remarkable species and habitats



**Habitats:** mangroves, bolongs of sandy beaches or dune cords, tannes, wooded and shrub savannah.

**Species:** West African manatee (*Trichechus senegalensis*), marine turtles, dolphins (*Sousa teuszii*), sitatunga (*Tragelaphus spekii*), leopard, spotted hyena, Buffon's cob (*Kobus kob*), patas monkeys or bay colobus.

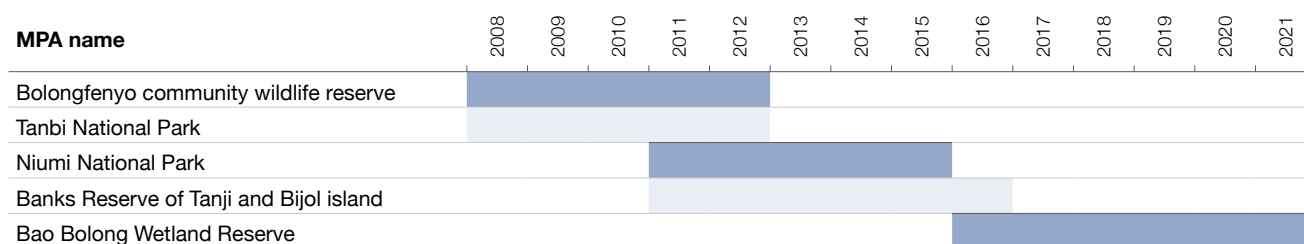
### Distribution between marine and terrestrial surface of MPAs in Gambia (ha)



### Pressures and threats

- ⊕ Overfishing and inappropriate fishing techniques
- ⊕ Exploitation of mangrove wood
- ⊕ Reduced rainfall
- ⊕ Agricultural intensification
- ⊕ Water salinization
- ⊕ Siltation and sedimentation of bolongs
- ⊕ Urban expansion

### Application period of management plans



Source: RAMPAO

### National designation of MPAs

National designation	Number
APAC	8
National Park	4
Community Wildlife Reserve	1
Wetland reserve	1
Nature reserve	1

### IUCN MPA management category

Category	Number
Category Ia - Integral nature reserve	0
Category Ib - Wilderness Area	0
Category II - National Park	3
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	0
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	12

Figure 1.8 Overview of the state of MPAs in Gambia

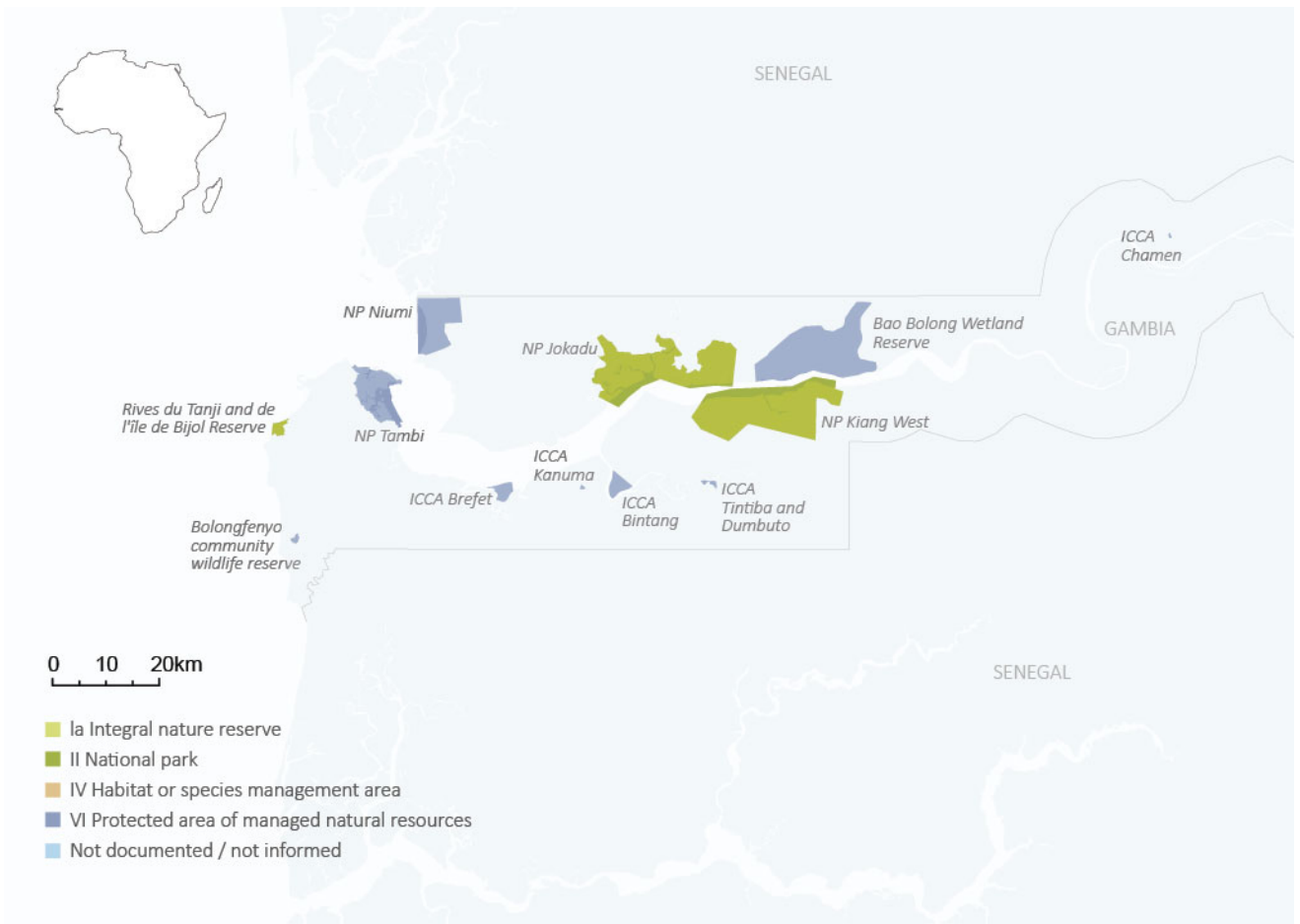


Figure 1.9 Map locating of the MPAs in Gambia Source: OBAPAO: Reference geographic database





## 1.4 Guinea-Bissau

© Helljo & Van Ingen, Bijagós, Guinea-Bissau

### Marine protected areas in Guinea-Bissau

Guinea-Bissau has 6 MPAs with national status covering 559,035 ha. Among these nationally designated MPAs, the Rio Cacheu River Mangroves Natural Park and the Cufada Ponds Natural Park are also RAMSAR sites. In addition, the Bijagós Archipelago Biosphere Reserve created in 1996, which has also been a RAMSAR site since 2014, is an MPA with only international status. It represents 1,046,950 hectares and includes in particular the community MPA of Urok, the Orango National Park and the João Vieira e Poilão Islands Marine National Park.

Rio Grande Buba<sup>6</sup> (2015, 110,846 ha) is considered an MPA in the “Protected Planet” database, but no official validation has confirmed this.

### Transboundary MPAs

Guinea-Bissau does not have any transboundary MPAs.

### Policy and regulatory framework

Guinea-Bissau’s MPAs were created between 1990 and 2015. The legal framework governing these marine areas is defined by Framework Law No. 3-97 of 26 May 1997 related to protected areas. At the same time, Guinea-Bissau is involved in various regional

programmes, in particular the Central and West Africa Programme (PACO), the coastal planning programme in 1989, in collaboration with numerous national partners, and the regional programme for the conservation of the coastal and marine zone in West Africa. The country is also a member of the Regional Network of Marine Protected Areas in West Africa (RAMPAO). Guinea-Bissau has also ratified several international conventions as shown in Figure 1.10. Furthermore, as concerns the management of MPAs, the policy of protected areas is placed under the general supervision of the Ministry of Agriculture and Forests.

### Key habitats

The MPAs are home to remarkable ecosystems: The Cantanhez forest represents the last vestige of dense subhumid forest, the Rio Cacheu River Mangroves Natural Park (PNMC) mainly made up of mangroves (68% of the territory) and is considered the largest contiguous mangrove formation in West Africa.

There is also shrubby, herbaceous coastal savannah or mudflats rich in molluscs and annelids, salt flats and also sandbanks playing the role of resting place for migrating water birds.

The Cufada Ponds Natural Park includes freshwater lakes, with significant aquatic vegetation, as well as extensive marshes and seasonally flooded meadows.

<sup>6</sup> <https://www.protectedplanet.net/317051>

## Remarkable species

Marine mammals include manatees, dolphins (humpback, bottlenose dolphin), white-cheeked otters, hippopotamus and turtles (green turtles, hawksbill turtles, olive ridley turtles, leatherback turtles).

In the João Vieira e Poilão Islands Marine National Park, there are 7,000 breeding female green turtles. The island thus represents the most important spawning site for this species in the entire eastern part of the Atlantic.

Due to the diverse habitats, a great diversity of birds exists: 56 species of waterbirds live in the Urok MPA and the forests of Cantanhez are classified by the WCMC (World Conservation Monitoring Centre) as one of the 9 important sites from the point of view of biodiversity, they are home to a rare species of bird, such as the yellow-helmeted hornbill.

The PNTC Cacheu is home to 248 species of birds such as the crowned crane (*Balearica pavonina*), the flamingo (*Phoenicopterus roseus*), the lesser flamingo (*Phoeniconaias minor*), the gray pelican (*Pelecanus rufescens*), etc.

The Orango National Park is also an important habitat for the Gabonese gray parrot (*Psittacus erithacus*), a rare and threatened species across the sub-region.

Terrestrial mammals are also present such as the elephant (*Loxodonta africana*), the buffalo (*Syncerus manus*), the antelopes (*Hippotragus equinus*, *Kobus ellipsiprymnus*), the deffasa waterbuck, and primates.

## Pressures and threats

Illegal fishing, often undertaken by non-resident fishermen, puts pressure on fishery resources. Slash-and-burn agriculture affects forest resources, as does the cutting of mangroves for smoking fish purposes. The exploitation of wood from forests, palm groves for structural timber or the installation of new plantations (Tabancas, cashew nuts) is increasingly degrading the forest ecosystem.

Human activities upstream also represent threats (e.g. development of a phosphate mining industry in the prospecting phase upstream of the Rio Cacheu).

Similarly, Climate change is also a threat due to associated reduced rainfall and sea level rise.

In the Catanhez National Park, upstream deforestation, particularly of the mangroves on the banks of rivers, leads to erosion, siltation of rivers, and progressive silting up. There is also a rise in salt water.

Table 1.4 List of MPAs in Guinea-Bissau

MPA name	Surface (ha)
Cufada Ponds Natural Park (1990) <sup>1</sup>	89 000
Orango National Park (2000) <sup>2</sup>	158 235
João Vieira e Poilão Islands Marine National Park (2000) <sup>2</sup>	49 513
The Rio Cacheu River Mangroves Natural Park (PNMC) (2000) <sup>1</sup>	88 615
Community Marine Protected Area of Urok (2005) <sup>2</sup>	54 500
Cantanhez Forest National Park (2008) <sup>2</sup>	105 767
Archipelago Bolama Bijagós (Ramsar 2014) <sup>1,2</sup>	1 046 950

<sup>1</sup>-Included in a RAMSAR site or constitutes a RAMSAR site

<sup>2</sup>-Site included in a biosphere reserve or that constitutes a biosphere reserve

## Conventions ratified by Guinea-Bissau

- ✦ **25 August 1986**  
 United Nations Convention on the Law of the Sea (UNCLOS)

---

- ✦ **14 May 1990**  
 RAMSAR Convention

---

- ✦ **14 August 1990**  
 Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora

---

- ✦ **27 October 1995**  
 Convention on Biological Diversity (CBD)  
 United Nations Framework Convention on Climate Change (UNFCCC)

Figure 1.10 Conventions ratified by Guinea-Bissau

## Management of marine protected areas

Management and conservation instruments (Parks, Biosphere Reserve, RAMSAR, etc.) overlap.

Except for the natural park of the ponds of Cufada and the Rio Grande de Buba, all the other MPAs have a management plan although these may not be up to date. Local actors and traditional communities are involved in the process of creating and then managing protected areas which are “parks with people and for people”. For more information see Chapter 4.

## Country summary



Surface  
(Km<sup>2</sup>)  
**36 130**


Population  
(Millions)  
**1,96**

Demography  
(% annual)  
**2,4**

GDP (USD  
current Billions)  
**1,43**

GDP growth in  
2019 (%/year)\*  
**4,5**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



**Mangrove area (km<sup>2</sup>)**  
2016 / variation 1996-2016  
**2 571.69 / +3.28**

Source: Global Mangrove Watch

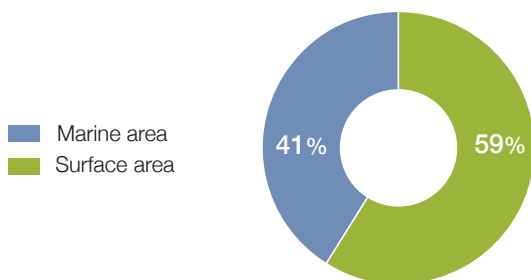
### Remarkable species and habitats



**Habitats:** mangroves, dry and subhumid forests, shrubby and herbaceous coastal savannah, mudflats and sandbanks.

**Species:** manatees, dolphins (humpback, bottlenose dolphin), white-cheeked otters, hippopotamus and turtles (green, hawksbill, olive ridley and leatherback).

### Distribution between marine and terrestrial surface of MPAs in Guinea-Bissau (ha)



### Pressures and threats

- ⊕ Overfishing
- ⊕ Cutting of mangroves and forest
- ⊕ Slash-and-burn agriculture
- ⊕ Climate change (reduced rainfall, sea level rise)
- ⊕ Prospective mining development upstream of MPAs

### Application period of management plans

MPA name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Rio Cacheu River Mangrove Natural Park																
João Vieira e Poilão Islands Marine Natural Park																
Urok Community MPA																
Orango National Park																
Cantanhez Forest National Park																

### National designation of MPAs

National designation	Number
National Park	2
Marine National Park	1
Natural Park	2
Community marine protected area	1

### IUCN MPA management category

Category	Number
Category Ia - Integral nature reserve	0
Category Ib - Wilderness Area	0
Category II - National Park	3
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	0
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	
Not specified	3

Figure 1.11 Overview of the state of MPAs in Guinea-Bissau

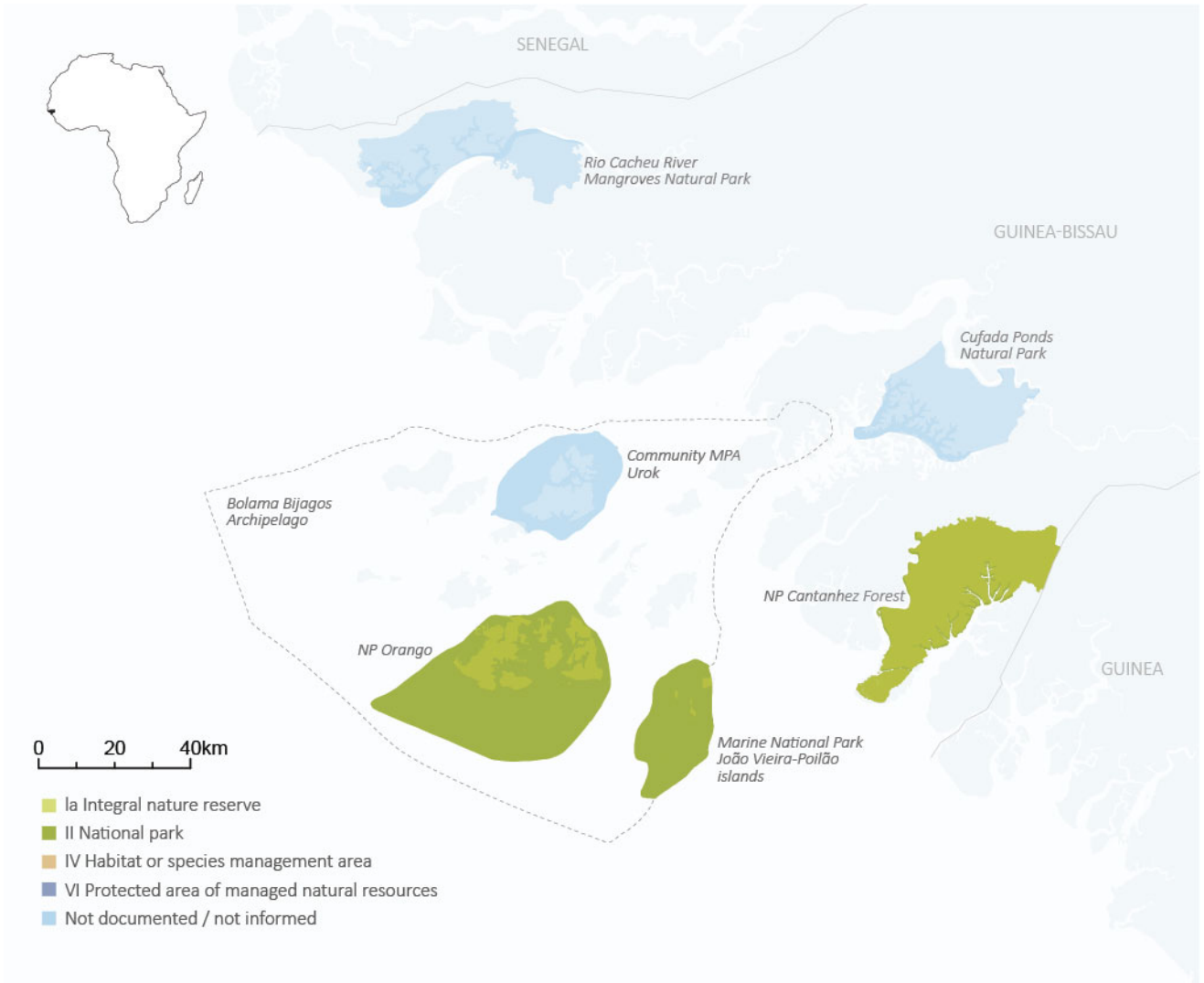


Figure 1.12 Map locating of the MPAs in Guinea-Bissau Source: OBAPAO: Reference geographic database







## 1.5 Guinea

© Julien Semelin, bobby brown, Alcatraz, Guinea

### Marine protected areas in Guinea

Guinea has 6 MPAs covering 220,384 ha. All of these MPAs are on the list of RAMSAR sites. However, since their registration as RAMSAR sites in 1992, the Rio Pongo and Rio Konkouré have not yet been officially designated as MPAs. The other MPAs have national status.

### Transboundary MPAs

Guinea does not have a transboundary MPA.

### Policy and regulatory framework

Guinea's MPAs were created between 1992 and 2013. The legal framework governing these marine areas is defined by Law No. 99/038/AN on the Code for the Protection of Wildlife and Hunting Regulations, and the Decree creating the Tristão Islands Managed Nature Reserve D/2013/037/PRG/SGG of 20 February 2013. At the same time, Guinea has committed to various regional programmes, in particular the Central and West Africa Programme (PACO), and the regional programme for the conservation of the coastal and marine zone in West Africa. The country has also ratified several international conventions as shown in Figure 1.13.

Guinea is also a member of the Regional Network of Marine Protected Areas in West Africa (RAMPAO).

Furthermore, as concerns the management of MPAs in the country, the Guinean Office of Parks and Reserves (OGUIPAR), is the government authority responsible for creating and managing MPAs in Guinea. It is placed under the authority of the Ministry of Environment and Sustainable Development. The Department of Fisheries also plays an important and essential role, particularly in the identification, the process of setting up and in the future management of Guinea's MPAs.

### Key habitats

Three MPAs (Tristão, Alcatraz, Loos) are island complexes with a diversity of ecosystems such as coral reefs, sandy beaches and islands, and rocky bottoms. Alcatraz Island is covered in a thick layer of guano. On the Tristão Islands, there are also mangroves, grasslands of Sesuvium plant formation. In the back of the mangrove, there are zones of halophilic herbaceous plants (grassy tannes) and oversaline bare surfaces (live tannes). These ecosystems are migration, reproduction, spawning and nursery areas for coastal and marine wildlife species. They are also breeding, nesting and hibernation habitats for a large number of rare birds.

The other three MPAs correspond to an estuary complex, a delta or ecosystems along a river. There are marshy coastal plains bordered by a cordon of stabilized dykes, mangroves which constitute spawning grounds, hatcheries and niches for a varied range of marine species, sandbanks sheltering the reproduction of turtles,

and intertidal mudflats, with freshwater marshes for the nesting of a wide variety of waterfowl.

### Remarkable species

Because of their habitats conducive to the reproduction and nesting of birds, MPAs in Guinea are home to a high diversity of birds. The Tristão/Alcatraz Islands complex is home to 223 species of birds<sup>7</sup>. Alcatraz Island is home to the largest colony of brown boobies (*Sula Leucogaster*) in West Africa (3,000 pairs). Other bird species include terns (Royal, Caspian, Pierregarin, Caugek, Dwarf) and black terns (*Chlidonias nigra*), two rare species of flamingos, swallows, the Episcopal stork (*Ciconia episcopus*), the goliath heron (*Ardea goliath*), the Ombrette (*Scopus umbretta*), the tantalum (*Tantale ibis*) and the fish eagle (*Haliaetus vocifer*).

The terrestrial fauna is characterized by a significant presence of warthogs, primates, genets, cane rats and various species of reptiles.

The site also serves as a wintering area for Osprey (*Pandion haliaetus*). In the backwaters, the presence of the manatee (*Trichechus senegalensis*) is also reported. The seafront is rich in fishing resources. Finally, it is home to dolphins, manatees, sea turtles and Nile crocodiles.

### Pressures and threats

Illegal industrial fishing, as well as uncontrolled small-scale fishing, with the taking of protected species (rays, turtles, etc.) deplete fishery resources. Logging of inland forests and mangroves threatens habitats for the species mentioned below. Rice cultivation and intensive agriculture are also a threat to the diversity of the sites. Bauxite mines are also a source of pollution (e.g. Friguia-Kimbo bauxite smelter).

### Management of marine protected areas

The Alcatraz Islands are uninhabited but monitored by the conservators of the Tristão Islands MPA, they do not have a management plan.

The Tristão Islands Managed Nature Reserve and the Loos Islands Wildlife Sanctuary have a management plan for the period 2016-2021. In addition, the Rio Kapatchez Nature Reserve Management Plan is being developed. Rio Pongo and Rio Konkouré do not have management plans. For more information see Chapter 4.

**Table 1.5 List of MPAs in Guinea**

MPA name	Surface (ha)
Loos Islands/White Island Wildlife Sanctuary (1992) <sup>1</sup>	294
Rio Kapatchez Nature Reserve (1992) <sup>1</sup>	30 478
Tristão Islands Managed Nature Reserve (2009) <sup>1</sup>	135 000
Alcatraz Integral Nature Reserve (2013) <sup>1</sup>	5
MPA not designated	Surface (ha)
Rio Konkouré Delta (1992) <sup>1</sup>	29 614
Rio Pongo (1992) <sup>1</sup>	24 993

<sup>1</sup>-Included in a RAMSAR site or constitutes a RAMSAR site

<sup>2</sup>-Site included in a biosphere reserve or that constitutes a biosphere reserve

### Conventions ratified by Guinea

#### 📅 20 December 1977

Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora

#### 📅 06 May 1984

Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones

#### 📅 05 September 1985

United Nations Convention on the Law of the Sea (UNCLOS)

#### 📅 18 March 1993

RAMSAR Convention

#### 📅 07 May 1993

United Nations Framework Convention on Climate Change (UNFCCC)  
Convention on Biological Diversity (CBD)

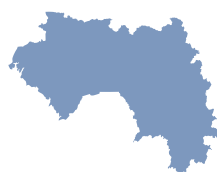
#### 📅 02 October 2002

MARPOL International Convention for the Prevention of Pollution from ships

**Figure 1.13 Conventions ratified by Guinea**

<sup>7</sup> Last inventory in 2017

## Country summary



Surface  
(Km<sup>2</sup>)

**245 860**



Population  
(Millions)

**13,13**



Demography  
(% annual)

**2,8**



GDP (USD  
current Billions)

**15,68**



GDP growth in  
2019 (%/year)\*

**5,6**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



### Mangrove area (km<sup>2</sup>)

2016 / variation 1996-2016

**2 225.98 / -16.82**

Source: Global Mangrove Watch

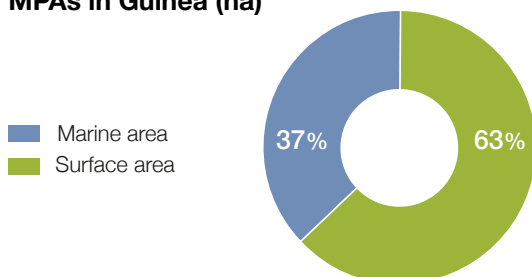
### Remarkable species and habitats



**Habitats:** coral reefs, beaches and sandy islets, rocky bottoms, continental forest, mangroves and marshy coastal plains bordered by a stabilized line of dikes.

**Species:** brown boobies, flamingos, herons, terns, dolphins, turtles, manatees, Nile crocodiles, warthogs and primates.

### Distribution between marine and terrestrial surface of MPAs in Guinea (ha)



### Pressures and threats

- ⊕ Overfishing
- ⊕ Exploitation of wood from continental and mangrove forests
- ⊕ Mining (Bauxite)
- ⊕ Intensive farming
- ⊕ Destruction of habitats
- ⊕ Coastal erosion

### Application period of management plans

MPA name	2016	2017	2018	2019	2020	2021
Tristão Islands managed Natural Reserve	[Active]					
Loos Islands Wildlife Sanctuary	[Active]					

### National designation of MPAs

National designation	Number
Managed Community Nature Reserve	1
Managed nature reserve	1
Integral Nature Reserve	1
Wildlife sanctuary	1
Not specified	2

### IUCN MPA management category

Category	Number
Category Ia (Integral nature reserve) or Ib (Wilderness area)	2
Category II - National Park	0
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	0
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	2
Not specified	2

Figure 1.14 Overview of the state of MPAs in Guinea



Figure 1.15 Map locating of the MPAs in Guinea Source: OBAPAO: Reference geographic database



© Penumb - stock.adobe.com, tropical forest, Guinea



## 1.6 Sierra Leone

© Leasmhar, Wikimedia Commons, Sierra Leone

### Marine protected areas in Sierra Leone

Sierra Leone has 5 MPAs which represent 135,173 ha. The Scarcies MPA includes Yelibuya island; The Sherbro River estuary includes Turtle and Bonthe island, while the Sierra Leone River Estuary, which is also a RAMSAR site, includes two forest reserves (Waterloo and Western area).

### Transboundary MPAs

Sierra Leone does not have transboundary MPAs.

### Policy and regulatory framework

All MPAs were created in 2012. The legal framework governing these MPAs is defined by Law No. 27 of 1972 on wildlife conservation, amended in 1990 and Forestry Law No. 27 of 1988 of 24 May 1988. In addition, Sierra Leone is involved in various regional programmes, including the Central and West Africa Programme (PACO), the UNDP Small Grants Programme, and the Regional Coastal and Marine Zone Conservation Program in West Africa. The country is also a member of the Regional Network of Marine Protected Areas in West Africa (RAMPAO). Sierra Leone has also ratified several international conventions as shown in Figure 1.16

### Key habitats

Yawri Bay is the outlet of 3 rivers, namely Ribi, Kukuli and Kargboro, around which extend mangrove forests. Further upstream, there are freshwater swamp forests. The site consists of intertidal sand and mudflat at the mouth of Kargboro Creek. Similarly the Sierra Leone River Estuary, the Scarcia Region and the Sherbro River Estuary are also dominated by a mangrove ecosystem. Marsh meadows are also present on the sites.

These four estuaries account for over 90% of the mangrove area of Sierra Leone, and the Sherbro Estuary accounts for over half of the mangrove area.<sup>8</sup>

### Remarkable species

Yawri Bay is Sierra Leone's most productive coastal wetland in terms of fishery resources.

MPAs are home to many waterbirds. 46 species of migratory birds are present in Yawri Bay including 4 remarkable species, including the avocet, the crested tern, the water dikkop and the Damara tern. The estuaries are home to globally threatened species of sea turtles: hawksbill turtle, green turtle, olive ridley turtle, loggerhead turtle; as well as the West African manatee.

<sup>8</sup> <https://www.wabicc.org/mdocs-posts/sherbro-river-estuary-co-management-plan/>

In the Sierra Leone River estuary, 36 species of waterbirds were recorded in 1994 with a total of over 20,000 waterbirds. In the estuary of the Sherbro River, 147 species of freshwater and marine fish have been recorded.

### Pressures and threats

The main pressure is the cutting of mangroves for firewood and the change of land use for agriculture purposes. In addition, overfishing and unsustainable fishing activities (e.g. illegal mesh, use of toxic products) affect aquatic wildlife and water birds.

The estuary of the Sierra Leone River is threatened by industrial development in the bay (two industrial ports and industrial sites), and by unplanned urban expansion which has caused the elimination of 20 hectares of mangroves. In addition, miners clear the mangrove to access the sand along the beaches.

Coastal flooding and erosion damage coastal biodiversity. Finally, pollution of water resources reduces the stock of fish and affects the quality of fishing.

### Management of marine protected areas

Two MPAs do not have management plans. Yawri Bay is a classified site and does not yet have a formal management plan for the management of the site's biodiversity, but this is under construction. Official management of the bay focuses on regulating fishing activities. For more information see Chapter 4.

**Table 1.6 List of MPAs in Sierra Leone**

MPA name	Surface (ha)
Scarcies (2012)	12 803
Sierra Leone Estuary River (2012, RAMSAR: 1999) <sup>1</sup>	48 906
Sherbro river estuary (2012)	33 564
Yawry Bay (2012)	36 659
Sulima (unspecified)	3 240

*1-Included in a RAMSAR site or constitutes a RAMSAR site*

*2-Site included in a biosphere reserve or that constitutes a biosphere reserve*

### Conventions ratified by Sierra Leone

- 05 May 1984**  
Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones

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- 12 December 1994**  
United Nations Convention on the Law of the Sea (UNCLOS)

---

- 26 January 1995**  
Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora

---

- 22 June 1995**  
United Nations Framework Convention on Climate Change (UNFCCC)

---

- 13 April 2000**  
RAMSAR Convention

---

- 26 July 2001**  
MARPOL International Convention for the Prevention of Pollution from ships

**Figure 1.16 Conventions ratified by Sierra Leone**



© Helliö & Van Ingen, sternes

## Country summary



Surface  
(Km<sup>2</sup>)

**72 300**



Population  
(Millions)

**7,97**



Demography  
(% annual)

**2,1**



GDP (USD  
current Billions)

**3,86**



GDP growth in  
2019 (%/year)\*

**5,6**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



### Mangrove area (km<sup>2</sup>)

2016 / variation 1996-2016

**1 264.03 / -4.51**

Source: Global Mangrove Watch

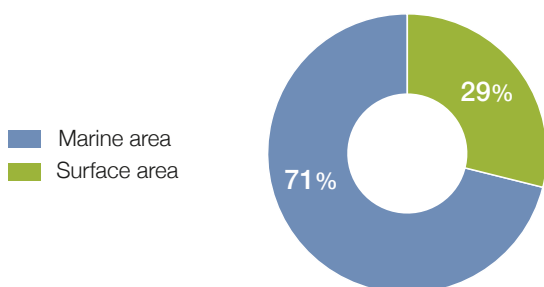
### Remarkable species and habitats



**Habitats:** mangroves, mudflats, freshwater swamp forests and wet meadows.

**Species:** water birds, migratory birds, sea turtles, manatees, freshwater and marine fish.

### Distribution between marine and terrestrial surface of MPAs in Sierra Leone (ha)



### Pressures and threats

- ⊕ Exploitation of the mangrove
- ⊕ Uncontrolled fishing
- ⊕ Industrial development of the bay and urban extension
- ⊕ Floods and coastal erosion

### National designation of MPAs

National designation	Number
MPA	4
Integral nature reserve	1

### Application period of management plans

Lack of information for the dates of the two existing management plans (Sherbro river estuary, Sierra Leone River Estuary).

### IUCN MPA management category

Category	Number
Category Ia - Integral nature reserve	0
Category Ib - Wilderness Area	0
Category II - National Park	0
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	0
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	0
Not specified	5

Figure 1.17 Overview of the state of MPAs in Sierra Leone



Figure 1.18 Map locating of the MPAs in Sierra Leone Source: OBAPAO: Reference geographic database



© Gaylen Rathburn via Wikimedia Commons, West African manatee





## 1.7 Liberia

© Bethel. Anthony Chisom via Creative Commons, Lake Piso, Liberia

### Marine protected areas in Liberia

Liberia has an MPA with national status (Lake Piso) covering 109,381 ha, but with RAMSAR classification. This country also has two MPAs with international status only (RAMSAR sites) representing 18,928 ha. Three MPAs have been proposed as national parks, but they have not been formalized.

### Transboundary MPAs

Liberia does not have any transboundary MPAs.

### Policy and regulatory framework

Liberia's MPAs were established in 2003. The Environmental Protection Agency (EPA) is responsible for RAMSAR wetlands.

In addition, the country is committed to a regional programme (PACO) Central and West Africa Programme and has ratified several international conventions as presented in Figure 1.19

Protected areas are the responsibility of the Liberian Environmental Protection Agency (EPA).

### Key habitats

Liberia's 3 MPAs provide sandy and rocky shorelines along Lake Piso or the rivers that feed them. Further upstream, there are

evergreen rainforests, freshwater swamp forests, coastal savannah grasslands. All these protected areas have mangrove forests comprising 3 species, namely *Rhizophora harrisonii*, *R. mangle* and *Avicennia africana*.

### Remarkable species

These habitats are suitable for harboring migratory birds as the Lesser Kestrel (*Falco naumanni*), Purple Heron (*Ardea purpurea*), Glossy Ibis (*Plegadis falcinellus*), African White-crested Bittern (*Tigrionis leucolophus*), Red-thighed Sparrowhawk (*Accipiter erythropus*), etc. 51 of the 184 species of birds in the Guinea-Congo forest biome have been spotted at Lake Piso.

The Mesurado wetlands freshwater lagoon is also home to some of the most popular fish species for Liberians (Barracuda and Cavalla). While Lake Piso is home to a rich aquatic life: crocodile, fish, lobsters, crabs, crayfish, etc.

Endangered species are also present at these sites, such as the endangered olive colobus (*Procolobus verus*) and the chimpanzee (*Pan troglodytes*).

### Pressures and threats

The main pressures on habitats and species come from anthropogenic activities and are aggravated by the increase in the local population. This results in site pollution (solid waste, sewage,

Table 1.7 List of MPAs in Liberia

MPA name	Surface (ha)
Lake Piso (2003) <sup>1</sup>	79 091
Marshall Wetlands (2006) <sup>1</sup>	12 168
Measured wetlands (2006) <sup>1</sup>	6 760
Proposed MPAs	Superficie (ha)
Magribi mangrove	23 813
Cestos-Senkwehn	83 209
Grand kru river gee	135 100

1-Included in a RAMSAR site or constitutes a RAMSAR site

2-Site included in a biosphere reserve or that constitutes a biosphere reserve

upstream industrial pollution: Firestone Rubber Plantation company, Liberia Refinery Company), urban expansion and road construction. In addition, the continuous and uncontrolled harvesting of mangroves and fishing with tight mesh nets in particular are significant pressures on ecosystems. Finally, agriculture, fires and hunting degrade the biodiversity of sites.

### Management of marine protected areas

The three RAMSAR sites in Liberia do not have a management plan. For more information see Chapter 4.

### Conventions ratified by Liberia

- ✦ **28 October 1980**  
MARPOL International Convention for the Prevention of Pollution from ships

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- ✦ **09 June 1981**  
Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora

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- ✦ **05 May 1984**  
Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones

---

- ✦ **08 November 2000**  
Convention on Biological Diversity (CBD)

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- ✦ **05 November 2002**  
United Nations Framework Convention on Climate Change (UNFCCC)

---

- ✦ **02 November 2003**  
RAMSAR Convention

---

- ✦ **25 September 2008**  
United Nations Convention on the Law of the Sea (UNCLOS)

Figure 1.19 Conventions ratified by Liberia



© Marc Languy, egretta, Liberia

## Country summary



Surface  
(Km<sup>2</sup>)

**111 370**



Population  
(Millions)

**5,05**



Demography  
(% annual)

**2,4**



GDP (USD  
current Billions)

**2,95**



GDP growth in  
2019 (%/year)\*

**-2,3**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



### Mangrove area (km<sup>2</sup>)

2016 / variation 1996-2016

**189.23 / -3.62**

Source: Global Mangrove Watch

### Remarkable species and habitats

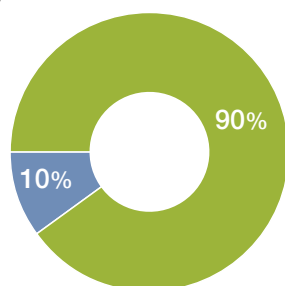


**Habitats:** mangroves, coastal savannah grasslands and forests, tropical evergreen rainforest, swamp forest, sandy and rocky shores.

**Species:** migratory birds, crocodile, fish, lobsters, crabs, crayfish and primates (colobus and chimpanzee).

### Distribution between marine and terrestrial surface of MPAs in Liberia (ha)

■ Marine area  
■ Surface area



### Pressures and threats

- ⊕ Pollution from anthropogenic activities (solid waste, wastewater, industrial pollution, etc.)
- ⊕ Uncontrolled exploitation of mangroves
- ⊕ Fishing with unsuitable means (small meshes of the net)
- ⊕ Farming
- ⊕ Hunting

### National designation of MPAs

National designation	Number
Reserve for multiple and sustainable uses (Multiple Sustainable Use Reserve)	1

Two MPAs do not have national status.

### Application period of management plans

No management plan is developed for Liberia's MPAs.

### IUCN MPA management category

Category	Number
Category Ia - Integral nature reserve	0
Category Ib - Wilderness Area	1
Category II - National Park	0
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	0
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	0
Not specified	2

Figure 1.20 Overview of the state of MPAs in Liberia



Figure 1.21 Map locating of the MPAs in Liberia Source: OBAPAO: Reference geographic database



© Marc Languy, sunbird dans la mangrove, Liberia



## 1.8 Côte d'Ivoire

© Hans-Peter Schaub, sooty mangabey, Côte d'Ivoire

### Marine protected areas in Côte d'Ivoire

Côte d'Ivoire has 15 MPAs representing 479,009 ha, of which 272,375 hectares correspond to the first site with official marine protected area status in Côte d'Ivoire, which was designated by Decree in 2022 (Grand-Béréby). It is the first site of the initiative to create the network of MPAs in Côte d'Ivoire, which should include the transboundary site of Tabou at the mouth of the Cavally River, the classified forest of Dassioko, the site of the National Park of Azagny, the transboundary site of the Ehotilé Islands.

Among the 15 MPAs, six are concerned by a RAMSAR inscription and two only have the international RAMSAR status (Grand Bassam, Sassandra Dagbego complex).

### Transboundary MPAs

Côte d'Ivoire does not have an official transboundary MPA. Among the future MPAs being created, there are 2 transboundary MPAs: the transboundary site at the mouth of the Cavally River in Tabou (Côte d'Ivoire – Liberia) and the transboundary site of the Ehotilé Islands (Côte d'Ivoire – Ghana).

### Policy and regulatory framework

The majority of Côte d'Ivoire's MPAs are in the process of being created. The legal framework governing these marine areas is defined by Law No. 2017 – 378 of 2 June 2017 on the Development, Protection and Integrated Management of the Coast. The Decree for the Grand Béréby MPA was adopted in July 2022<sup>9</sup>. Côte d'Ivoire is involved in the PACO regional programme (Central and West Africa Programme). The country has also ratified several international conventions as shown in Figure 1.22.

The management of National Parks and Nature Reserves is carried out by the Ministry of Environment and Sustainable Development in collaboration with the Ministry of Water and Forests and in particular SOFEFOR (Société de Développement des Forêts) and DFRC (Direction de la Faune et Hunting Resources).

### Key habitats

Data concerning the habitats and species of classified forests are mostly missing. As far as the RAMSAR sites are concerned, they bring together a very wide diversity of habitats. On the one hand, there are rocky or sandy coasts, with sandy beaches or cliffs and habitats of estuaries or lagoons. On the other hand, the habitats correspond to brackish marshes, flooded meadows, wet or dry coastal savannahs as well as a great diversity of forests (terra firma

9 [https://www.gouv.ci/\\_council-minister-details.php?recordID=449](https://www.gouv.ci/_council-minister-details.php?recordID=449)

## Conventions ratified by Côte d'Ivoire

📅 <b>26 March 1984</b>	United Nations Convention on the Law of the Sea (UNCLOS)
📅 <b>05 May 1984</b>	Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones
📅 <b>05 October 1987</b>	MARPOL International Convention for the Prevention of Pollution from ships
📅 <b>29 November 1994</b>	United Nations Framework Convention on Climate Change (UNFCCC) Convention on Biological Diversity (CBD)
📅 <b>19 February 1995</b>	Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora
📅 <b>27 June 1996</b>	RAMSAR Convention

Figure 1.22 Conventions ratified by Côte d'Ivoire

forest, dense primary or secondary forest, riparian forest, swamp forests of pure water). Finally, several species of mangroves are present and constitute a refuge or feeding areas for many terrestrial (mammals, monkeys, snakes, etc.) and aquatic (fish, crabs, etc.) animal species. The Fresco site has the distinction of being the only wetland in Côte d'Ivoire with two types of mangroves (lagoon and estuary). These habitats are crossed by rivers, streams, or canals.

## Remarkable species

These habitats are home to endangered species such as the Diana monkey, the Nile or long-snouted forest crocodile, the leatherback or olive ridley turtle, the forest elephant, the West African manatee, or the peregrine falcon.

Endemic species are also present in these different sites: the white-necked monkey and the petaurist at N'ganda N'ganda; the pygmy hippopotamus in Azagny National Park; the black and white colobus and the hoary monkey in the Fresco site.

The avifauna is rich in many species, especially aquatic or waders such as the Blue-billed Malimbe (*Malimbus nitens*), the White-browed Flycatcher (*Fraseria cinerascens*), the Black-headed Timali (*Hypergerus atriceps*), with in particular quasi-endemic species such as the bronze-tailed starling, the bulbul anteat, the barbed cuckoosher in the Grand Bassam site.

Finally, the gray mangrove present on the Fresco site is an endangered species in Côte d'Ivoire.

The abundance of bats should be highlighted in the Ehotilé-Essouman complex, as well as the wealth of aquatic wildlife Elops lacerta (*Guinea copace*), sea banana (*Albula vulpes*), *Dasyatis margarita* (Stingray daisy), etc.

Table 1.8 List of MPAs in Côte d'Ivoire

MPA name	Surface (ha)
Dassioko Classified Forest (1923) - MPA status proposed in 2020	12 538
Nzida Classified Forest (1938)	25
Audoin Classified Forest (1939)	5 760
Kohoh Classified Forest (1943)	3 325
Nguechie Classified Forest (1945)	3 500
Port Gautier Classified Forest (1968)	5 269
Monogaga Classified Forest (1973)	79 600
Ehotilé-Essouman Islands National Park (1974) <sup>1</sup>	720
Azagny National Park (1981) - proposed MPA status in 2020 <sup>1</sup>	19 400
Nganda Ngada Classified Forest (1996) <sup>1</sup>	14 402
Dahliaffleur Nature Reserve (2004) - MPA status proposed in 2020 <sup>1</sup>	148
Sassandra-Dagbego Complex (2005) <sup>1</sup>	10 551
Grand Bassam (2005) <sup>1</sup>	40 211
Fresco Classified Forest (2010) <sup>1</sup>	15 507
Grand-Béréby MPA (2022)	272 375
<b>Proposed MPA</b>	<b>Superficie (ha)</b>
Transboundary site at the mouth of the Cavally River in Tabou (Côte d'Ivoire – Liberia)	Not specified
Côte d'Ivoire-Ghana transboundary coastal area	Not specified

<sup>1</sup>Included in a RAMSAR site or constitutes a RAMSAR site

<sup>2</sup>Site included in a biosphere reserve or that constitutes a biosphere reserve

## Pressures and threats

Human activities are the main threats to ecosystems. The hunting of mammals, birds and bats using non-selective techniques, as well as fishing without controlling the size of the nets and without protecting the spawning grounds, reduce the population species. The development of tourism and the associated urbanization leads to pressures on the environment. Buildings can erode forests. Effluents from agglomerations contribute to pollution downstream.

In addition, agriculture and the excessive use of fertilizers or pesticides are sources of pollution of surface waters, swamps or mangroves.

In addition, natural pressures exist such as: the proliferation of invasive plants (water hyacinth, water lettuce, etc.) leads to competition with local species and suffocates the environment. This can be accentuated by other phenomena such as the closure of the pass (link between the sea and the continent) which modifies the physicochemical conditions of the environment. The floating plants can then sediment and gradually fill in the ponds.



**Figure 1.23 Map locating of the MPAs in Côte d'Ivoire** Source: WDPA 2020

Mining and oil resources constitute a potential threat. Indeed, gas fields have been discovered off certain protected sites and exploration permits have been granted (Ehotilés islands). Beaches are sometimes degraded by hydrocarbons due to leaks along pipelines. In GrandGrand Bassam, sand extraction degrades habitats and destroys animals (e.g. benthic organisms and molluscs).

The exploitation of wood used for construction, heating (forest, mangrove) decreases stocks and fragments habitats. Bush fires destroy or degrade forests, especially when the dry season is tough.

Upstream of the sites, the construction of a dam (e.g. Buyo on the Sassandra River) has resulted in a drop in water levels in the area. Habitats are fragmented by road construction (Abidjan – San Pedro road axis).

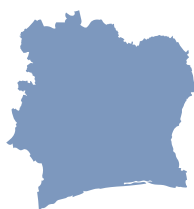
Finally, coastal erosion can lead to a retreat of the coastline. Similarly, the variation in the water regime (reduction of persistence, more frequent droughts) accentuated by climate change can contribute to the gradual disappearance of many ponds on the site which constitute habitats for many species. Following the decrease in the flow of the Comoé River and the opening of the Vridi Canal, a change

in hydro-biological parameters, in particular salinity, is observed, which affects species that preferred higher salinity.

### Management of marine protected areas

Ten MPAs in Côte d'Ivoire have a management plan. Information is lacking on their duration of application and management methods. The new Grand-Béréby MPA does not yet have a published management plan. For more information see Chapter 4.

## Country summary



Surface  
(Km<sup>2</sup>)  
**322 460**

Population  
(Millions)  
**26,37**

Demography  
(% annual)  
**2,5**

GDP (USD  
current Billions)  
**61,34**

GDP growth in  
2019 (%/year)\*  
**6,2**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



**Mangrove area (km<sup>2</sup>)**  
2016 / variation 1996-2016  
**57.92 / -4.91**

Source: Global Mangrove Watch

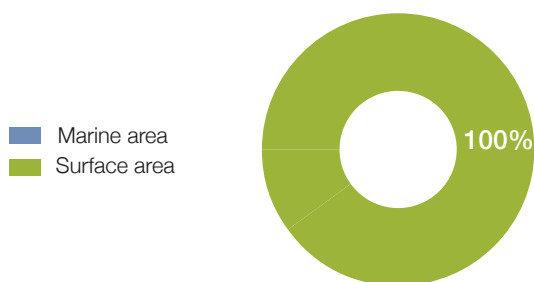
### Remarkable species and habitats



**Habitats:** brackish marshes, coastal forest, dry land forests, riparian forests, lagoons, freshwater swamp forests, estuary mangroves and mudflats.

**Species:** blue-billed malimbe, white-browed flycatcher, black-headed timalie, white-collared spittlebug, petaurist N'ganda N'ganda, pygmy hippopotamus, black and white colobus, rattling spittlebug and diana, Nile and forest crocodile and leatherback and olive ridley turtles.

### Distribution between marine and terrestrial surface of MPAs in Côte d'Ivoire (ha)



Missing data for the new MAP of Grand Béréby (2022).

### Pressures and threats

- ⊕ Hunting mammals and birds
- ⊕ Farming and cultivation of hillsides
- ⊕ The opening of the Abidjan – San Pedro road axis has led to habitat fragmentation and the depletion of wildlife species.
- ⊕ Domestic waste disposal water
- ⊕ Clearing, poaching and bush fires
- ⊕ Exploitation of mineral resources

### National designation of MPAs

National designation	Number
Classified forest	9
National Park	2
MPA	1
Nature reserve	1

2 MPAs have no national status (Grand Bassam, Sassandra-Dagbego)

### Management plans

Missing data regarding existing management plans.

### IUCN MPA management category

Category	Number
Category Ia - Strict nature reserve	
Category Ib - Wilderness Area	
Category II - National Park	2
Category III - Monument or natural feature	
Category IV - Habitat or species management area	
Category V - Protected Landscape or Seascape	
Category VI - Protected area for the sustainable use of natural resources	
Not filled in / not applicable	13

Figure 1.24 Overview of the state of MPAs in Côte d'Ivoire





## 1.9 Ghana

© MatKumahor, Wikimedia Commons, Sakumono, Ghana

### Marine protected areas in Ghana

Ghana has 6 MPAs including 4 MPAs with only international status (RAMSAR classification) representing 159,503 hectares and 2 MPAs (Yenku and Muni-Pomadze) with national status representing 10,407 ha. The Yenku site is included in the Muni-Pomadze site. The Songor Lagoon is also part of the Songor Biosphere Reserve created in 2011 and covering 51,133 ha.

### Transboundary MPAs

Ghana does not have any transboundary MPAs. A transboundary MPA project is underway with Côte d'Ivoire, concerning the site of the Ehotilés islands.

### Policy and regulatory framework

Ghana's MPAs were listed or created in 1992. The Wildlife Division (Forestry Commission) is responsible for protecting these MPAs.

The country is committed to a regional programme (PACO) Central and West Africa Programme, and has ratified several international conventions as presented in Figure 1.25.

### Key habitats

All the RAMSAR sites include a brackish water lagoon, located at estuary or delta level, and supplied with fresh water by rivers. Beyond

the lagoons are a diversity of habitats and landscapes such as floodplains, mudflats, salt ponds or salt marshes, coastal savannah grasslands but also mangroves. Also present in the forest are brush or groves of shrubs and agricultural land in the surrounding area.

### Remarkable species

The lagoons and surrounding habitats are home to many species of birds. For example, at the Muni Pomadze site, there are more than 23,000 waterbirds, including 27 species of waders, 8 species of terns and 7 species of herons, as well as 114 species of land birds. Sixty species of birds are present in the Sakumo Lagoon.

Other aquatic or terrestrial species remain such as turtles (green, leatherback), Sitatunga aquatic antelopes (in the Keta Lagoon complex) but also crocodiles or pythons.

### Pressures and threats

Pressures and threats come mainly from human activities. The rapid urbanization of watersheds, pollution (wastewater, waste, etc.) from activities located nearby, but also the installation of dams (ex: Weija dam) degrades biodiversity. Similarly, the overexploitation of mangroves or fishery resources, aquaculture and agriculture, which are subsistence activities for the local populations, cause ecosystem degradation and disruption of the reproduction cycles of the species present (e.g. egg laying of turtles).

**Table 1.9 List of MPAs in Ghana**

MPA name	Surface (ha)
Yenku (1992) included in the Muni-Pomadze site	946
Muni-Pomadze (1992) <sup>1</sup>	9461
Sakumo Lagoon (1992) <sup>1</sup>	1 364
Songor Lagoon (1992) <sup>1,2</sup>	51 133 <sup>3</sup>
Keta Lagoon complex (1992) <sup>1</sup>	101 023
Densu Delta (1992) <sup>1</sup>	5 983
<b>Proposed MPA</b>	<b>Surface (ha)</b>
Prampram Fuelwood	3 470

*1-Included in a RAMSAR site or constitutes a RAMSAR site*

*2-Site included in a biosphere reserve or that constitutes a biosphere reserve*

### Management of marine protected areas

All RAMSAR sites have a management plan, although they could not be retrieved.

The RAMSAR site management authorities include the “Wildlife Division (Forestry Commission)” sometimes associated with local actors. The Densu Delta site has the particularity of being 1/8 managed by a private company for the exploitation of salt. For more information see Chapter 4.

### Conventions ratified by Ghana

- ✦ **26 March 1984**  
 United Nations Convention on the Law of the Sea (UNCLOS)

---

- ✦ **05 May 1984**  
 Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones

---

- ✦ **05 October 1987**  
 MARPOL International Convention for the Prevention of Pollution from ships

---

- ✦ **29 November 1994**  
 United Nations Framework Convention on Climate Change (UNFCCC)  
 Convention on Biological Diversity (CBD)

---

- ✦ **19 February 1995**  
 Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora

---

- ✦ **27 June 1996**  
 RAMSAR Convention

**Figure 1.25 Conventions ratified by Ghana**



© Francesco Veronesi Creative Commons, dwarf cocodrile, Ghana

## Country summary



Surface  
(Km<sup>2</sup>)

**238 540**



Population  
(Millions)

**31,07**



Demography  
(% annual)

**2,1**



GDP (USD  
current Billions)

**72,35**



GDP growth in  
2019 (%/year)\*

**6,5**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



### Mangrove area (km<sup>2</sup>)

2016 / variation 1996-2016

**204.18 / -23.78**

Source: Global Mangrove Watch

### Remarkable species and habitats



**Habitats:** lagoons, mangroves, coastal savannah, floodplains, mudflats and salt marshes.

**Species:** terrestrial and migratory water birds, marine turtles, reptiles, crocodiles and sitatunga antelopes.

### Distribution between marine and terrestrial surface of MPAs in Ghana (ha)

The 6 marine protected areas have exclusively inland areas.

#### Pressures and threats

- ⊕ Urbanization and pollution
- ⊕ Hydraulic infrastructure
- ⊕ Overexploitation of mangroves
- ⊕ Overfishing
- ⊕ Agriculture and Livestock

### National designation of MPAs

National designation	Number
Classified forest	2

Ghana has 4 MPAs with international status only.

### Management plans

Currently no information could be retrieved regarding the management plans and their application periods.

### IUCN MPA management category

Category	Number
Category Ia - Strict nature reserve	0
Category Ib - Wilderness Area	0
Category II - National Park	0
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	3
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	0

Figure 1.26 Overview of the state of MPAs in Ghana



Figure 1.27 Map locating of the MPAs in Ghana Source: OBAPAO: Reference geographic database



© Cyril Laffargue, purple héron



## 1.10 Togo

© Fawaz Tairou via creative commons, water hyacinth in the Mono River, Togo

### Marine protected areas in Togo

Togo has an MPA with only international status. This is the Togo Coastal Wetlands RAMSAR site, representing 591,000 ha.

In addition, Togo has had the Mono Transboundary Biosphere Reserve since 2017 which covers 203,789 ha, and which has no national status.

### Transboundary MPAs

Togo has had a transboundary biosphere reserve with Benin since 2017. The Mono reserve is administered by the National Centre for the Management of Wildlife Reserves (CENAGREF) in Benin and the Department of Forest Resources (DRF) in Togo.

### Policy and regulatory framework

Togo's only MPA was created in 2008. The legal framework that governs this MPA is defined by Law No. 88-14 of 3 November 1988 relating to the environmental Code and which concerns the protection of fauna, flora and natural areas. In addition, Togo is committed to a regional programme (PACO) IUCN Central and West Africa Programme (PACO). It has also ratified several international conventions as shown in Figure 1.28.

Moreover, as concerns the management of MPAs in the country, the Department of Wildlife and Hunting is the first institution responsible for the management of coastal wetlands in Togo.

Other departments of the Ministry of Environment and Forest Resources and bodies such as the National Wetlands Committee, the National Wetlands Network are involved in the management. It is also important to note that the legal framework for the protection and management of the environment in Togo does not devote any specific legal provision to the management of wetlands. This is explained by the fact that most of the legislative and regulatory instruments were adopted before the entry into force of the Ramsar Convention in Togo.

### Key habitats

In addition to terra firma forests and gallery forests, Togo's MPA is distinguished by hygrophilous formations with, in particular, savannahs or floodplains, ponds, lakes and lagoons, sandy beaches.

Mangroves (*Rhizophora racemosa*, *Avicennia germinans*) complete the rich ecosystem of this MPA.

### Remarkable species

The coastline is home to many rare or endangered species such as turtles (green, hawksbill, olive ridley, leatherback), manatees, hippos and Nile crocodiles. In addition, the coast is part of the distribution

area of cetaceans such as the cape dolphin, the sperm whale or the jubarte whale.

Among birds, the wetlands are home to the endangered goliath heron. The mangroves are also home to a rich fauna among which 20 species are declared rare, threatened or endangered. In addition, 66 species of birds have been recorded, including 54 waterbirds; finally there are 6 species of crustaceans, and 16 species of molluscs.

### Pressures and threats

Climate change threatens wetlands, which are mainly fed by continental inputs, by rivers. The state of wetlands is degraded by the exploitation of mangrove wood, slash-and-burn agriculture and deforestation to meet the needs for firewood and timber. Poverty and dependence on surrounding natural resources aggravate pressures on ecosystems. Improper fishing practices and overfishing, as well as poisoning voluntary use of ponds and watercourses to collect fish affects the biodiversity of aquatic environments in addition to its danger to human health.

Major dam projects (e.g. Nangbéto) have modified the water regime, the construction of rural roads or mining operations degrade ecosystems. In most wetlands, there is a proliferation of invasive alien species such as *Eichornia crassipes* and *Pistia stratiotes*.

The increase in the population, which lives mainly on agriculture and the production of wood or coal, and fishing, increases the pressure on resources.

### Management of marine protected areas

There is no management plan at the level of the RAMSAR site. For more information see Chapter 4.

**Table 1.10 List of MPAs in Togo**

MPA name	Surface (ha)
Togo coastal wetlands (2008) <sup>1</sup>	591 000
Réserve de biosphère transfrontalière du Mono <sup>2</sup>	203 789

1-Included in a RAMSAR site or constitutes a RAMSAR site

2-Site included in a biosphere reserve or that constitutes a biosphere reserve

### Conventions ratified by Togo

- 21 January 1979**  
Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora
- 05 May 1984**  
Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones
- 16 April 1985**  
United Nations Convention on the Law of the Sea (UNCLOS)
- 09 February 1990**  
MARPOL International Convention for the Prevention of Pollution from ships
- 08 March 1995**  
United Nations Framework Convention on Climate Change (UNFCCC)
- 04 October 1995**  
Convention on Biological Diversity (CBD)
- 04 November 1995**  
RAMSAR Convention

**Figure 1.28 Conventions ratified by Togo**



© Tony Campbell - stock.adobe.com

## Country summary



Surface  
(Km<sup>2</sup>)

**56 790**



Population  
(Millions)

**8,27**



Démography  
(% annual)

**2,4**



GDP (USD  
current Billions)


**7,57**



GDP growth in  
2019 (%/year)\*

**5,5**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



**Mangrove area (km<sup>2</sup>)**  
2016 / variation 1996-2016  
**Nd / Nd**

Source: Global Mangrove Watch

### Remarkable species and habitats



**Habitats:** dry land forests, gallery forests, tree and shrub savannah, floodplain meadows, marshes, ponds, lakes, lagoons, sandy beaches, natural and artificial mangroves.

**Species:** turtles (green, hawksbill, olive ridley, leatherback), manatees, hippos, Nile crocodiles, cape dolphin, sperm whale, humpback whale, birds (Goliath heron), crustaceans and molluscs.

### Distribution between marine and terrestrial surface of MPAs in Togo (ha)

The RAMSAR site is mostly made up of land surface while the marine surface along the 55km coastline is undetermined.

### Pressures and threats

- ⊕ Overfishing and unsuitable practices
- ⊕ Cutting of mangroves and forest
- ⊕ Slash-and-burn agriculture
- ⊕ Climate change
- ⊕ Upstream dams and roads
- ⊕ Poisoning of streams and ponds
- ⊕ Increase of the population

### National designation of MPAs

Togo's only MPA does not have a national designation.

### Application period of management plans

There is a lack of information on the management plans for the RAMSAR site.

### IUCN MPA management category

Category	Number
Not specified	1

Figure 1.29 Overview of the state of MPAs in Togo

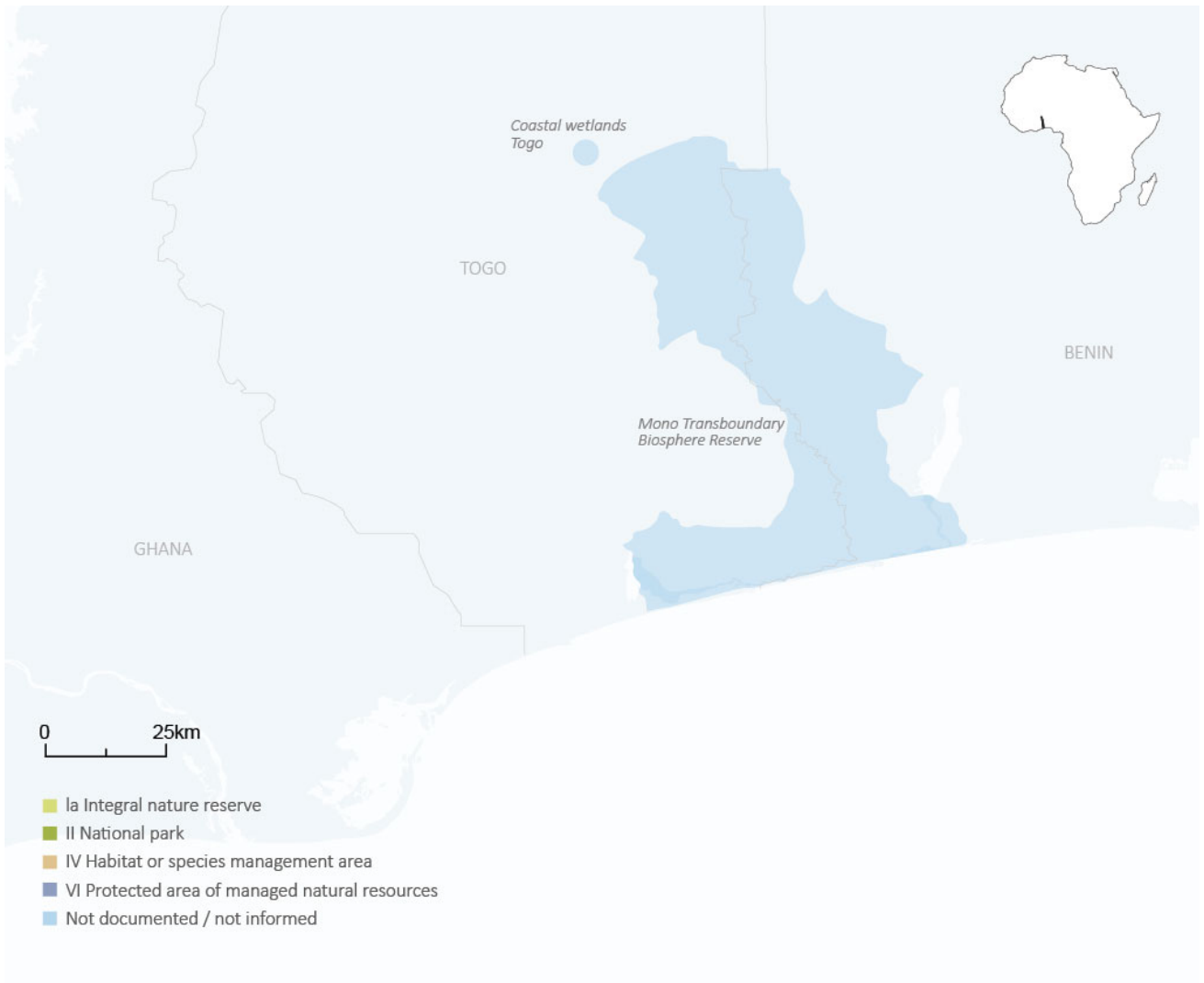


Figure 1.30 Map locating of the MPAs in Togo Source: OBAPAO: Reference geographic database







## 1.11 Benin

© Cyril Laffargue, slaty egret

### Marine protected areas in Benin

Benin has a total of six MPAs, including four MPAs with national status representing 14,305 ha, as well as 2 MPAs (Lower Valley of Ouémé, Lagoon of Porto-Novo, Lake Nokoué; Lower Valley of Couffo, Coastal Lagoon, Chenal Aho, Lac Ahémé) with only international status (RAMSAR) representing 1,177,049 ha. These two RAMSAR zones created in 2001 were enlarged in 2018 and cover the entire coast of Benin.

In addition, Benin has two biosphere reserves (Lower Ouémé Valley Biosphere Reserve created in 2020; Mono Transboundary Biosphere Reserve created in 2017) which overlap with the MPAs already present.

### Transboundary MPAs

Benin has had a transboundary biosphere reserve with Togo since 2017. The Mono reserve is administered by the National Centre for the Management of Wildlife Reserves (CENAGREF) in Benin and the Department of Forest Resources (DRF) in Togo.

The site of the transboundary Gbagba channel with Togo has been proposed as a RAMSAR site.

### Policy and regulatory framework

Benin's MPAs were created between 2001 and 2022. The legal framework governing these marine areas is defined by Law No. 2002-016 of 18 October 2004 on the wildlife regime, as well as Law No. 98-030 of 12 February 1999 relating to Environmental Management. At the same time, the Republic of Benin has embarked on a regional programme (Central and West Africa Programme, PACO) which concerns both the issue of conservation policies and global, regional and local environmental governance and the field projects that have related to the sustainable management of biological diversity. Benin is also a member of the Regional Network of Marine Protected Areas in West Africa (RAMPAO). The Ministry in charge of the Environment through the Beninese Agency for the Environment (ABE) is the accredited management body to manage of wetlands.

Alongside the ABE, other State entities such as the Department of the Environment, the Department of Fisheries Production, the General Department of Water, Forests and Hunting, the National Centre for the Management of Wildlife Reserves, the General Department of Water participate in their management. With regard to the governance of the biosphere reserve, the National Centre for the Management of Wildlife Reserves (CENAGREF) operates in synergy with other institutions such as the General Department of Water, Forests and Hunting (DGEFC), the Beninese for the Environment (ABE), universities, schools and research centres, the General Department of Water (DG Eau), sectoral administrations

(Agriculture and Fisheries). The Republic of Benin has also ratified several international conventions as shown in Figure 1.31.

## Key habitats

The biosphere reserve includes a great diversity of landscapes and habitats: wetlands, savannas, alluvial plains of Mono, peninsulas and islands of sacred forests. Coastal and marine ecosystems are present: mangroves, grasslands and swamp forests, riparian forests and are home to a great diversity of species. There are also maritime lawns, mudflats and floodplains and a lagoon complex. The entire coastline of Benin is covered by the two RAMSAR sites, and the area contains around ten sacred forests rich in flora and fauna.

## Remarkable species

MPAs provide habitat for turtles and migratory birds. In particular, the Bouche du Roy site is one of the largest migration areas for Palearctic birds in Benin.

There are terrestrial or semi-aquatic mammals (hippopotamus and otters). Some species are critically endangered in Benin (African manatee, leatherback turtle, and tortoiseshell) or endangered (white-cheeked otter, green turtle, olive ridley turtle, sitatunga).

The wetlands are home to a very rich bird fauna, with more than 500 species including 215 species of birds in the RAMSAR site “Lower Valley of Ouémé, Lagoon of Porto-Novo, Lake Nokoué”. The site has 24 threatened bird species, including *Scotopelia bouvieri*, *Pelecanus rufescens*, *Egretta ardesiaca*, *Francolinus achantensis*. In addition, 8 species of threatened primates are listed, including the endemic red-bellied monkey in Benin, as well as a threatened antelope species *Tragelaphus spekii*. There is also a great diversity of plants: around 67 plant species are threatened there, including *Mansonina altissima*. On the RAMSAR site “Basse Vallée du Couffo, Lagune Côtère, Chenal Aho, Lac Ahémé”, more than 90 species of fish are found, including the endangered *Brycinus carolinæ*; more than 364 species of plants belonging to 100 families have also been counted.

## Pressures and threats

Pressures are of anthropogenic and natural origin and cause an erosion of biodiversity of the environments.

In the Mono reserve, 80% of the population lives from agriculture, fishing or logging. The increase in population and its settlements encroaches on the exposed lands formerly left fallow. Overfishing and the use of inappropriate techniques lead to a scarcity of resources and a drop in yields. Some fishermen are converting to agriculture but this consequently creates pressure on the unused land which is cleared. There is also pastoral pressure related to the search for fodder and water. In addition, slash-and-burn agriculture leads to a decrease in biodiversity. The need for construction wood, wood energy is met by cutting mangroves, which are spawning grounds for the production of aquatic fauna, or coconut palms. Finally, the poaching of species of manatees and sea turtles represents a threat.

The exploitation of freshwater sand along the Mono River disturbs the hydrological functioning, while the destruction of the vegetation

Table 1.11 List of MPAs in Benin

MPA name	Surface (ha)
Lower Couffo Valley, Coastal Lagoon, Aho Channel, Lake Ahémé” (2001, then 2018) <sup>1,2</sup>	524 289
Lower Ouémé Valley, Porto-Novo Lagoon, Lake Nokoué (2001, then 2018) <sup>1</sup>	652 760
Togbin-Adouanko (2014) <sup>1</sup>	17.5
Bouche du Roy MPA (2016) <sup>1,2</sup>	8 980
MPA Donaten (2022) <sup>1</sup>	4900
Vodountô community area (2022) <sup>1</sup>	407.26
Proposed MPA	Surface (ha)
Channel Gbaga	5361

<sup>1</sup>-Included in a RAMSAR site or constitutes a RAMSAR site

<sup>2</sup>-Site included in a biosphere reserve or that constitutes a biosphere reserve

## Conventions ratified by Benin

### 📅 28 May 1984

Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora

### 📅 30 June 1994

United Nations Framework Convention on Climate Change (UNFCCC) Convention on Biological Diversity (CBD)

### 📅 16 October 1997

United Nations Convention on the Law of the Sea (UNCLOS) Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones

### 📅 11 February 2000

MARPOL International Convention for the Prevention of Pollution from ships

### 📅 24 May 2000

RAMSAR Convention

Figure 1.31 Conventions ratified by Benin

cover along the rivers causes the erosion of the banks and their filling of the beds.

The Bouche du Roy MPA is threatened by the risk of flooding increased by climate change. Finally, aquatic environments are threatened by invasive alien species *Pistia stratiotes* (water lettuce), *Eichhornia crassipes* (water hyacinth) which can cause eutrophication of environments.



**Figure 1.32 Map locating of the MPAs in Benin** Source: WDPa 2020 / [www.boucheduroy.bj](http://www.boucheduroy.bj)

### Management of marine protected areas

The Bouche du Roy and Donaten MPAs, created in 2022, do not have a management plan, unlike the other MPAs in Benin. Before its official designation, the management of the Bouche du Roy community area was delegated to the Association de Conservation et de Promotion of the community biodiversity conservation area of the Bouche du Roy (ACP Doukpo), which is the interface between the Town Halls which are the contracting authorities and the National Centre for the Management of Wildlife Reserves (CENAGREF) which is the state body accredited for the management of biosphere reserves. For more information see Chapter 4.

## Country summary



Surface  
(Km<sup>2</sup>)

**114 760**



Population  
(Millions)

**12,12**



Demography  
(% annual)

**2,7**



GDP (USD  
current Billions)

**15,65**



GDP growth in  
2019 (%/year)\*

**6,9**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



### Mangrove area (km<sup>2</sup>)

2016 / variation 1996-2016

**Nd / +0.20**

Source: Global Mangrove Watch

### Remarkable species and habitats



**Habitats:** maritime grassland, mangroves, mudflats, floodplains, swamps and forests.

**Species:** manatees, hippopotamus, otters, waterbirds, terns, slaty egret, primates (red-bellied monkey endemic to Benin), Tragelaphus spekii antelope, turtles (marine and terrestrial) and fish (Brycinus caroliniae).

### Distribution between marine and terrestrial surface of MPAs in Benin (ha)

There is a lack of data to differentiate between marine and land surfaces.

### Pressures and threats

- ⊕ Overexploitation of fishery resources, cutting of woody species of mangroves and coconut plantations,
- ⊕ Installation of human dwellings,
- ⊕ Climate change, silting of rivers and bodies of water
- ⊕ Population growth and urbanization
- ⊕ Sand mining
- ⊕ Pressure from agriculture and pastoralism

### Application period of management plans

MPA name	2017	2018	2019	2020	2021	2022	2023	2024	2025
MPA Bouche du Roy									
Basse Vallée du Couffo, Lagune Côtière, Chenal Aho, Lac Ahémé									
Basse Vallée de l'Ouémé, Lagune de Porto-Novo, Lac Nokoué									
Community area de Vodountô									
Togbin-Adouanko									

Source: RAMPPO

### National designation of MPAs

National designation	Number
Community Biodiversity Conservation Area	2
Marine Protected Area (MPA)	2

The Community Biodiversity Conservation Area of the Bouche du Roy, created in 2016, became an MPA in 2022. Two MPAs have no national status because they are sites only with international status (RAMSAR).

### IUCN MPA management category

Category	Number
Category Ia - Strict nature reserve	0
Category Ib - Wilderness Area	0
Category II - National Park	0
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	0
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	4
Not specified	2

Figure 1.33 Overview of the state of MPAs in Benin



© Hans-Peter Schaub

## 1.12 Nigeria

### Marine protected areas in Nigeria

Nigeria has 24 MPAs located mainly in the Niger Delta, in the coastal area. These MPAs, which cover 355,008 ha, are mostly forest reserves that have seawater intrusions, as well as mangroves, and four MPAs have a marine area (Subbs creek, Andoni, Olague, Uremure Yokri). Two MPAs in Nigeria are RAMSAR sites.

### Transboundary MPAs

Nigeria does not have any transboundary MPAs.

### Policy and regulatory framework

Nigeria is committed to a regional programme (PACO) Central and West Africa Programme and has ratified several international conventions as presented in Figure 1.34.

### Key habitats

Mostly located in the Niger Delta, these MPAs are made up of swamp forests and mangroves, as well as freshwater swamps.

### Remarkable species

Concerning the two RAMSAR sites, they are habitats for the endemic red colobus monkey of the Niger delta. We mainly find marshy species such as buffalo (*Syncerus caffer*), black-fronted duiker

(*Cephalophus nigrifrons*), sitatunga (*Tragelaphus spekii*), Maxwell's duiker, etc. Other endangered species exist such as the African dwarf crocodile *Crocodilus de Sclater*. Apoi Creek is home to aquatic wildlife of at least 17 species.

Finally, the flora is also very rich: more than 240 species of plants have been recorded in the Apoi Creek Forest.

Data are missing for classified forests.

### Pressures and threats

The main threat to these MPAs is logging. Similarly, the digging of canals to extract logs in particular, can modify the hydrological regimes, drying up certain parts and consequently affecting the production of fish or giving access to other parts of the site for future exploitation.

Upstream, oil exploration puts pressure on the environment; beyond the pollution it can cause, it is at the origin of the construction of roads which potentially open access for poachers.

### Management of marine protected areas

Only the Upper Orashi Forest MPA has a management plan. For more information see Chapter 4.

Table 1.12 List of MPAs in Nigeria

MPA name	Surface (ha)
Gilli-Gilli <sup>3</sup>	31 766
Lekki (1990)	78
Eba island	2 299
Ejigbobini	2 064
Okomu	18 100
Ogun river	2 475
Olague Forest	32 971
Uremure Yokri	32 882
Ukpe-Sobo	11 033
Egbedi creek	6 632
Sambrero	13 756
Otamiri	18 096
Upper Imo river	10 782
Stubbs Creek	29 580
Lower Imo river	8 175
Nun river	9 718
Lower Orashi river	4 007
Obeaku	2 675
Ikebiri Creek	19 171
Taylor creek	22 646
Andoni	12 400
Upper Orashi Forests (2008) <sup>1</sup>	25 165
Edumanom Forest Reserve (2020)	9 324
Apoi Creek Forest (2020) <sup>1</sup>	29 213

1-Included in a RAMSAR site or constitutes a RAMSAR site

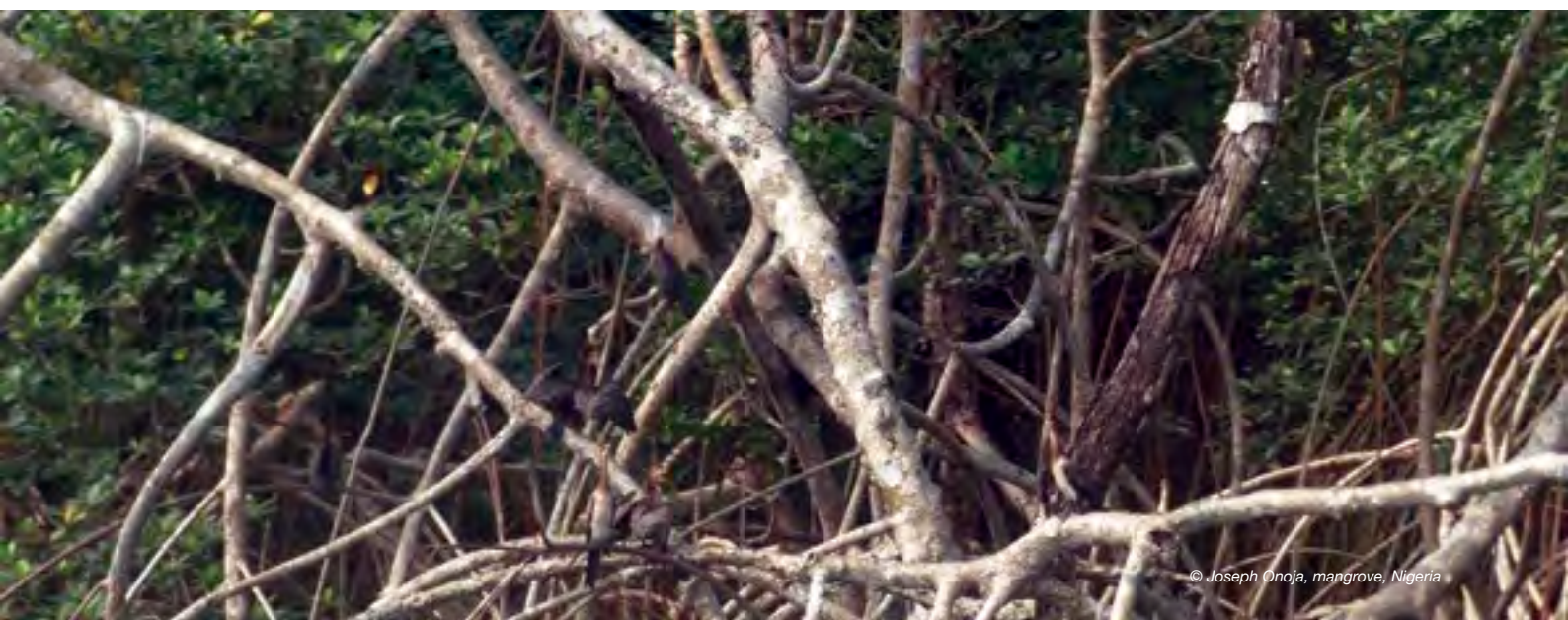
2-Site included in a biosphere reserve or that constitutes a biosphere reserve

3-Missing data on the creation date of these forest reserves

## Conventions ratified by Nigeria

- 📅 **01 July 1975**  
Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora
- 📅 **05 May 1984**  
Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones
- 📅 **14 August 1986**  
United Nations Convention on the Law of the Sea (UNCLOS)
- 📅 **29 August 1994**  
United Nations Framework Convention on Climate Change (UNFCCC)  
Convention on Biological Diversity (CBD)
- 📅 **02 February 2001**  
RAMSAR Convention
- 📅 **24 May 2002**  
MARPOL International Convention for the Prevention of Pollution from ships

Figure 1.34 Conventions ratified by Nigeria



© Joseph Onoja, mangrove, Nigeria

## Country summary



Surface  
(Km<sup>2</sup>)

**923 770**



Population  
(Millions)

**206,13**



Demography  
(% annual)

**2,5**



GDP (USD  
current Billions)

**432,29**



GDP growth in  
2019 (%/year)\*

**2,2**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



### Mangrove area (km<sup>2</sup>)

2016 / variation 1996-2016

**6 894.17 / -93.88**

Source: Global Mangrove Watch

### Remarkable species and habitats

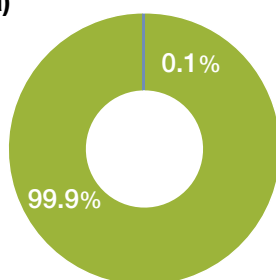


**Habitats:** swamp and mangrove forests and freshwater swamps.

**Species:** Red colobus monkey endemic to the Niger Delta, buffalo, black-fronted duiker, sitatunga, Maxwell's duiker and fish.

### Distribution between marine and terrestrial surface of MPAs in Nigeria (ha)

■ Marine area  
■ Surface area



Missing data for Andoni and Olague Forest

### Pressures and threats

- ⊕ Logging and construction of canals for transporting logs
- ⊕ Oil exploration and related infrastructure

### National designation of MPAs

National designation	Nombre
Classified forest	19
National Park	2
Animal reserve	2
Integral reserve	1

### Application period of management plans

The period of the Upper Orashi Forest MPA management plan could not be found.

### IUCN MPA management category

Category	Number
Category Ia - Strict nature reserve	1
Category Ib - Wilderness Area	0
Category II - National Park	1
Category III - Monument or natural feature	0
Category IV - Habitat or species management area	2
Category V - Protected Landscape or Seascape	0
Category VI - Protected area for the sustainable use of natural resources	1
Not specified	19

Figure 1.35 Overview of the state of MPAs in Nigeria

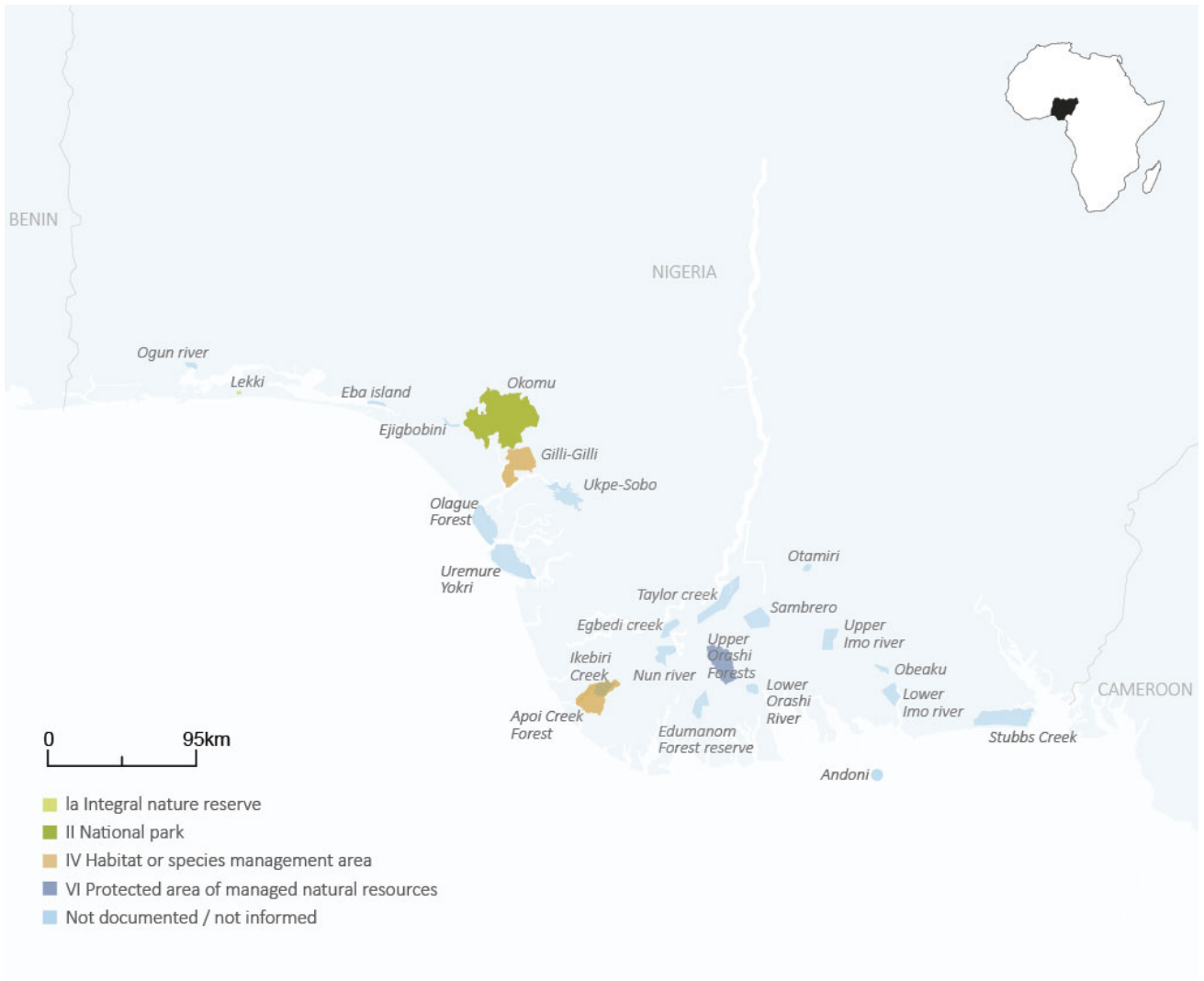


Figure 1.36 Map locating of the MPAs in Nigeria Source: OBAPAO: Reference geographic database



© Joseph Onoja





## 1.13 Cabo Verde

© Thomas Reischige, loggerhead turtle nesting, Cabo Verde

### Marine protected areas in Cabo Verde

Cabo Verde has 24 marine protected areas, spread over 6 groups of islands and representing 171,405 hectares. Among these 24 MPAs, Cabo Verde has 4 coastal RAMSAR sites representing 2,300 hectares, of which only “Curral Velho” has national MPA status. With the exception of the Baía do Inferno y Monte Angra Natural Park created in 2021, all the MPAs were designated by Decree in 2003. All the MPAs on the island of Maio also belong to the Maio Biosphere Reserve created in 2020 and covering 73,972.43 hectares including 47,072.43 hectares of marine surface. Cabo Verde is also covered by the Fogo Biosphere Reserve which represents: 47,074.19 hectares of land surface and 55,067.83 hectares of marine surface.

### Transboundary MPAs

Cabo Verde does not have a transboundary MPA.

### Policy and regulatory framework

The majority of Cabo Verde’s MPAs were created in 2003. The legal framework governing these marine areas is defined by Framework Law No. 3-2003 of 24 February 2003 related to the legal status of protected areas. At the same time, Cabo Verde is involved in various regional programmes, in particular the work programme on protected areas of the Convention on Biological Diversity (CBD), the Central and West Africa Programme (PACO) and the regional programme for conservation of the coastal and marine zone in West Africa. In addition, the country is a member of the Regional Network of Marine

Protected Areas in West Africa (RAMPAO). The country has also ratified several international conventions as shown in Figure 1.37. Furthermore, the management of MPAs in the country is centralized. The General Directorate of Environment (DGA), which is under the Ministry of Environment, Rural Development and Marine Resources (MADRRM), has the mandate and responsibility for the management of protected areas in Cabo Verde. The MADRRM nevertheless has delegations in the main islands of Cabo Verde.

### Key habitats

Cabo Verde’s marine protected areas have a wide diversity of habitats including coral reefs, wetlands and salty land, dune ridges, and lagoons. The archipelago is also characterized by rocky coasts and cliffs.

### Remarkable species

Cabo Verde is a biodiversity hotspot with a high level of endemism. Among the aquatic wildlife are dolphins, 5 species of turtles (ex: leatherback, *Caretta caretta*, hawksbill, green and olive ridley), sharks (lemon, nurse, hammerhead), and humpback whales. 570 species of fish were inventoried in 2005.

The archipelago also has many species of birds including some endemic, threatened species (*Pandion haliaetus*, *Halcyon leucocephala*, *Calonectris edwardsii* and *Alauda razae*). In addition, the archipelago is an important stage for migratory birds (150 species), breeding birds (41 species), some of which are threatened

## Conventions ratified by Cabo Verde

<p>📅 <b>05 May 1984</b> Abidjan Convention on the Protection and Management of the Marine Environment and Coastal Zones</p>
<p>📅 <b>10 August 1987</b> United Nations Convention on the Law of the Sea (UNCLOS)</p>
<p>📅 <b>29 March 1995</b> United Nations Framework Convention on Climate Change (UNFCCC) Convention on Biological Diversity (CBD)</p>
<p>📅 <b>04 June 2003</b> MARPOL International Convention for the Prevention of Pollution from ships</p>
<p>📅 <b>08 November 2005</b> Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora</p>
<p>📅 <b>18 November 2005</b> RAMSAR Convention</p>

Figure 1.37 Conventions ratified by Cabo Verde

(*Fregata magnificens*, *Sula leucogaster*, *Calonectrix edwardsii* and *Phaethon aethereus mesonauta*).

Finally, there is a great diversity of insects, gastropods (37 species including 15 endemic) and reptiles.

## Pressures and threats

Pressures and threats are mainly of anthropogenic origin. Illegal fishing, destructive fishing methods or fishing during the spawning season can lead to a reduction in stocks. There is also a destruction of coral reefs. In addition, the predation of turtles for local consumption or trade, the use of motorized vehicles on beaches are a pressure for turtle populations.

Around the MPAs, tourism, the development of agriculture and stray grazing are factors of pressure on the environment. As well as the extraction of inert materials or pleasure boating which also generate pollution.

In coastal areas, soil erosion, potentially aggravated by construction and the development of tourism, is also responsible for the destruction of habitats.

In addition, invasive species (e.g. *Lantana camara*, *Furcraea gigantesca*) are a growing threat to the Cabo Verde archipelago.

Climatic conditions such as droughts can be a threat to some marine protected areas, especially those containing wetlands. Rising sea levels are likely to increase erosion, and rising sea temperatures are a threat to coral reefs.

Lastly, releases of water from desalination processes create imbalances in MPA environments as a result of their salt content and higher water temperature.

Table 1.13 List of MPAs in Cabo Verde

Island	MPA name	Surface (ha)
Sal	Costa da Fragata	2693
Sal	Ponta do Sino	5747
Sal	Serra Negra	2627
Sal	Baia da Murdeira	6057
Rombo	Ihéus do Rombo	ND
Maio	Norte do Maio (includes Terras Salgadas) <sup>2</sup>	26 777
Maio	Terras Salgadas <sup>2</sup>	5845,4
Maio	Salinas de Porto Inglês <sup>1,2</sup>	534,67
Maio	Casas Velhas <sup>2</sup>	6623,8
Maio	Lagoa Cimidor <sup>2</sup>	389,34
Maio	Praia do Morro <sup>2</sup>	665,98
Santa Luzia	Santa Luzia, Ilhéus Branco, Ilhéu Raso	51 214
Santiago	Baia do inferno y Monte Angra (2021)	21 000
Santiago	Lagoa Pedra Badejo <sup>1</sup>	831
Boavista	Norte do Boavista	22 047
Boavista	Curral Velho <sup>1</sup>	1 635
Boavista	Ponta do Sol	748
Boavista	Boa Esperança	4010
Boavista	Morro de Areia	2 567
Boavista	Tartaruga	14 875
Boavista	Ilhéu de Baluarte	94,65
Boavista	Ilhéu dos Pássaros	38,82
Boavista	Ilhéu de Curral Velho	41,77
Boavista	Lagoa de Rabil <sup>1</sup>	189

<sup>1</sup>-Included in a RAMSAR site or constitutes a RAMSAR site

<sup>2</sup>-Site included in a biosphere reserve or that constitutes a biosphere reserve

## Management of marine protected areas

The management of the different MPAs is sometimes done by grouping together several MPAs (complex of protected areas) within the same management plan.

In 2015, an ordinance has approved the management and eco-tourism plans of the complex of protected areas of South-East Sal Island, East Boavista, Ponta do Sino Nature Reserve (Island de Sal), and the Fogo Natural Park.

However, according to Resolution No. 36/2016 of 17 March 2016, with the exception of the management plan proposal that was formulated for the complex of protected areas of Santa Luzia and the «Branco e Raso» islands in awaiting validation, no other MPA has operational management. For more information see Chapter 4.

## Country summary



Surface  
(Km<sup>2</sup>)  
**4 030**


Population  
(Millions)  
**0,55**

Demography  
(% annual)  
**1,1**

GDP (USD  
current Billions)  
**1,70**

GDP growth in  
2019 (%/year)\*  
**5,7**

\* The year 2020 was not taken into account for the GDP growth figure due to the bias linked to the COVID-19 crisis. Source: World Bank (2020)



**Mangrove area (km<sup>2</sup>)**  
2016 / variation 1996-2016  
**Nd / Nd**

Source: Global Mangrove Watch

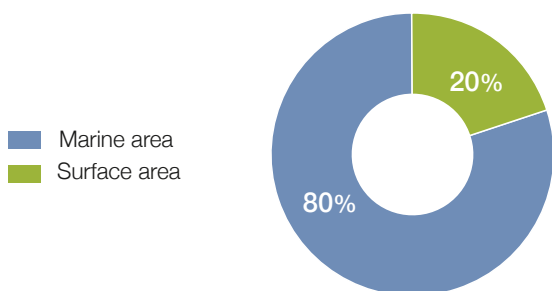
### Remarkable species and habitats



**Habitats:** coral reefs, lagoons, rocky coasts and cliffs, sandy beaches and dune cords.

**Species:** High rate of endemism. Turtles (leatherback, loggerhead, hawksbill, green, olive ridley), sharks (lemon, nurse, hammerhead), humpback whale, fish, migratory and nesting birds, reptiles, gastropods and insects.

### Distribution between marine and terrestrial surface of MPAs in Cabo Verde (ha)



Missing data for Ilhéus do Rombó

### Pressures and threats

- ⊕ Overfishing, illegal fishing, destructive fishing methods
- ⊕ Tourism development along the coast or at sea (pleasure boats)
- ⊕ Climate change: drought, rising water, increase in water temperature
- ⊕ Agriculture and stray grazing
- ⊕ Extraction of inert materials
- ⊕ Water discharges from desalination

### National designation of MPAs

National designation	Number
Nature reserve	13
Integral nature reserve	4
Natural Park	3
Protected landscape	2
Not concerned	2

The two RAMSAR sites only have international status (Lagoa Pedra Badejo, Lagoa de Rabil).

### Period of application of the most recent management plans

Information is missing. Santa Luzia is the only MPA with a management plan that was being validated in 2016.

### IUCN MPA management category

Category	Number
Category Ia - Strict Nature Reserve	
Category Ib - Wilderness Area	
Category II - National Park	
Category III - Monument or natural feature	
Category IV- Habitat or species management area	
Category V - Protected Landscape or Seascape	
Category VI - Protected area for the sustainable use of natural resources	2
Not specified	22

Figure 1.38 Overview of the state of MPAs in Cabo Verde

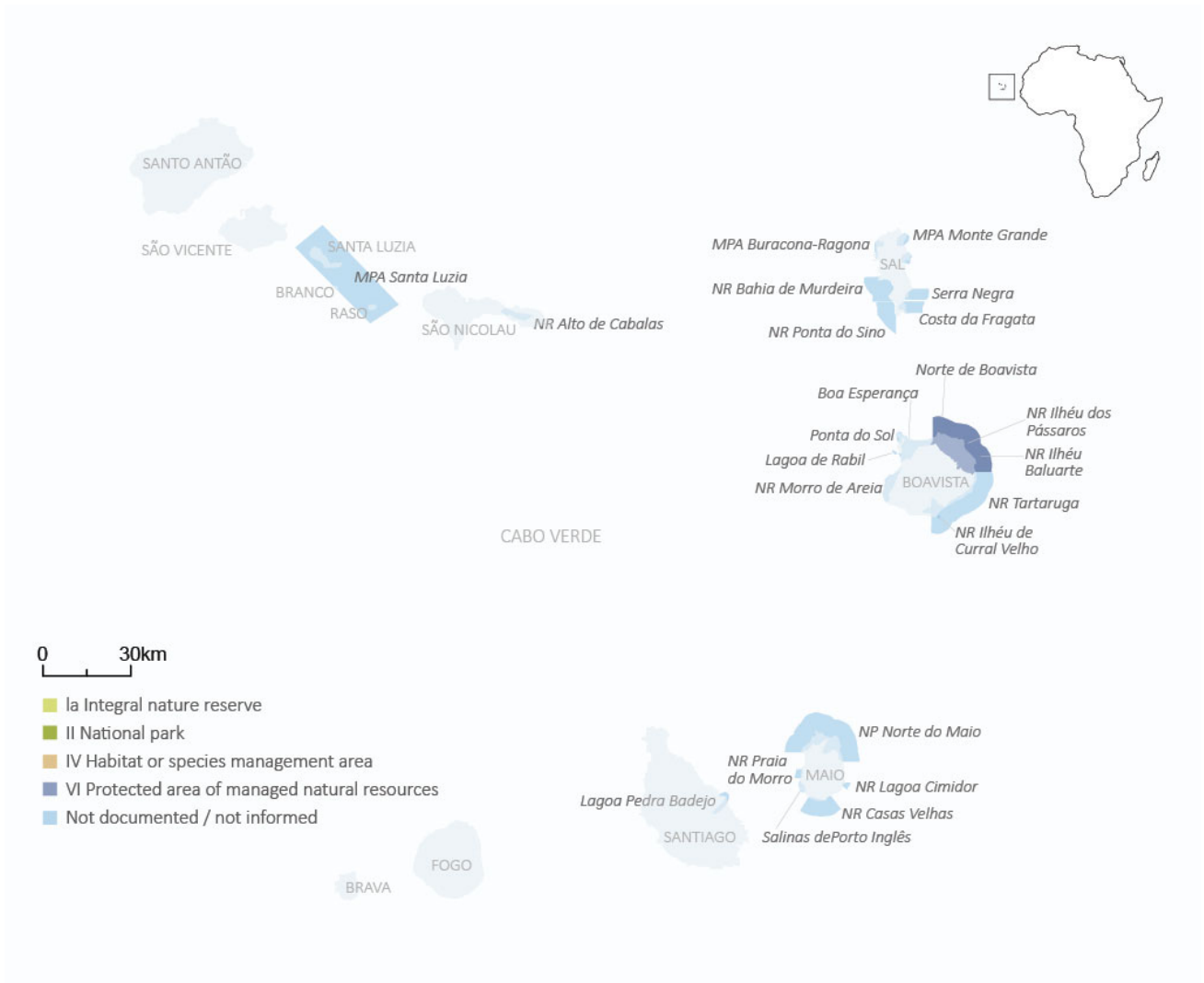


Figure 1.39 Map locating of the MPAs in Cabo Verde Source: OBAPAO / [www.naturezaurbana.net](http://www.naturezaurbana.net)





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## Chapter 2

# Dynamics of West African marine protected areas

*Catherine GABRIÉ*

The document on the state of West African marine protected areas (EdAMP) aims to present the current status of the network of marine protected areas in West Africa, from Mauritania to Nigeria, according to the state of knowledge to date. The first chapter made it possible to make an inventory of MPAs with the administrative officials of the countries concerned and reports on findings, in terms of the number of marine protected areas per country, their surface area, their status. Furthermore, the document highlights the differences between the World Database of Protected Areas (WDPA) and the reality on the ground. This chapter is structured as follows:

- Presentation of the geographic context of the region and the history on the creation of West African MPAs.
- Presentation of West African MPAs in 2022:
  - General characteristics of the network: number of MPAs, surface areas, size, national statutes, strong protection, other statutes (APAC, AMECZ), IUCN categories, international statutes.
  - Areas of international ecological interest (EBSA, KBA).
- Regional Network of West African marine protected areas (RAMPAO).
- Status of MPAs in light of the Aichi targets: percentage of protection of the EEZ, representativeness, connectivity.

## 2.1 Geographic and historical context

### 2.1.1 Geographic context<sup>1</sup>

The West African coastal zone covered by EdAMP extends over approximately 6000 km, from Mauritania to the north, passing through the deeply indented coasts of islands and estuaries (Guinea-Bissau with its archipelago of Bijagós, Guinea), to the lagoon coasts and the coastal strips of the Gulf of Guinea, and to Nigeria. The small island developing state of Cabo Verde, volcanic and mountainous, located some 600 kilometres west of Dakar (Senegal) completes this geography.

Three main ecosystem types were identified:

- Senegalo-Mauritanian system characterised by upwellings;
- Cabo Verdian system, which is mainly rocky islands;
- Guinea and Guinea-Bissau, mostly estuarine mangrove.

The coastal areas of West Africa are home to a great diversity of ecosystems: sandy coasts, dune complexes, rocky coasts, vast deltaic and estuarine areas with mangroves, coastal wetlands (mudflats, sebkhas, lagoons), vast sea grass beds, as well as the coral areas of Cabo Verde with a high rate of endemism. Further

offshore, notable habitats in Exclusive Economic Zones (EEZs) include cold-water coral reefs (e.g. off Nouakchott in the Mauritanian EEZ - ZEEM), upwelling areas, canyons ("Canyons of Timiris" of the same ZEEM).

One of the main characteristics of this region is the presence of seasonal upwellings. Enriched by the primary production of Saharan upwellings and coastal ecosystems, West African coastal areas are home to extraordinary biodiversity: molluscs, fish, sea turtles (five of the world's seven species), marine mammals, including the largest colony of breeding monk seals on land, manatees, whales, dolphins. Several species are listed on the International Union for Conservation of Nature (IUCN) Red List as threatened with Extinction, Vulnerable or Endangered.

There is an exceptional ornithological community here, with Afro-tropical species breeding and residing in the area, alongside Palearctic species migrating to spend the winter (up to 10 million individuals) in the region. It is also a vital wintering and/or breeding area for many migratory species.

**Mangroves** play a key role in maintaining coastal dynamics all along the southern rivers region and in estuaries, and contribute to the existence of remarkable marine and terrestrial fauna (MAVA Strategy, 2016-2022).



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<sup>1</sup> According to M. Ducrocq, 2021. RESILAO project notes

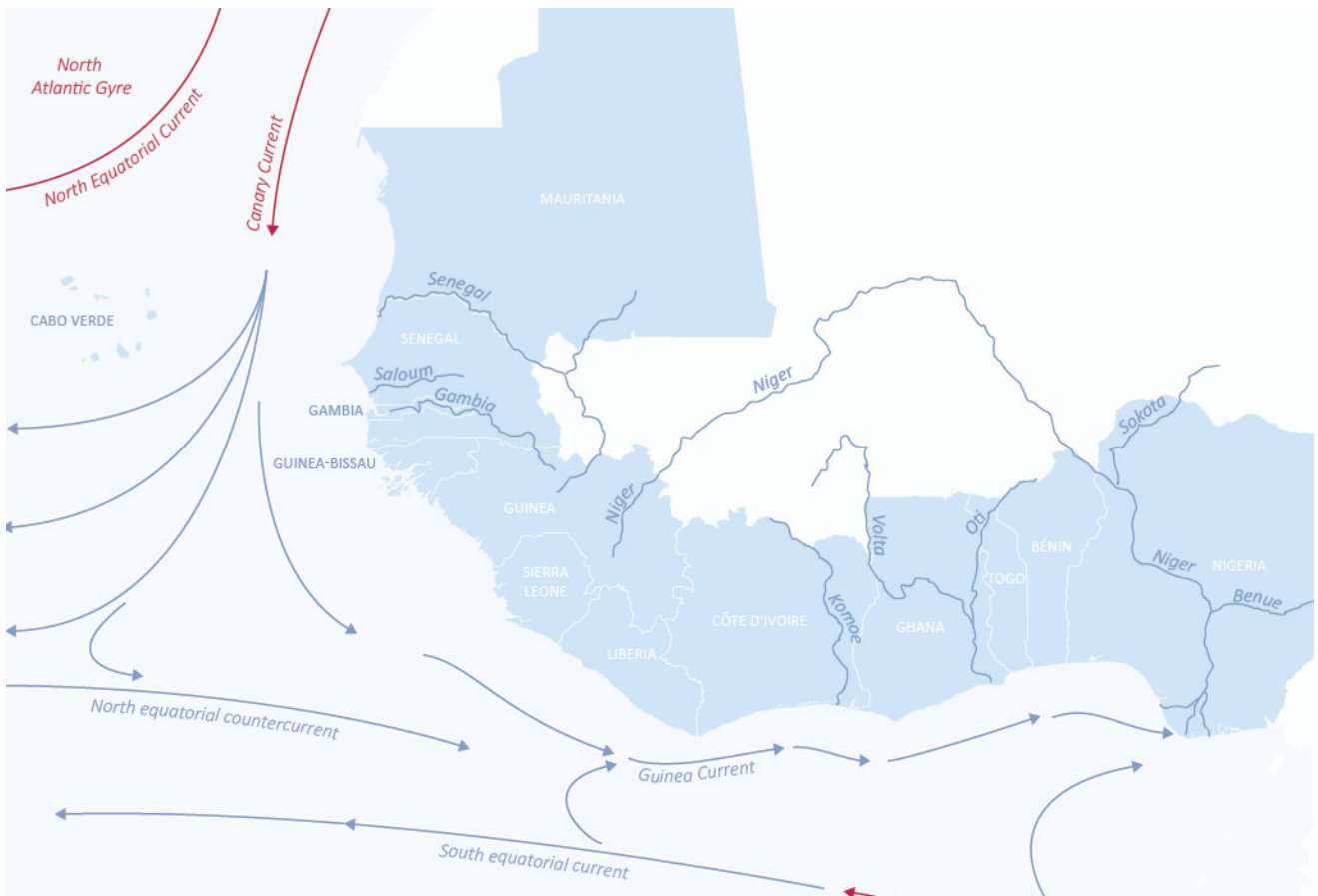


Figure 2.1 Map of the West African coastal region: main currents and rivers Source: Diop et al, 2014 / fao.org

They are essential habitat and a breeding ground for a large number of birds and fish, including some of the most important commercial species in the region. Beyond that, they play a major role in mitigating and regulating the impacts of climate change, contributing in particular to the sequestration and storage of carbon but also to the vertical erection of the ground, thus reducing the risks of submersion and salinization linked to sea level rise. The distribution of mangroves plays a major role in wave energy attenuation (up to 90% attenuation). They are very dynamic, and while they were losing surface area in West Africa in the period from the 1950s-1995, with a decrease of nearly 40% in surface area (from 14,757 km<sup>2</sup> to 9,799 km<sup>2</sup> - in Zwarts, 2014), others on the contrary have gained ground (Macera et al., in press); this increase is either natural or due to protective actions and major restoration programmes undertaken several years ago.

**Seagrasses** also play a very important ecological, economic and social role. They are feeding grounds, breeding grounds and nurseries for many species such as fish, turtles, molluscs and crustaceans. They contribute to maintaining clear and quality water, store carbon, produce a large quantity of oxygen used by all the organisms that live there. They thus play a preponderant role in the climatic cycle and, by retaining sediments and protecting the coast. Knowledge of West African seagrasses is still sketchy, especially their spatial distribution and state of health (see [resiliencesea.org](http://resiliencesea.org)).

Also poorly known are the habitats of cold-water reefs and the warm-water coral communities found, for example, in Cabo Verde (Monteiro et al, 2008).

### The role of mangroves and seagrass beds in climate regulation

“Coastal wetlands (mangroves, salt marshes and seagrass beds) are by far the best carbon stores, and should thus be prioritise for protection. They concentrate ten times more carbon than tropical forests or other marine ecosystems, such as coral reefs or phytoplankton!” (Jennifer Howard)

The prospective demo-economic reflections carried out in 2011 as part of the development of the West African Coastline Master Plan (SDLAO), the main trends of which were verified in 2016, show the growing strategic importance of the West African coastal area, where most of the “modern” economic activity is concentrated and which brings together more than 40% of the total population and around 60% of the urban population of the coastal States, depending to varying degrees on these coastal and marine resources, often pillars of their economies.





**Figure 2.2** Distribution of the main marine and coastal habitats of the region *Source: UNEP-WCMC, 2022 / habitats.oceanplus.org*

**Table 2.1** Distribution of the main marine and coastal habitats of the region

Country	Surface (km <sup>2</sup> )			
	Saltmarsh	Mangroves	Seagrass	Cold-water corals
Benin	0.00	1.40	1 343	1.00
Cabo Verde	0.00	0.00	0.00	34.30
Côte d'Ivoire	0.00	57.80	0.00	10.00
Gambia	200.00	598.00	0.00	0.00
Ghana	100.00	204.20	2 714	7.60
Guinea-Bissau	0.00	2 587	15 318	1.00
Liberia	0.00	189.20	0.00	6.90
Mauritania	12 133	0.80	0.00	39.60
Nigeria	0.00	6 881	8 829	9.20
Senegal	0.00	1246	1 482	4.20
Sierra Leone	0.00	1264	4 411	0.00
Togo	0.00	0.00	190	0.00
<b>Total</b>	<b>12 433</b>	<b>13 031</b>	<b>34 287</b>	<b>114</b>

*Source: UNEP-WCMC, 2022*

**Table 2.2** Evolution of the area of mangroves and levels of protection in the PRCM countries

Country	Number of mangrove species	% of change in surface area (1980-2006)	% of mangroves located in an MPA
Mauritania	3	39,3	62,5
Senegal	7	-23,8	42,5
Gambia	7	-17,5	3,5
Guinea-Bissau	6	8,7	35,5
Guinea	7	-31,9	0,26
Sierra Leone	6	-37,3	14,5

*Source: The Land/Ocean Interactions in the Coastal Zone of West and Central Africa (Salif Diop, et al., 2014), according to UNEP 2007 and Tendeng et al., 2012*

## International context

### Context in 2022

**SDG Target 14.5:** By 2020, conserve at least ten per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.

**Aichi Target 11:** By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through systems of protected areas and other effective area-based conservation measures, effectively and equitably managed, ecologically representative and well-connected, and integrated into the wider landscape and seascape.

At the regional level, we can cite the Regional Strategy for MPAs in West Africa and the development of a new additional protocol on marine protected areas by the Abidjan Convention.

The post-2020 Global Biodiversity Framework was not adopted until December 2022 at CBD COP 15 in Canada. The preparatory work led to the proposal of a framework that “includes 22 action-oriented targets to be urgently achieved over the next ten years, up to 2030”. Among these targets, and although the final figures remain to be adopted, we will mainly retain the targets below as objectives for the dimensioning of the West African MPA network:

**TARGET 1:** Ensure that the marine and coastal areas of West Africa are the subject of integrated spatial planning taking into account biological diversity, or any other process of effective management of uses, allowing (i) to maintain, in particular, critical and threatened ecosystems and areas of very high biological diversity and (ii) to improve connectivity, ecological integrity and maintain ecosystem functions and services, while protecting rights of indigenous peoples and local communities.

**TARGET 2:** Increase the ecological integrity of at least 20 per cent of degraded marine and coastal areas, through effective ecological restoration measures, with a focus on areas of particular importance for biodiversity.

**TARGET 3:** Ensure that at least 30 per cent of marine and coastal waters are effectively conserved through networks of protected areas, of which a substantial part is strictly protected, and other effective area-based conservation measures, in particular areas for biodiversity, areas of ecological or biological importance, threatened ecosystems and other areas of particular importance for biodiversity. Countries will need to establish national targets/indicators aligned with this framework and progress towards national and global targets will be periodically reviewed and a related monitoring framework developed.



## 2.1.2 Historical context of the creation of MPAs

While classified forests with mangroves have been protected for many years (1923 for the Dassioko forest in Côte d'Ivoire, for example), the first nationally designated marine protected areas in West Africa date from the 1970s (1970 for Lower Casamance, 1976 for the Saloum Delta, the Madeleine Islands and the Langue de Barbarie in Senegal). Then the number of MPAs increased year after year, relatively regularly, between one and three per year, with the exception of more massive creations, often on the occasion of regional or international events, such as in Cabo Verde with the designation of 20 MPAs in 2003, 5 in 2004 in Senegal, 4 in Sierra Leone in 2012 and 9 in Gambia in 2019.

The region now has 139 marine and coastal protected areas, including 84 all or part marine areas, for a total area of 6 million ha, of which, as far as is known, nearly 30% of marine areas (knowing that in several countries the marine surfaces are unknown, have not been informed or have been partially informed).

### 2003: The first regional strategy for MPAs

In 2003, the first regional strategy was launched under the impetus of a group of NGOs and organisations (PRCM, SRFC, IUCN, WWF, FIBA and UNESCO). At the time, this document was signed by all the Ministers in charge of the Environment and Fisheries for a subset of six PRCM countries: Cabo Verde, Gambia, Guinea, Guinea-Bissau, Mauritania and Senegal. This was a major step forward for the coherence between the two sectors and for the definition of major regional objectives in terms of marine and coastal conservation.

West Africa then had 21 MPAs (Figure 2.3).

### Brief history

**1920s:** First mangrove protected areas

**1970 – 1976:** First MPAs created in the marine environment (Senegal)

**2003:** First regional MPA strategy in West Africa (CRSP countries)

**2007:** Creation of RAMPAAO for rational and concerted management of marine and coastal resources in the PRCM area

**2009 – 2012:** RAMPAAO gap analysis process

**2018:** RAMPAAO's MPA reference status

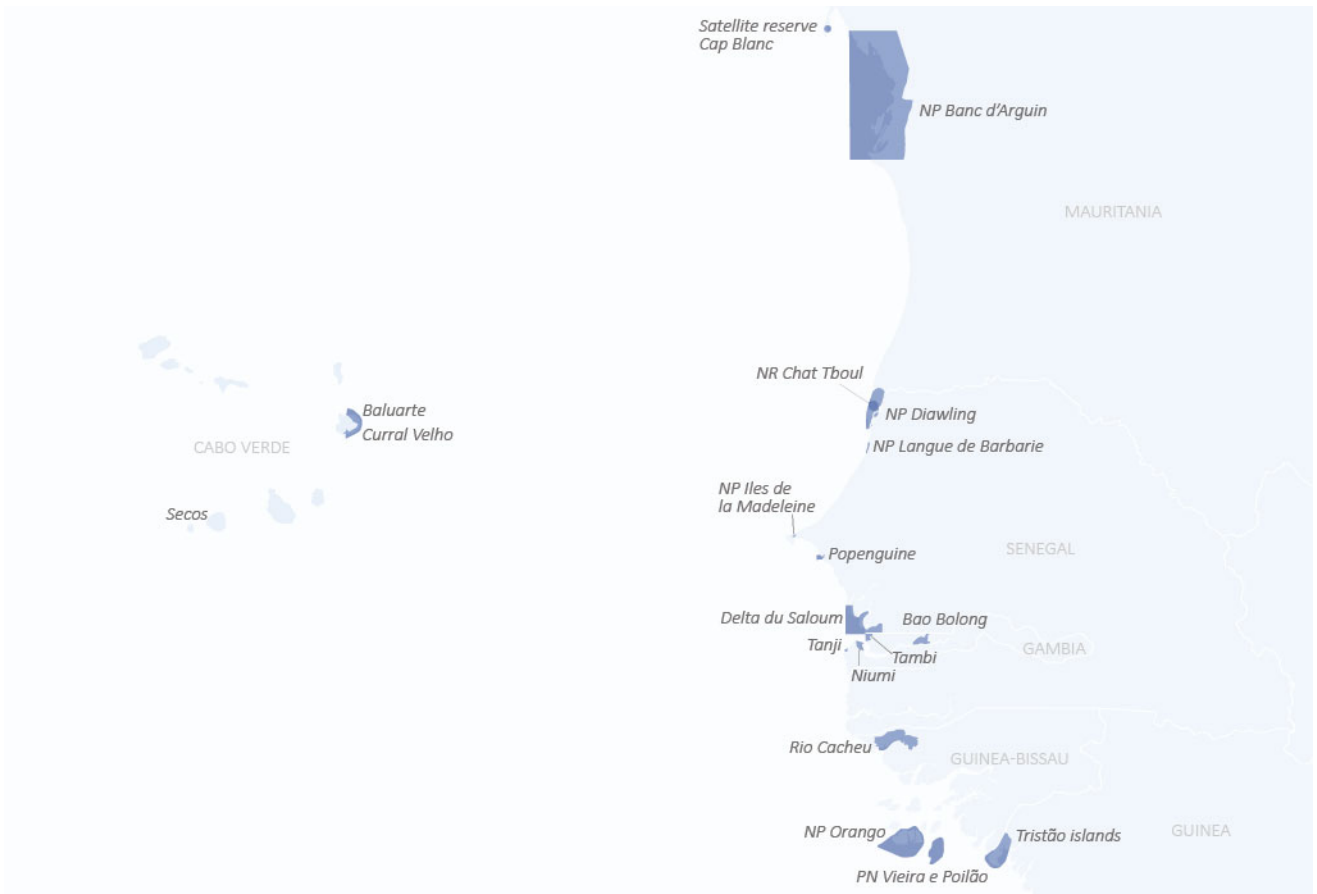
The 'vision' for this network is to create: An effective network of marine protected areas (MPAs) in West Africa with participatory management, led by strong institutions contributing to the sustainable development of the region by enhancing natural and cultural diversity.

### 2007: Creation of RAMPAAO

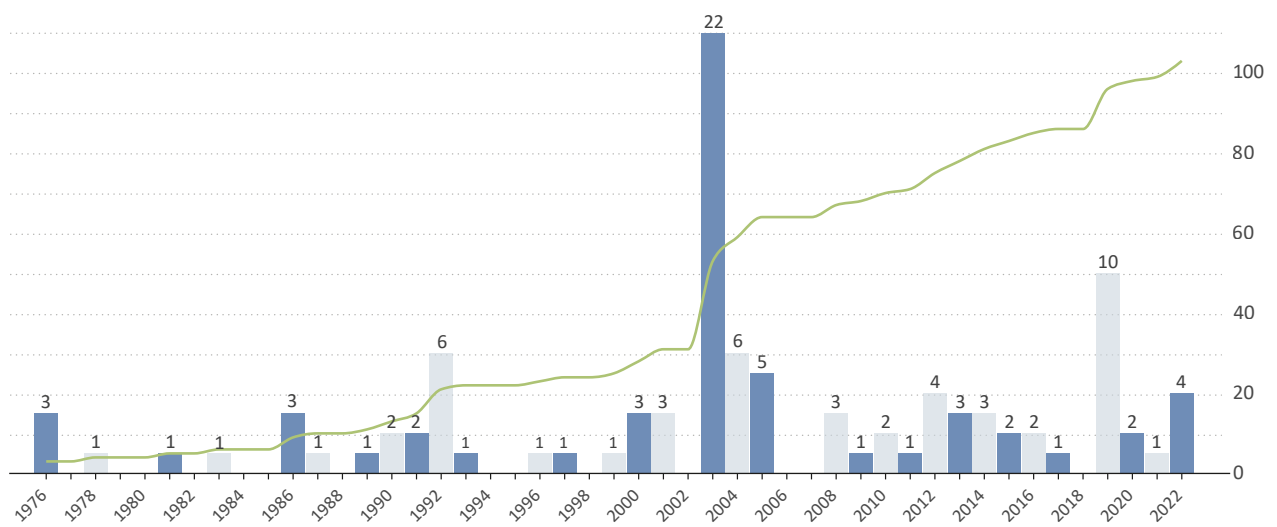
As part of this regional strategy, the regional network of MPAs in West Africa (RAMPAAO) was formally launched in April 2007 by 15 founding member MPAs. One of the goal of the RAMPAAO is to "network a set of MPAs representative of ecosystems and critical habitats necessary for the renewal of fishery resources, the regeneration and restoration of critical habitats and the preservation of biodiversity".



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**Figure 2.3 MPAs in 2003** Source : PRCM, IUCN, WWF, FIBA, Wetlands International, 2003 Stratégie régionale pour les aires marines protégées d'Afrique de l'Ouest



**Figure 2.4 Evolution between 1950 and 2022 of the number of MPAs created** Source: created from data collected by the authors



© Pierre-Yves Babelon - stock.adobe.com, mangrove

## 2012: First gap analysis

Since the network did not meet the required conditions of effectiveness, RAMPAO launched the first gap analysis in 2008, in order to identify the key areas of ecological and biological importance not yet protected and thus strengthen the level of representativeness, the coherence and network functionality (Tendeng et al., 2012). The analysis concerns 25 MPAs of the RAMPAO network.

This work is based on different levels of analysis:

- Analysis of the spatial distribution of MPAs in the ecoregion, both in terms of (i) spatial coverage of EEZ spaces and according to depths, as well as distances between MPAs; (ii) the distribution of MPAs according to the key habitats selected (corals, mangroves, sea grass beds, estuaries, lakes/ponds/lagoons, beaches, canyons, and seamounts) and (iii) the distribution of MPAs according to the areas of presence of rare, threatened or endangered species (monk seals, sea turtles, manatees, dolphins, hippos, rays and sharks).
- Analysis of the representativeness of the network, both in relation to physical elements (habitats, geomorphological zones) and biological elements (key species; fishery resources), in the coastal zone (5m), the benthic zone (5 to 200m) and the bathyal and pelagic (beyond the base of the slope).

Findings (see inset the main conclusions from the study) showed the very coastal nature of the network which protected approximately 12.69% of territorial waters and 0.12% of the EEZ. There was then a good representativeness of coastal habitats such as mangrove ecosystems (10%), seagrass beds (74%), estuaries (13%), coral reefs (5%), but low protection of habitats in high seas such as canyons (3% of Kayar Canyon), seamounts (only one seamount is protected in the

MPA of Santa Luzia, Cabo Verde), cold water reefs and permanent upwelling zones.

**One of the key findings from this study, published in 2012, is the identification, based on the criteria of the Convention for Biological Diversity (CBD), of approximately 48 sites of ecological and biological importance in the 7 countries involved, including about twenty sites located offshore.**

## 2018: RAMPAO MPA baseline

In 2018, RAMPAO launched a study to define the reference state of the MPA network (Failler et al, 2018). The network then has 32 MPAs, i.e. 7 more than in the previous study, and the results of this report confirm the previous conclusions. The study identifies the level of presence of the main habitats in the MPAs (Figure 2.5).

The evaluation of the **evolution of habitats** shows a regeneration of certain protected habitats such as mangroves, forests and sea grass beds and a regression of other habitats (beaches, rocky bottoms, coral bottoms) and above all reveals the lack of monitoring of the evolution of the area of habitats by MPA managers.

The assessment of the **evolution of the species** considered globally shows a numerical increase, with the exception of some of them such as the loggerhead, leatherback and olive ridley turtles which are in decline. The overall trend is upward for demersal fish, shellfish, monk seals and birds; down for populations of pelagic fish, turtles, manatees and dolphins.

This work notes that current MPAs are confined to the coastline, estuaries and lagoons.

**Table 2.3 Habitats identified in the 2012 gap analysis**

Marine habitats	Coastal habitats	Wet area
Sandbars, sand spits and sand islands	Sand beaches	Mangroves, tannes and bolon
Rocky shoals	Dunes and dune belts	Estuaries
Shellfish shoals	Rocky shores	Intertidal zones
Underwater cliffs	Islands	Mudflats
Underwater pits	Terrestrial coastal habitats	Flood basins
Coral reefs	Wooded savannas	
Seamounts	Shrubby savannah	
Seagrass beds	Palm grove	
Canyons	Forest	
	Paddy fields	

Source: Tendeng et al., 2012

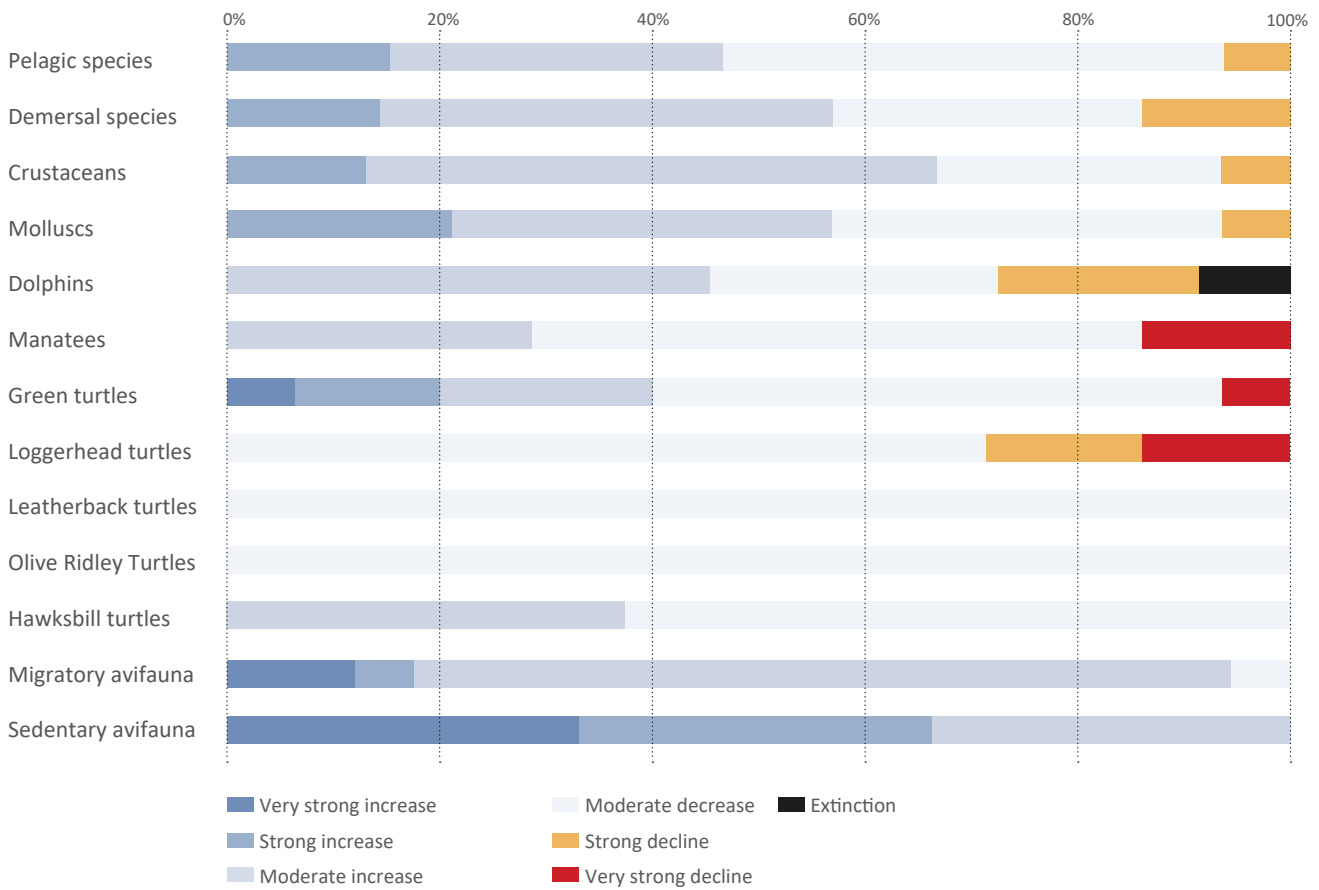
### Main conclusions of the gap analysis

- Only 0.12% of EEZ is protected.
- All MPAs are located in the coastal zone (between 0 - 50 nautical miles) and shallow (between 0 - 50m); remote and deep areas and the biotic communities associated with these areas are not protected: the level of protection of key ecosystems located offshore, in the exclusive economic zone, in the deepest areas must be reinforced.
- Across the entire ecoregion, 94% of the area of the key habitats considered are not protected by MPAs.
- Mangroves are the best represented in MPAs in terms of area, followed by seagrass beds and estuaries. Beaches, seamounts, corals and canyons (mainly located in Cabo Verde) are proportionally the least represented habitats; the protection of these habitats and especially the seamounts, 65% of which are located in Cabo Verde, is one of the priorities for marine conservation in the sub-region.
- Almost all the MPAs considered are home to at least one of the rare, threatened or endangered species selected.
- As regards areas important for fishery resources, knowing that the available data are insufficient, the analysis shows that the areas where cuttlefish, thiof and squid are present are not protected. It notes the need to continue thinking about the identification of critical sites for fish species outside existing MPAs, in order to better take them into account in future measures to strengthen the RAMP AO.

Source: Tendeng et al., 2012

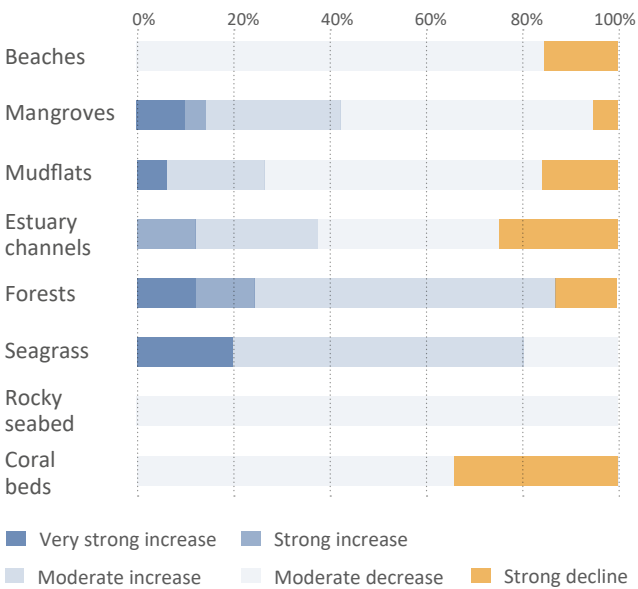


© Cyril Laffargue, knight guillemotte, Guinea



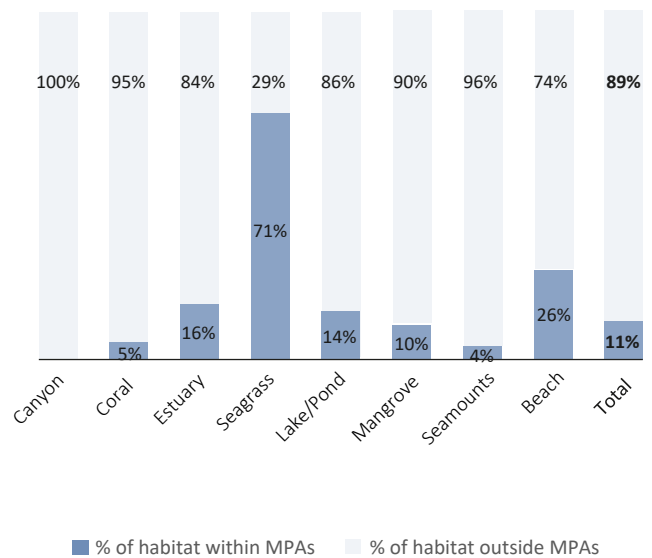
**Figure 2.7 Evolution of fauna in the MPAs of the network**

Note: The species are ordered from the most to the least recurrent. Source: Failler et al., 2018



**Figure 2.6 Evolution of the surface area of habitats in the network's MPAs**

Note: The habitats are ordered from the most to the least recurrent. Source: Failler et al., 2018



**Figure 2.5 Proportion of critical habitats protected and unprotected by the RAMPAO network**

Source: Failler et al., 2018

## 2.2 Characteristics of the regional network of marine protected areas

### 2.2.1 Marine protected areas considered in the EdAMP

The IUCN defines a protected area as “a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values” (Dudley, 2008).

The Convention on Biological Diversity (CBD) defines a Marine Protected Area (MPA) as “Any defined area within or adjacent to the marine environment, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surroundings”.

Were considered in this publication:

- Fully marine protected areas;

- Protected areas having a marine part, even small, and a coastal part;
- Wet terrestrial protected areas with mangroves, having no marine part (coastal protected area), but whose proximity to the coast and the intrusions of salt water in the deltas and estuaries have allowed the installation of mangroves.

On the other hand, in each country, there can be (i) zones of only national status, (ii) zones of only international status, some being able to have two or three international statuses (thus the Banc d'Arguin and the Djoudj are both UNESCO World Heritage, Ramsar site and Biosphere Reserve) and (iii) areas of national status also recognized internationally.

Among these sites, the analyses focused on protected areas with official national status and, in the absence of this status, on Ramsar sites; Indigenous and Community Conserved Areas (ICCAs) were also selected. In accordance with IUCN guidelines, biosphere reserves have not been counted, but a paragraph is dedicated to them.

Fishing reserves, and in particular the large reserved fishing zone of Guinea -Bissau (Rio Grande de Buba – 110,846 hectares) are not considered MPAs by the IUCN.



© Régis L'hostis, Atlantic humpback dolphin (*Sousa teuszii*) critically endangered, Senegal



## Data Sources

A variety of data sources were used as follows:

For marine protected areas that are members of the Regional Network of West African marine protected areas (RAMPAO):

- The MPA database produced as part of the RAMPAO marine protected areas baseline (Report by Failler P., Sadio O., Touron Gardic G., 2018) and subsequent publications, (in particular Failler et al., 2020), which remains the most comprehensive database to date, bearing in mind that in this work Failler counted 88 MPAs, compared with 86 validated in the EdAMP. The surface area values for the marine areas under consideration are taken from this database and have not been corrected, with a few exceptions, to reflect the countries' validations.

For all RAMPAO member and non-member marine protected areas:

- The World Database on Protected Areas (WDPA)/Protected Planet<sup>1</sup>.
- The "Directory of marine and coastal protected areas in Central and West Africa" produced by the IUCN (2017).
- Websites related to Ramsar sites and biosphere reserves.

These data were then sent to the countries for completion and validation, which was necessary for countries whose MPAs are not members of RAMPAO.

The data was provided and/or validated at the central administrative level for the following countries (see list of contributors and data providers at the beginning of the document):

- **Mauritania:** Directorate for the Protection and Restoration of Species and Environments of the Ministry of the Environment and Sustainable Development
- **Senegal:** Directorate of Community Protected Marine Areas (DAMCP) and Directorate of National Parks (DPN)
- **Sierra Leone:** Heads of Wetland and Marine Ecosystems – National Protected Areas Agency
- **Nigeria:** Forestry Department of the Federal Ministry of the Environment
- **Benin:** National Wildlife Reserve Management Centre
- **Togo:** Ministry of the Environment
- **Gambia:** Data provided by Mr Kawsu Jammeh of the Ministry of the Environment, Climate Change, Water and Wildlife.

The situation in the other countries is as follows:

- **Cabo Verde:** The data was provided by Antonio Araujo, consultant, and, for the Baia do inferno y Monte Angra natural park (PNBIMA), by Włodzimir Jozef Szymaniak. The list of marine protected areas has not been officially validated, but it is also taken from several official creation bulletins (official bulletins no. 37 of 9 April 2021, no. 30 of 22 March 2022, no. 119 of 19 October 2020 and sup no. 17 of 17 March 2016).
- **Guinea:** The data was provided by Mr Alkaly DOUMBOUYA of the Boussoura National Centre for Fisheries Science, who is member of the World Commission on Protected Areas (WCPA) of the World Conservation Union (IUCN).
- **Ghana:** Data provided by Ignatius K. Williams - Environment Officer, Regional Marine Centre; Global Monitoring for Environment and Security Africa (GMES & Africa) and University of Ghana.
- **Guinea-Bissau, Liberia:** No official validation.

<sup>1</sup> <https://www.iucn.org/our-work/protected-areas-and-land-use> ; <https://www.protectedplanet.net/en>

### 2.2.2 West African MPAs in 2022

Beyond the MPAs in the RAMPAO network considered so far, EdAMP is broadening its analysis to other countries in the region which do not have MPAs within RAMPAO (Liberia, Côte d'Ivoire, Togo, Nigeria), as well as in Benin (an MPA member of RAMPAO).

**The inventory work carried out within the framework of the EdAMP identifies 139 marine and coastal protected areas, of which 84 are marine areas (with at least a small marine part) and 55 are coastal only (without marine part but with intrusions of salt water allowing the establishment of mangroves); 124 sites have been officially designated (by decree or order) and therefore have a national status and 15 do not have a national status but**

**have been designated of international interest (Ramsar); Added to this are the 7 biosphere reserves.**

**These protected marine and coastal areas cover 60,000 km<sup>2</sup>, including 16,189 km<sup>2</sup> of declared marine area (27% of the total protected area).**

#### Types of marine protected areas with national status

For the IUCN, a protected area must have nature conservation as its primary objective and "if a marine area does not correspond to this definition, then it cannot be considered to be an MPA". In 2008, the IUCN identified seven categories of PA, which also apply to marine areas.



Marine and coastal  
protected areas  
**139**



Marine  
areas only  
**44**



Coastal areas  
only  
**55**



MPA members of  
RAMPAO  
**48**



Nationally  
designated MPAs  
**124**

In the marine domain, in addition to MPAs, there is a long tradition of fisheries management and protection of fishery resources through fishing zones. To date, the IUCN does not consider these areas to be MPAs. According to the IUCN, “Areas subject to some form of management could be MPAs or parts of MPAs in some cases, but MPA status should not be assumed and decisions must be made on a case-by-case basis, the essential criterion being whether nature conservation is the primary objective.” (Day et al., 2012)<sup>2</sup>.

IUCN PA categories, which also apply to MPAs, the names of the national statuses of MPAs are numerous, not always consistent between the different countries, in terms of level of protection and management., and these national categories do not necessarily correspond to the same IUCN categories. The list of national categories noted within the framework of West African MPAs includes 23 different names of marine protected areas (Table 2.4). As concerns terrestrial protected areas, IUCN categories are independent of the names given to MPAs (park, reserve, etc.).

#### Characteristics of regional network of MPAs

The importance of MPAs (with marine part) in number and surface area varies greatly depending on the country: some countries have a large number of MPAs (more than 20 for Cabo Verde and Senegal), others on the contrary have not yet officially established an MPA (Ghana, Togo).

**Cabo Verde:** the country has 24 MPAs, against only 4 listed in WDPA; 22 are MPAs with strictly national status (nature reserves - including integral nature reserve; marine nature reserve; protected landscapes and natural parks). All but two of these marine areas were declared in 2003 (decree no. 7/2002 of 30 December 2003) and validated in 2016. One was declared more recently (2021). Six sites are internationally recognized, with 4 Ramsar sites and 2 biosphere reserves, including the Fogo biosphere reserve, and that of Maio, both Ramsar and biosphere reserve, which includes 6 MPAs of national status, as well as the Peripheral Marine Protected Area of the Barreiro e Figueira Protected Landscape, on a 300-meter strip along the coast.

The IUCN categories are not known, knowing that the strict nature reserves are of categories I or II, but overall in the marine environment there are few integral protection zones. Within the framework of the zoning plan of the island of Maio, it is thus said that it is desirable to establish no-fishing areas, in order to protect some areas recognized as important, in particular for reproduction, but it has been considered that the majority of marine areas of the zoning plan

#### Note on the WDPA database

The WDPA database counts 83 protected sites (knowing that a site can cover several polygons<sup>1</sup>): 54 MPAs identified in the context of this study are therefore not included, in particular the the most recent MPAs (2022 for MPAs in Benin or Côte d'Ivoire, or in Senegal, for example); but MPAs that are already old are not included: 4 MPAs are noted in WDPA out of the 24 existing MPAs in Cabo Verde, 12 out of 15 MPAs in Gambia, 7 out of 24 in Nigeria). On the other hand, some MPAs considered in WDPA have not been retained in this work.

This under-representation of MPAs in the WDPA database has already been highlighted by Failler et al (2020): “Comparing WDPA protected area figures against database created directly from national data showed large discrepancies, etc. Possible explanations for the differences include: countries not transmitting information or doing so incorrectly; methodological transformations of data are inducing errors; and multiple MPA statutes leading to double counting of protected areas.

**Important note: while this chapter has relied on the 139 MPAs listed in this publication (MPAs with national status, as listed with country officials, and Ramsar sites, even if they do not national), Chapter 3, related to knowledge, only considered the 83 MPAs present in the WDPA database, which explains the differences in results.**

<sup>1</sup> 95 polygons listed.

“can be managed by a regime of traditional use (ZUT), reserved for small-scale fishing and possibly recreational sport fishing.”

**Mauritania** has five MPAs, but they are the largest (1,242,492 ha) and represent, to the best of our knowledge, 40% of the total MPA surface area of all the countries considered in the EdAMP. These areas are all recognized as being of international interest: World Heritage, Ramsar and biosphere reserves. A new national strategy for MPAs is being developed in the country.

**Senegal** is the first country to have created marine protected areas. It currently has 23, covering 677,243 ha, including 20 marine ones. Six sites are of national interest, with 6 Ramsar sites and the Saloum delta which, moreover, is World Heritage and a biosphere reserve.

<sup>2</sup> Day J., Dudley N., Hockings M., Holmes G., Laffoley D., Stolton S. & S. Wells, 2012. Application of management categories to protected areas: guidelines for marine areas. Gland, Switzerland: IUCN . 36 pp. <https://portals.iucn.org/library/sites/library/files/documents/PAG-019-Fr.pdf>

Out of the 23 MPAs, 16 are IUCN category VI community areas), including 2 APACs.

**The Gambia:** There are 15 marine and coastal areas in The Gambia, including 7 marine areas. Twelve MPAs are IUCN category VI and 3 are national parks (category II).

**Guinea-Bissau** has 6 MPAs (over 559,035 ha), including three IUCN II category national parks – the others are not categorized. The immense AMO of the Bolama Bijagós archipelago covers 1,046,950 ha and is both a Ramsar site and a biosphere reserve and contains MPAs of various statuses which alone have been counted. Added to this is the reserved fishing area (OECS) of Rio Grande de Buba, not considered by the IUCN as an MPA (but present in WDPa).

**Sierra Leone** has 5 MPAs (135,173 ha), one of which is also a Ramsar site.

In **Liberia** a single MPA has been identified (109,381 ha) plus two other coastal Ramsar sites. Three other coastal sites are proposed as national parks.

**Côte d'Ivoire** has just declared, in 2022, its first marine protected area (Grand-Béréby, for a total surface area of 272,375 ha; the marine area is not known). There are also 12 protected coastal areas (without marine part) but containing mangroves. Among these 12 zones, four were proposed in 2020 as marine protected areas (the national parks of Azagny and the Iles Ehotilé-Essouman, the classified forest of Dassioko), to which is added the proposal for classification as a marine protected area of mouth of the Cavally River, which should eventually bring the number of marine protected areas to five. In addition to the two national parks already mentioned, the country has a nature reserve, the other 9 sites being designated as classified forests. Internationally there are 6 Ramsar sites.

**Ghana** has no MPAs but 6 coastal sites with mangroves are protected as forest reserves or as Ramsar sites (168,964 ha); the country has 5 Ramsar sites and a biosphere reserve (Songor lagoon). The Keta Lagoon complex has the largest distribution of mangroves among the five Ramsar sites.

**Togo** does not officially have any MPAs. The entire coast, over 55 linear km, is a Ramsar site “Zones Humides du Littoral du Togo” characterized by natural and artificial mangroves, rivers, lakes, lagoons, marshes, ponds and above all a very long beach of sand. The country also has the Mono biosphere reserve, which crosses the border with Benin.

**Benin** has 6 marine areas, three of which have just been designated (2022), two MPAs and one community area (all IUCN category VI). Two Ramsar sites, the only ones mentioned in the WDPa, the “Basse Vallée de l’Ouémé, Lagune de Porto-Novo, Lac Nokoué” site and the site “Basse Vallée du Couffo, Lagune Côtière, Chenal Aho, Lac Ahémé” cover two of the entire coastline of Benin with marine parts whose total surface area is not known. Newly designated MPAs fall within these sites.

**Nigeria** has 24 coastal protected areas, of which 2 are marine parks and 22 are reserves, including 19 forest reserves. Among them, 4 have marine parts, namely Stubbs Creek, Andoni, Olague and Uremure Yokri, and the others are considered as such because they have mangroves and some marine intrusion.

The size of MPAs varies greatly, ranging from 5 ha for the smallest (Alcatraz in Guinea) to 1,208,013 for the largest (Banc d’Arguin in Mauritania). Excluding the Banc d’Arguin and the Bolama Bijagós archipelago in Guinea-Bissau (1,046,950 ha), outside the standards, and the MPAs whose surface area has not been communicated, the distribution of size classes shows that 85% of MPAs are smaller than 500 km<sup>2</sup> (total surface area, terrestrial + marine part).

As regards strictly marine areas, knowing that for 9 sites the marine area is not known, the sizes of MPAs are between 2 ha and 639,341 ha.

Six MPAs are totally or nearly totally marine, 26 are more than 75% marine, 9 have between 50 and 75% marine area and 35 (46%), half terrestrial, have less than 50%.

Four countries account for approximately 86% of the total marine protected area: Mauritania (40% of marine protected areas), Senegal (23%), Guinea-Bissau (14%) and Cabo Verde (8.49%).

**Table 2.4 Name of MPA categories according to country and possible correspondence with the IUCN categories (knowing that several criteria are involved in the IUCN categorization). The other MPAs are of international status only (Ramsar)**

Designation of MPAs with national status	Potential matches with IUCN categories*	Cabo Verde	Mauritania	Senegal	Gambia	Guinea-Bissau	Guinea	Sierra Leone	Liberia	Côte d'Ivoire	Ghana	Togo	Benin	Nigeria
Nature Reserve	I	13		1	1					1				
Integral Nature Reserve	I	4					1	1						1
Satellite Reserve	I		1											
Wildlife sanctuary	I						1							
Bird sanctuary	I or IV		1	1										
Forest reserve/classified forest	I, IV or VI									9	2			19
National park	II		2	4	4	2				2				2
National marine park	II					1								
Special wildlife reserve	IV			1										
Managed nature reserve	IV or VI						1							
Game reserve	IV or VI													2
Protected Landscape	V	2												
Nature park	VI	3				2								
Marine Protected Area	VI							4		1			2	
Multiple-use marine protected area	VI		1											
Community Marine Protected Area (CMPA)	VI			13	8	1							2	
Indigenous and Communitarian Conservation Area (ICCA)	VI			2**										
Wetland reserve	VI				1									
Community nature reserve	VI			1										
Managed Community Nature Reserve	VI						1							
Community wildlife reserve	VI				1									
Sustainable development reserve	VI								1					
Urban nature reserve				1										
<b>Total (Countries)</b>		<b>22</b>	<b>5</b>	<b>23</b>	<b>15</b>	<b>6</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>13</b>	<b>2</b>	<b>0</b>	<b>4</b>	<b>24</b>

\* Knowing that several criteria are involved in the IUCN categorization

\*\* Including one included in an AMCP

Source: created from data collected by the authors

Table 2.5 Characteristics of MPAs by country

Pays	Total number of marine and coastal PAs	Number of coastal-only PAs	Number of marine MPAs	Number of MPAs with national status	Number of Ramsar-only MPAs*	Total surface area (ha)	Terrestrial area (ha)	Marine area (ha)
Cabo Verde	24	1	23	22	2	171.405	33.907	137.498
Mauritania	5	0	5	5	0	1.245.471	596.216	649.255
Senegal	23	3	20	23	0	677.244	308.850	368.394
Gambia	15	8	7	15	0	92.004	56.841	35.163
Guinea-Bissau	6	0	6	6	**	558.934	328.658	230.276
Guinea	6	0	6	4	2	220.379	138.685	81.694
Sierra Leone	5	0	5	5	0	135.173	38.597	96.576
Liberia	3	2	1	1	2	128.309	115.404	12.905
Côte d'Ivoire	15	14	1	13	2	479.009	206.634	ND
Ghana	6	6	0	2	4	168.964	168.964	0
Togo	1	1	0	0	1	591.000	591.000	ND
Benin***	6	0	6	4	2	1.177.049	1.170.239	6.810
Nigeria	24	20	4	24	0	309.637	309.427	210
<b>Total</b>	<b>139</b>	<b>55</b>	<b>84</b>	<b>124</b>	<b>15</b>	<b>5.954.578</b>	<b>4.063.422</b>	<b>1.618.781</b>

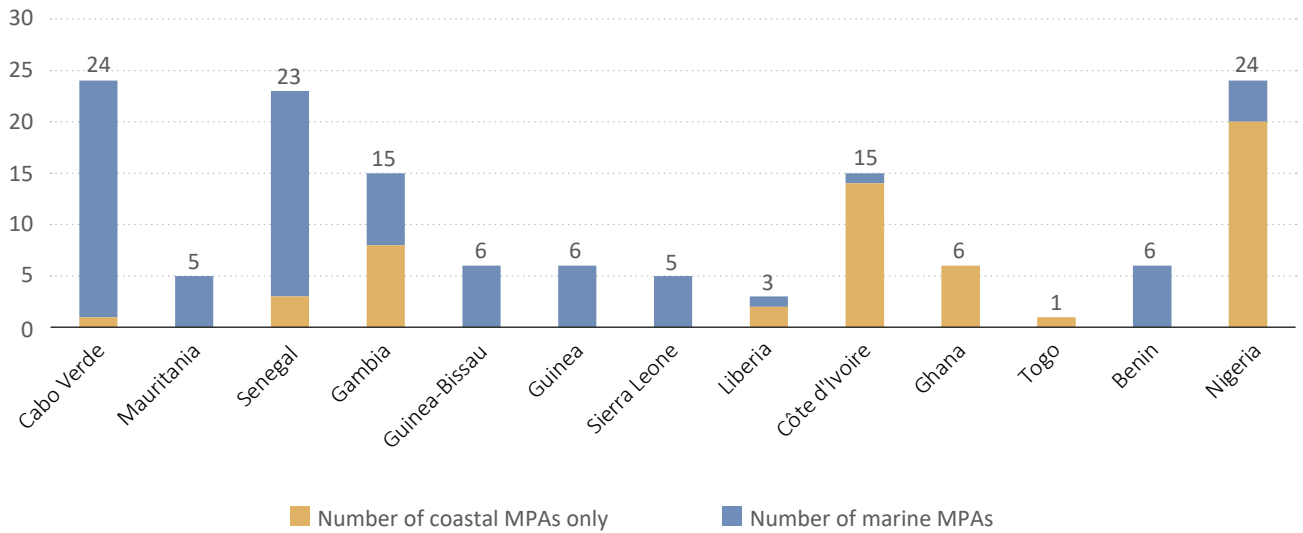
\* Without national designation

\*\* To which must be added Bolama Bijagós (Ramsar site and Biosphere Reserve on 1,046,950 ha)

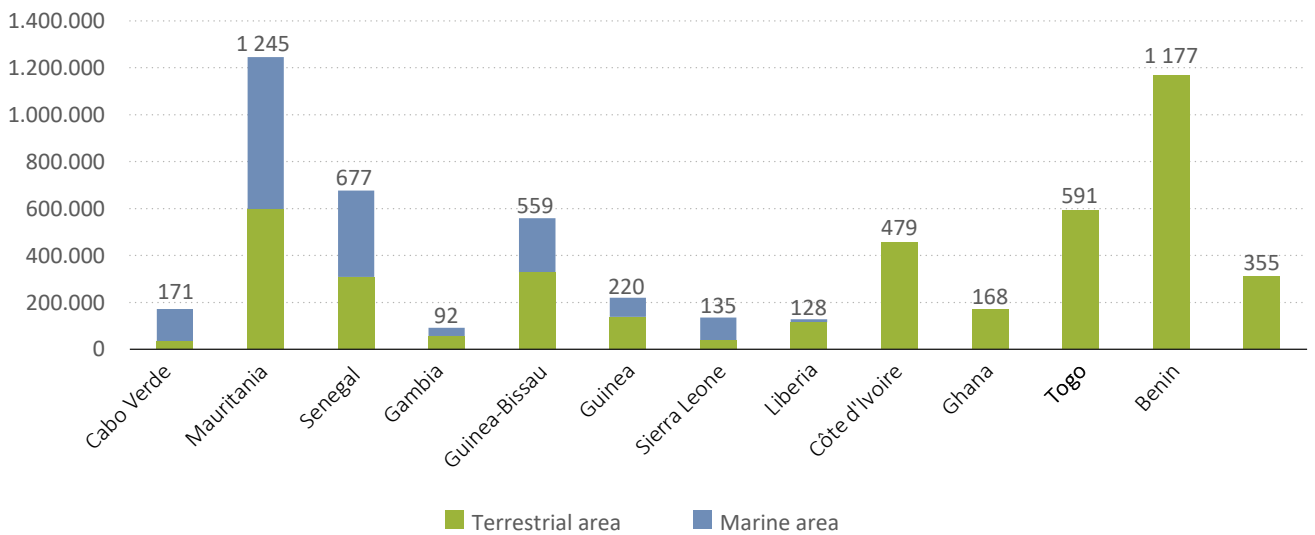
\*\*\* Land surface extrapolated to Benin. (Marine surfaces partially unknown)



© suvorovalex - stock.adobe.com, mangroves, Gambia

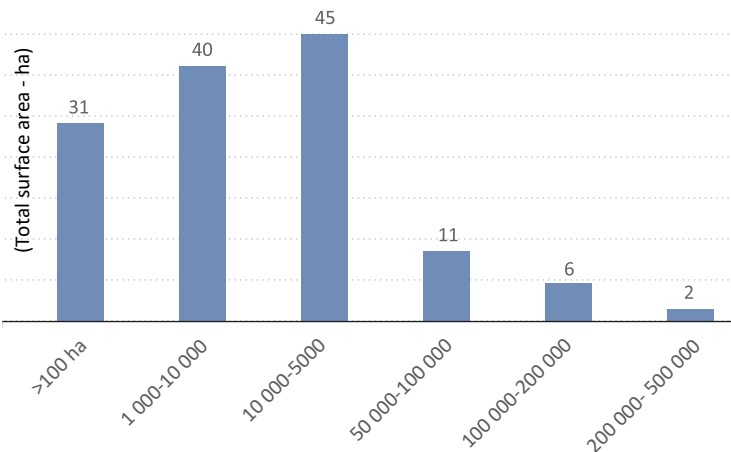


**Figure 2.8 Total number of MPAs per country** Source: created from data collected by the authors



**Figure 2.9 Land and sea surfaces of MPAs by country (ha)**

Note: Bearing in mind that (1) for several countries, only the total surfaces are known, which explains why the total surface does not correspond to the sum of the surface terrestrial + marine (see e.g. Benin) and that (2) the marine surfaces of MPAs are poorly known for Togo, Côte d'Ivoire, Benin and Nigeria and are therefore underestimated. Source: created from data collected by the authors



**Figure 2.10 Distribution of MPA size classes** Source: Failler et al., 2018



© gwenaël - stock.adobe.com, path in the mangrove, Senegal

### 2.2.3 Indigenous and Community Conserved Areas (ICCAs)

Indigenous and Community Conserved Areas (ICCAs) are defined by the IUCN as: “natural and/or modified ecosystems containing significant biodiversity values and ecological services, voluntarily conserved by (sedentary and mobile) indigenous and local communities, through customary laws or other effective means”.

They are therefore territories and areas conserved by indigenous peoples and communities (Box 2.1). Ten marine protected areas have been identified as ICCAs, in Senegal (Kapac Olal and Kawawana) and nine in The Gambia. In addition to these ten ICCAs, 17 areas in all are designated as community areas: community areas in Benin (2), community marine protected areas in Senegal (13) or community nature reserves in Senegal (1) and Guinea-Bissau (1).

### 2.2.4 Other effective area-based conservation measures (OECMs)

The concept of “other effective area-based conservation measures” was adopted in 2010, at the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD). All Parties have agreed to an international conservation target, called Aichi Target 11, which states that 10% of marine and coastal areas will be

conserved by 2020 through protected areas and other conservation measures effective area-based conservation (“other measures”).

An “other effective area-based conservation measure” is defined by the CBD as:

*A geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in-situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic, and other locally relevant values.* (CBD, 2018).

Recently, WCMC has started collecting and documenting data on AMECZs.

The number and total extent of AMECZ in West Africa is not known. There are only two AMECZs listed as such in the WDPA database, the Rio Grande de Buba reserved fishing zone (Guinea-Bissau) and the Djibelor forest reserve (Senegal). In addition, all the community protected areas and all the fishing reserves that could not be identified in this work, such as the Protected Fishing Zones (PFZ) in Senegal (see fishing chapter), can also be considered as AMECZs as well as other areas such as prohibited military areas.



Figure 2.11 Map of ICCAs and OECM Source: Failler et al., 2018

### Box 2.1 The ICCAs

“The ICCA concept includes a wide range of examples, but ICCAs generally have the following three characteristics<sup>1</sup>:

- There is a close and deep connection between a territory or area and its indigenous people or local community who care for it. This relationship is generally rooted in history, social and cultural identity, spirituality and/or people’s dependence on the territory for their material and intangible well-being;
- The people or community in charge of it make and apply (alone or with other actors) decisions and rules concerning the territory or area through a functional governance institution (which can or not be recognized by third parties or by the statutory law of the country concerned);
- Governance decisions and rules (for example, regarding access to and use of land, water, biodiversity and other gifts of nature) and efforts to manage populations or concerned community contribute positively to nature conservation (i.e. the preservation, sustainable use and restoration, where appropriate, of ecosystems, habitats, species, natural

resources, terrestrial landscapes and seafarers), as well as the livelihoods and well-being of communities;

Beyond these common characteristics, ICCAs are very diverse. Some examples include indigenous territories, indigenous protected areas, cultural lands and seascapes, sacred natural sites, migration routes of mobile indigenous peoples, bio-cultural heritage territories, sustainable resource reserves and managed areas by the community.”

Source: <https://www.iccaregistry.org/fr/about/iccas>

1 Sajeva, G, Borrini-Feyerabend, G & Niederberger, T 2019, Meanings and More...: Policy Brief of the ICCA Consortium no. 7. [Barcelona].



### Strong protection areas within marine areas

The importance of strong protection for the conservation of biodiversity and resources is now well recognised. However, it has not been possible to calculate the percentage of strongly protected areas within West African MPAs. Out of 84 marine areas, only seven integral reserves are counted (for 554 marine hectares, i.e. 0.03% of marine areas); if we also count the 16 nature reserves (for which it is not known whether or not they are strongly protected), this would bring the relatively strong level of marine protection to less than 6% of the marine areas of the MPAs.

### 2.2.5 IUCN categories

The IUCN recognizes seven categories of protected areas, defined mainly by their management objective (see Table 2.6).

Several countries have not yet classified their MPAs according to the IUCN categories (Cabo Verde, Togo, Benin, etc.) and 51% of the MPAs identified are not classified (63 out of 124 MPAs with national status). Among the MPAs whose category has been entered, category VI (Protected Area of managed natural resources) is the most frequent (57% of MPAs), followed by category II (National Park, 23%). No MPA falls under categories III (Natural monument) and V (protected landscape), statuses which however exist in Cabo Verde for example, where the IUCN category has not been officially entered.

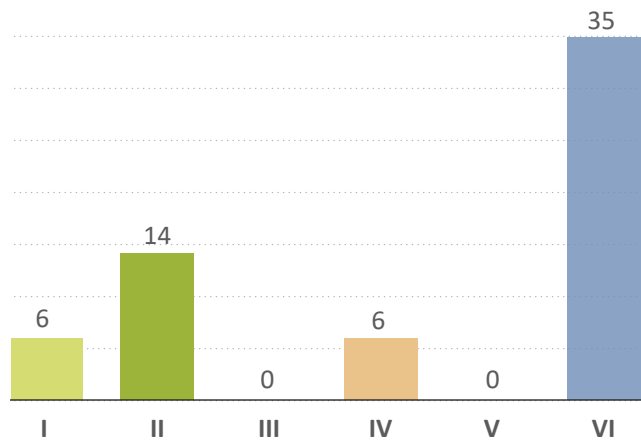


Figure 2.12 Number of MPAs by IUCN category

Note: Categories not documented for 50% of MPAs.



© Hellio & Van Ingen, bolon Orango island, Guinea-Bissau

**Table 2.6 IUCN protected area categories**

IUCN Category	Name	Characteristics and management objectives
<b>Ia</b>	Integral nature reserve	area managed mainly for science or wilderness protection
<b>Ib</b>	Wilderness area	area managed mainly for wilderness protection
<b>II</b>	National Park	area managed mainly for ecosystem protection and recreation
<b>III</b>	Natural monument	area managed mainly for conservation of specific natural features
<b>IV</b>	Habitat or species management area	area managed mainly for conservation through management intervention
<b>V</b>	Protected landscape or seascape	area managed mainly for landscape/seascape conservation or recreation
<b>VI</b>	Protected area of managed natural resources	area managed mainly for the sustainable use of natural resources

**Table 2.7 Distribution of IUCN categories of MPAs identified by country**

Country	Number of nationally designated MPAs	IUCN Categories						Not documented
		I*	II	III	IV	V	VI	
Cabo Verde	22	2						20
Mauritania	5	1	1				1	2
Senegal	23		4		4		15	
Gambia	15		3				12	
Guinea-Bissau	6		3					3
Guinea	4	2					2	
Sierra Leone	5							5
Liberia	1							1
Côte d'Ivoire	13		2					11
Ghana	2							2
Togo	0							
Benin	4						4	
Nigeria	24	1	1		2		1	19
<b>Total</b>	<b>124</b>	<b>6</b>	<b>14</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>35</b>	<b>6</b>



© Overflightstock - stock.adobe.com, Banc d'Arguin National Park, Mauritania, Unesco World Heritage

## 2.2.6 International status

Various international labels can be attributed to protected areas. Non-binding, they nevertheless constitute an “excellent means of awareness-raising for the protection and improvement of the management efficiency of these sites with high natural and cultural potential” (IUCN).

These labels are awarded to protected areas under agreements, including:

- The Convention on Wetlands (Ramsar convention) [of international importance particularly as a habitat for birds (Ramsar convention)] whose mission is “the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world”.
- The Convention for the Protection of the World Cultural and Natural Heritage - World Heritage or UNESCO World Heritage refers to a set of cultural and natural properties of outstanding interest for the common heritage of humanity. This heritage is the subject of an international treaty entitled “Convention for the Protection of the World Cultural and Natural Heritage”, adopted by UNESCO in 1972, updated each year since 1978 by the World Heritage Committee of the Organization of United Nations Educational, Scientific and Cultural Organization (UNESCO), which is a specialised agency of the United Nations Organization.

The sites are inscribed on lists (the List of Wetlands of Importance, or “Ramsar List” or the World Heritage List) and these inscriptions encourage states to ensure the protection of these sites: “By signing the Convention, each country pledges to conserve not only the World Heritage sites situated on its territory, but also to protect its national heritage.”. Although non-binding, these “renowned” inscriptions therefore allow a certain protection and the states then tend to protect these sites on a national status. States Parties have an obligation to report regularly on the state of conservation of their inscribed properties.

Sites may also be recognized under the UNESCO “man and biosphere” programme or the IUCN green list.

### UNESCO World Heritage: Listed natural marine sites

On the entire West African coast, only one natural marine site is listed as a UNESCO World Heritage Site:

In Mauritania, the Banc d'Arguin inscribed in 1989 over 1,200,000 ha.

“The Banc d'Arguin is one of the most important zones in the world for nesting birds and Palearctic migratory waders. Located along the Atlantic coast, this Park is formed of sand dunes, areas of coastal swamps, small islands and shallow coastal waters. The austerity of the desert and the biodiversity of the marine area results in a land and seascape of exceptional contrasting natural value.” (UNESCO site).

## Wetlands of International Importance (RAMSAR Website)

Contracting Parties shall undertake to identify wetlands that meet specific criteria and to include them in the list. The criteria related to the safeguarding of biodiversity that the sites must meet are diverse:

- Sites containing representative, rare or unique wetland types.
- Sites of international importance for conserving biological diversity, with criteria taking into account species or ecological communities, waterbirds, fish, or other important species.

In line with the Ramsar List's vision to "develop and maintain an international network of wetlands which are important for the conservation of global biological diversity and for sustaining human life through the maintenance of their ecosystem components, processes and benefits/services.", the West African network includes 47 Ramsar sites, for a total area of 64,823 ha, which most often cover marine and coastal areas protected by national statutes, including a transboundary site, the Niuni -Saloum between Gambia and Senegal.

## Biosphere reserves

Developed under UNESCO's Man and Biosphere (MAB) Programme, "biosphere reserves are designated by UNESCO as places to experiment and demonstrate sustainable development practices at the regional scale, by reconciling the social and economic development of populations with the conservation of biological diversity and more broadly the protection of the environment, while respecting cultural values. Territorial dialogue between different actors and institutions is privileged, according to specific consultation mechanisms. Scientific research and monitoring, training, education and awareness support the territory's project. They contribute to the implementation of the Sustainable Development Goals (source: Mab-France)".

There are 86 biosphere reserves in Africa, which participate in the African Network of Biosphere Reserves (AfrimAB), created in 1996 to promote regional cooperation.

The West African region has 7 biosphere reserves with at least one marine part, two in Cabo Verde, one in Senegal, Guinea-Bissau and Ghana, including 2 transboundary reserves between Benin and Togo, and between Senegal and Mauritania (Senegal River Delta).

The IUCN does not consider biosphere reserves to be protected areas; they are therefore not considered in the analyses, unless they are also recognized nationally.

## Transboundary sites

"In order to achieve all of their conservation objectives, protected areas must defy these human barriers to align themselves as much as possible with the natural limits of ecosystems. Thus, the transboundary protected area (APTF), which consists of a conservation tool not limited to borders and which encourages cooperation between States, is proving to be appropriate"

## Biosphere reserve zone

Biosphere reserves have three interrelated zones that aim to fulfil three complementary and mutually reinforcing functions:

- The core area (s) comprises a strictly protected zone that contributes to the conservation;
- The buffer zone surrounds or adjoins the core area(s), and is used for activities compatible with sound ecological practices that can reinforce scientific research, monitoring, training and education;
- The transition area is the part of the reserve where the greatest activity is allowed, fostering economic and human development that is socio-culturally and ecologically sustainable.

(Montpetit, 2013)<sup>3</sup>. It frees itself from administrative constraints for unbounded natural spaces and biodiversity, and can be a source of conflict reduction. The region has two transboundary biosphere reserves, with a marine or coastal part, between Benin and Togo (Mono) and between Senegal and Mauritania (Senegal River) and a transboundary Ramsar site between the Gambia and Senegal (Saloum Niuni Complex).

## IUCN Green List

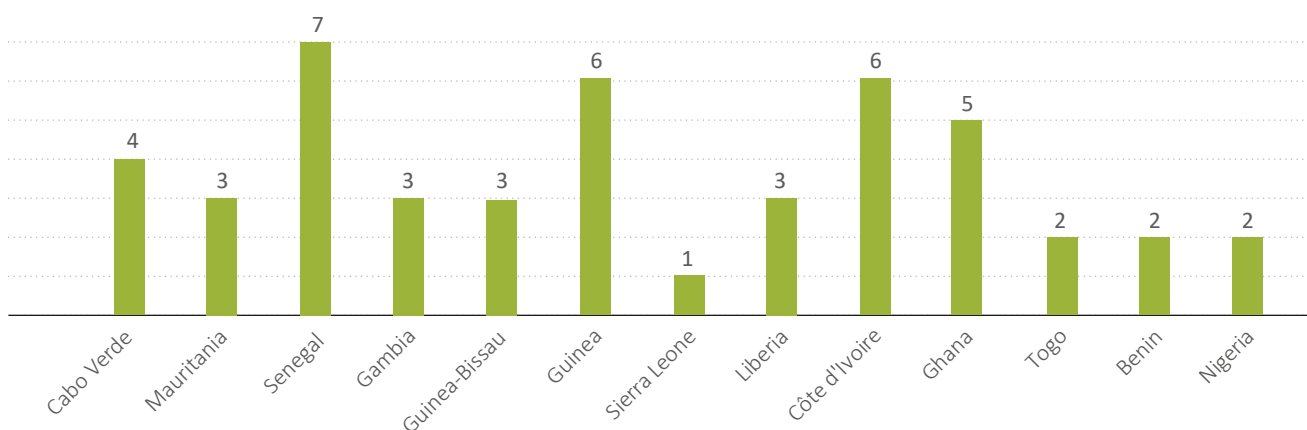
The Green List is an international label whose main objective is to promote sites and exemplary practices in order to advance the management of all protected areas. Sites on the IUCN Green List are certified as being effectively managed and fairly governed, with long-term positive impacts on people and nature. Every five years, they are evaluated "against a set of demanding criteria that include the quality of protection of natural values and the effectiveness of actions against threats".

Only Senegal (since 2020), Côte d'Ivoire (since 2017), Benin (since 2016) and Nigeria are involved in the IUCN Green List of Protected and Conserved Areas process. But there are still no sites on the IUCN Green List.

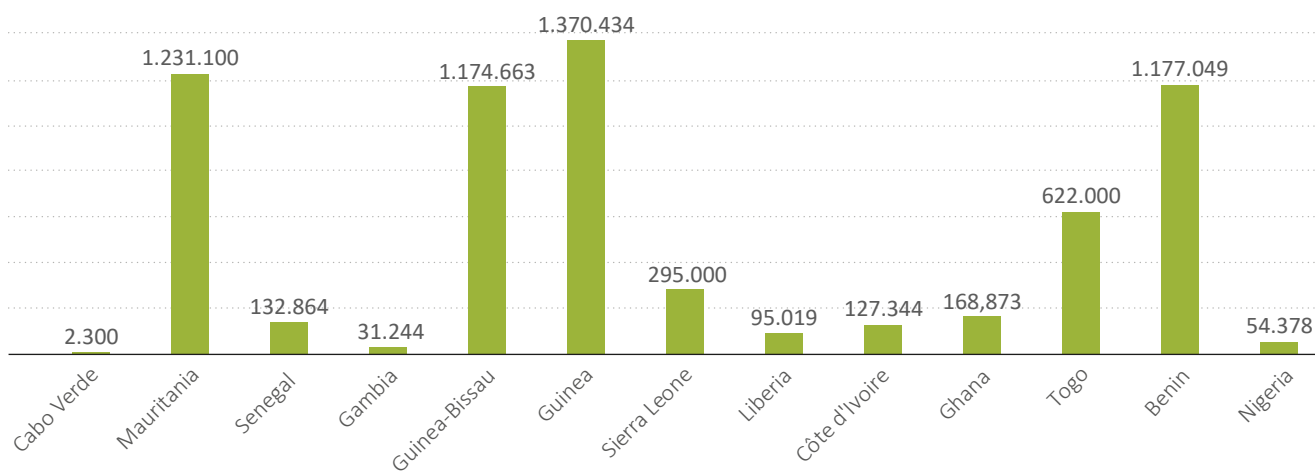
3 Sandrine Montpetit. 2013. Transboundary Protected Areas: Beyond Biodiversity Conservation Masters Report. Univ. from SHERBROOKE (Canada)

**Table 2.8 Marine and coastal biosphere reserves in West Africa**

Country	MPA designation	Date of designation	Surface area (ha)				
			Terrestrial area	Marine area	Core area	Buffer zone	Transition zone
Cabo Verde	Fogo	2020	102.142	55.068	6.919	15.031	80.192
Cabo Verde	Maio	2020	73.972	47.072	10.513	1.865	593.237
Senegal	Delta du Saloum	1981	408.906		76.000	144.378	188.528
Guinea-Bissau	Iles Bolamà Bijagós	1996	101.230				
Ghana	Songor lagoon	2011	37.596	1.699	7.822	28.075	
<b>Transboundary biosphere reserves with marine or coastal areas</b>							
Benin/Togo	Mono Transboundary Biosphere Reserve	2017	346.286		14.496	43.378	288.412
Senegal/Mauritania	River delta Senegal	2012	641.768		95.460	86.142	460.165



**Figure 2.14 Number of marine and coastal Ramsar sites per country** *Source: created from data collected by the authors*



**Figure 2.13 Surface area (ha) of Ramsar sites by country** *Source: created from data collected by the authors*

## 2.2.7 Areas of international ecological interest

### Ecologically or Biologically Significant Marine Areas (EBSAs)<sup>4</sup>

The CBD aims to effectively protect and preserve marine biodiversity. To do this, it wants to have a good understanding of the different types of marine ecosystems in the different regions, including the areas with the greatest diversity, in order to know where to focus its efforts and to prioritize conservation and management. The EBSAs must correspond to 7 criteria (Figure 2.15). The region has 23 sites meeting the EBSA criteria (Figure 2.15). Nine of these areas are already protected. Fourteen major sites of interest therefore remain to be protected.

### Key Biodiversity Area (KBA)

According to IUCN (2016), Key Biodiversity Areas (KBAs) are sites that contribute significantly to the global persistence of critical populations of threatened species.

Applying the KBA criteria ensures that the global population of a species is assessed and the most important populations for that species as a whole are identified, including maintaining the genetic variation needed to adapt. Endangered species include:

- Species recognized as globally threatened on the IUCN Red List of Threatened Species. These are species with very small, geographically restricted or rapidly declining populations.
- Species whose populations are confined to small areas or form large aggregations at certain times of the year for breeding, feeding or migrating – since these species are all dependent on the health of a limited number of key habitats.

The KBA criteria also allow proposers to assess the genetic variation within a species, where this is known, to identify sites of critical importance for genetic diversity.

The region has 38 marine or /terrestrial KBAs, most of which are already protected either nationally or internationally.

### EBSA selection criteria

1. Uniqueness or Rarity
2. Special importance for life history stages of species
3. Importance for threatened, endangered or declining species and/or habitats
4. Vulnerability, Fragility, Sensitivity, or Slow recovery
5. Biological Productivity
6. Biological Diversity
7. Naturalness

Table 2.9 Number of marine or coastal KBAs by country

Country	Number
Cabo Verde	4
Mauritania	4
Senegal	8
Gambia	6
Guinea-Bissau	5
Guinea	
Sierra Leone	2
Liberia	1
Côte d'Ivoire	1
Ghana	5
Togo	0
Benin	2
Nigeria	0
<b>Total number</b>	<b>38</b>
<b>Total surface area</b>	<b>2 591 304</b>

Source: created from data collected by the authors



© Marc Languy, Liberia

<sup>4</sup> Secretariat of the Convention on Biological Diversity (2020). Ecologically or Biologically Significant Marine Areas (EBSA). Special places of world oceans. Volume 6: The Southeast Atlantic Ocean. Montreal: 108 pp.



■ Area meeting EBSA criteria

**Legend**

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>1. Coastal Habitats of the Neritic Zone of Mauritania and the Far North of Senegal</li> <li>2. Cold-water corals off Nouakchott</li> <li>3. Permanent upwelling cell in northern Mauritania</li> <li>4. Timiris Canyon system</li> <li>5. Cavar Seamount</li> <li>6. Cayar Canyon</li> <li>7. Saloum Delta</li> <li>8. Mouth of the Casamance River</li> <li>9. Island of Boavista</li> <li>10. Santa Luzia, Raso and Branco Complex</li> <li>11. Santo Antão, North-West Region</li> <li>12. Bijagós Archipelago</li> </ul> | <ul style="list-style-type: none"> <li>13. Rio Pongo River</li> <li>15. Yawri Complex</li> <li>16. Rivercess-Greenville turtle-breeding ground</li> <li>17. Tabou Canyon and Seamount</li> <li>18. Abidjan Canyon and Bottomless Pit</li> <li>19. Shrimp and sardine route from Tabou to Assinie</li> <li>20. The EEZ off the Coast of Côte d'Ivoire</li> <li>21. Agbodrafo coastal and marine habitat</li> <li>22. Mouth of the Roy-Togbin</li> <li>23. Togo-Benin Cross-border marine area</li> <li>31. Area of Convergence of the Canary-Guinea Currents</li> </ul> |
|---|--|

**Figure 2.15 Ecologically or biologically significant marine areas** *Source: CBD, 2020*



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Figure 2.16 MPAs of the RAMPAO network in 2022 *Source: RAMPAO*

## 2.3 The Regional Network of Marine Protected Areas in West Africa (RAMPAO)

### 2.3.1 RAMPAO characteristics and goals

The Regional Network of Marine Protected Areas in West Africa (RAMPAO) was officially established in 2007 as the result of a common will expressed by the States, the managers of protected areas and various actors of the conservation, in the face of the many pressures and threats on the marine and coastal ecosystems of the West African region.

The objective of the RAMPAO is, among other things, to:

- maintain a coherent set of critical habitats necessary for the dynamic operation of the ecological processes essential to the regeneration of marine natural resources.
- conserve biodiversity for the well-being of local communities, through a functioning regional network of MPAs.

More specifically, the RAMPAO aims to:

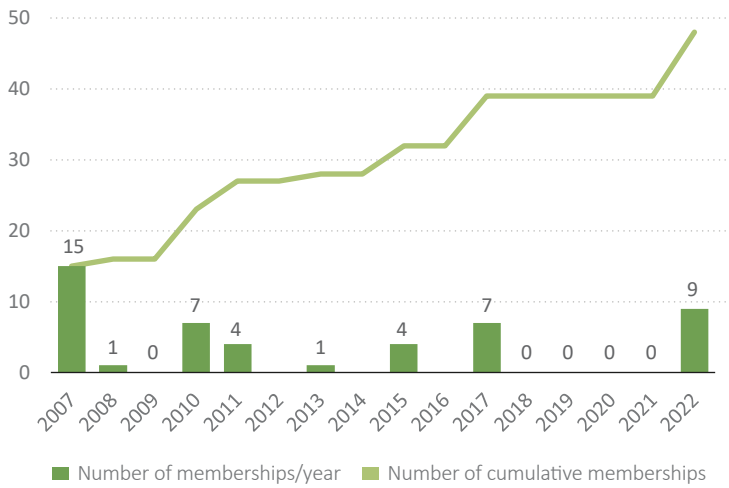
- Network a set of representative MPAs;
- Rehabilitate and restore critical habitats;
- Promote exchange and mutual learning between members;

- Create synergies between MPAs on topics of common interest;
- Make functional and operational MPAs of the region; and
- Strengthen mutual capabilities in advocacy, defence of interests and representation of MPAs in the region in the international framework.

RAMPAO has the status of a regional organization and enjoys official recognition from the services in charge of the environment and/or fisheries of the Member States. RAMPAO's general assembly, which is the network's supreme body, brings together:

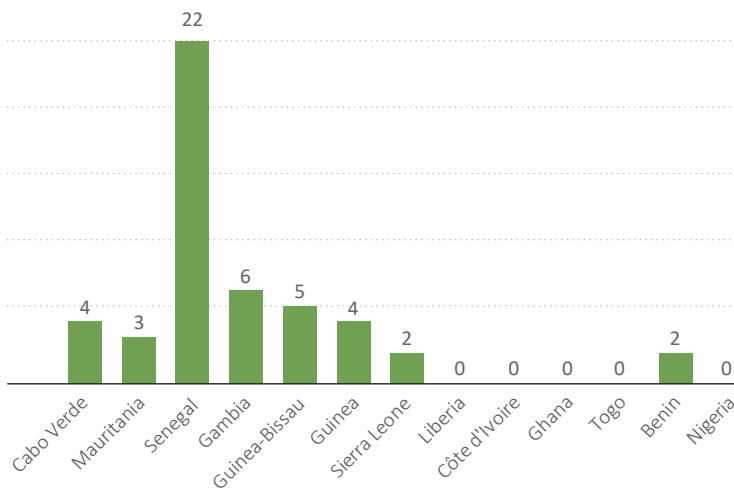
- the Board of Directors, made up of 3 colleges: the college of States, the college of managers and the college of local communities;
- the Executive Secretariat responsible for operating and coordinating the network and support bodies, which are the Scientific and Technical Council; and
- the various thematic task forces made up of experts in the various fields related to the effectiveness of MPA management.

In 2007, the network included 15 MPAs from 4 countries (Mauritania, Senegal, Guinea-Bissau and the Gambia); in 2010, there were 23 out of all the RAMPAO countries and in 2017 the number of members was 39. From 2017 - 2022, there were no memberships.



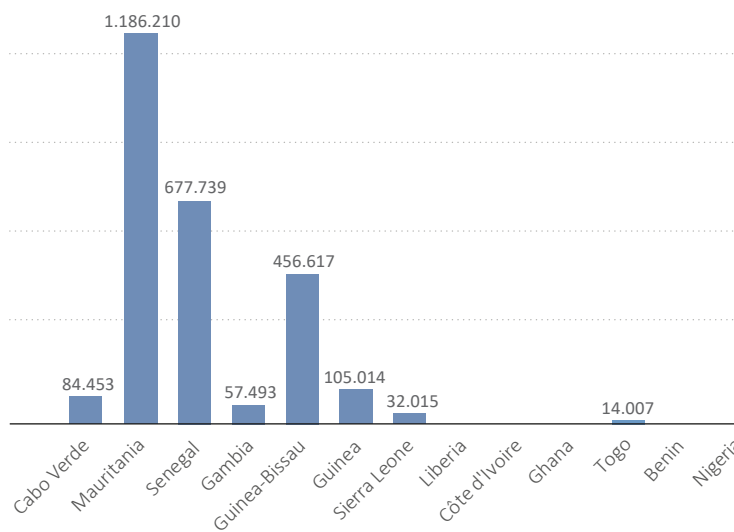
**Figure 2.17 Dynamic membership of MPAs to RAMPAO**

Source: created from data collected by the authors



**Figure 2.18 Number of RAMPAO member MPAs by country**

Source: created from data collected by the authors



**Figure 2.19 Surface area of RAMPAO member MPAs by country**

Source: created from data collected by the authors



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In 2022, and following the 9<sup>th</sup> edition of the RAMPAO general assembly held in March 2022, the total number of MPA members of the network has increased to 48 and extends, in addition to the original members, to Cabo Verde, the Republic of Guinea, Sierra Leone and finally to Benin, a very recently admitted member.

The network is made up of MPAs of various statuses: National Parks, Nature Reserves, marine protected areas, Community marine protected areas, Wetlands, Wildlife Sanctuaries, Indigenous and Community Conserved Areas. Thus, for more than ten years, RAMPAO has worked to strengthen the conservation system at the regional level and to improve the conservation status of many critical species and habitats, several of which are in decline, even severely threatened for some.

RAMPAO relies on various partnerships at the national, regional and international levels, with other regional networks of MPAs. RAMPAO has also enabled the strengthening of regional coordination between different categories of actors around joint objectives of preservation and enhancement of natural capital (States, environmental NGOs, local elected officials, researchers, MPA managers, etc.).

The network has contributed to greater coherence in the sub-regional dynamic carried by actors such as the PRCM, the Sub-Regional Fisheries Commission (SRFC), the IUCN and other major conservation organizations, aiming to implement common solutions to the multiple challenges arising from the impacts of sometimes poorly controlled socio-economic growth and the effects of climate change.

### 2.3.2 Dynamics of network extension and enlargement to new countries

Membership requests from other countries not yet members of the network with MPA projects are regularly presented to its executive secretariat, from Côte d'Ivoire, Togo, Ghana, Liberia and Nigeria. The network could therefore be extended with the creation of new MPAs in these countries.

This expansion dynamic of the regional network of MPAs in West Africa requires technical, financial and political support. If the financial and political prerequisites require the commitment of States and strategic financial partners, the technical dimension calls on the expertise of RAMPAO. Thus, the RAMPAO secretariat, whose mandate is to support the creation of new MPAs and to ensure their networking on a regional scale, based on some ecological criteria such as connectivity, complementarity, is regularly challenged with the support of members of its Scientific and Technical Council (CST) and the experts of its various thematic Task Forces.

### Towards a new strategy for RAMPAO

At the time of the extension of RAMPAO, the updating of the Regional Strategy for MPAs in West Africa is a crucial issue, which will make it possible to define strong objectives for the region, in line with the Post-2020 Global Biodiversity Framework, the Resolutions of the World Nature Forum, the development of the Strategic Investment Plan for the Resilience of West African Coastlines and the preparation of the Additional Protocol to the Abidjan Convention on MPAs. This strategic document should enhance the diversity of protection

Table 2.10 Dynamics of membership of MPAs in RAMPAO

Year	No. of memberships / year	No. of cumulative memberships	Surface (ha)	Surface cumulative (ha)
2007	15	15	1649 666	1649 666
2008	1	16	105 767	1755 433
2009	0	16	0	1755 433
2010	7	23	138 414	1893 847
2011	4	27	130 565	2 024 412
2012		27		2 024 412
2013	1	28	7110	2 025 112
2014		28		2 025 112
2015	4	32	140 324	2 165 436
2016		32		2165 436
2017	7	39	149 875	2 315 311
2018	0	39		2 315 311
2019	0	39		2 315 311
2020	0	39		2 315 311
2021	0	39		2 315 311
2022	9	48	298 237	2 613 548

Source: created from data collected by the authors

statuses, modes of governance and management of spaces and natural resources, and promote the involvement of a wide variety of stakeholders to pursuit conservation and development objectives shared at different scales.

## 2.4 Marine protected areas status with regard to the Aichi targets

### 2.4.1 Percentage of EEZ protection (per country and at global level)

Whether we look at the scale of the region, where 0.66% of the EEZ is protected, or of the countries, the objective of 10% is far from being achieved, and that of 30% even less; all the countries are below 4% and only Mauritania (3.93%), Senegal (2.43%), Guinea-Bissau (1.86%, not counting the entire Bolama archipelago Bijagós, which makes it possible to reach almost 10%), the Gambia (1.52%) and Guinea (1.37%) are above 1%. All the other countries (i.e 8 countries out of the 13 EdAMP countries) are well below 1% (Sierra Leone, Liberia, Ghana, Togo, Benin, Nigeria and Cabo Verde). The work is therefore immense to achieve current and future national objectives.

There is thus a disparity between member countries of the SRFC and RAMPAO, compared to the other non-member countries, even if all the countries are far from reaching 10% and are therefore very behind on objective 11. The countries of the RAMPAO thus concentrate 99% of the surface area of the MPAs of all the countries of the EdAMP, on 1.04% of their EEZ.

These calculations were made by counting the known marine areas of nationally designated MPAs and those of Ramsar sites. It should

**Table 2.11 Data related to protection by country with regard to Aichi targets according to EdAMP and according to WDPA**

Country	According to EdAMP			According to WDPA		
	EEZ (Km <sup>2</sup> )	Known marine protected area (Km <sup>2</sup> )	%	EEZ (Km <sup>2</sup> )	Known marine protected area (Km <sup>2</sup> )	%
Cabo Verde*	800.561	1.375	0,17	806505	7,4	0,00
Mauritania	165.338	6.493	3,93	174130	6505	3,74
Senegal	151.861	3.684	2,43	159517	3333	2,09
Gambia	23.112	352	1,52	23095	131	0,57
Guinea-Bissau**	123.725	2.304	1,86	107443	2372	2,21
Guinea	59.426	817	1,37	102819	591	0,58
Sierra Leone	215.611	966	0,45	161633	2658	1,64
Liberia	249.734	129	0,05	253482	145	0,06
Côte d'Ivoire	176.254	ND	ND	172 885	11	0,01
Ghana	235.349	0	0,00	229 001	229	0,10
Togo	12.045	ND	ND			
Benin	33.221	68	0,20			
Nigeria	217.313	2	0,00	180243	50,1	0,02
<b>Total</b>	<b>2.463.550</b>	<b>16.189</b>	<b>0,66</b>	<b>2370753</b>	<b>16032</b>	<b>0,68</b>

\* Cabo Verde: 0,0009%

\*\* Excluding Bolama Bijagós (which brings Guinea-Bissau's protected area to 13,356 ha) and keeping in mind that marine areas are not well known for Liberia, Togo, Côte d'Ivoire, Benin and Nigeria. Source: created from data collected by the authors

however be specified that the marine areas of the MPAs are not given for several of them (more than 30, in particular for Togo, Côte d'Ivoire, Benin and Nigeria), only the total area being known. The figure is therefore slightly below the reality.

As Failler et al. underscored (2020) within the framework of the RAMPAN MPAs, comparing WDPA protected area figures against database created directly from national data showed large discrepancies, with figures sometimes higher and sometimes lower (see Table 2.11).

“Possible explanations for the differences include: countries not transmitting information or doing so incorrectly; methodological transformations of data are inducing errors; and multiple MPA statutes leading to double counting of protected areas.”.

In this work, considering all of the 88 MPAs in West Africa<sup>5</sup>, including those that are not members of RAMPAN, he recommends developing large offshore MPAs, in order to ensure the achievement of target 11 of Aichi and to complete the range of existing MPAs. Knowing, however, that intense fishing activities and oil and gas exploitation are likely to be major obstacles to this offshore development in particular (Figure 2.22).

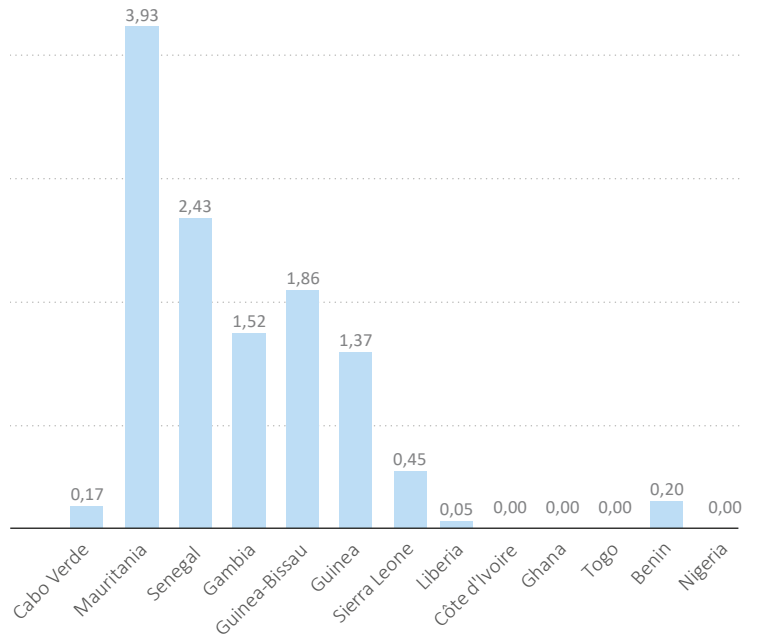
### Aichi Target 11

“By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.”

<sup>5</sup> The difference between Failler's list and those of this work comes mainly from Cabo Verde and Guinea where some MPAs have since been created.

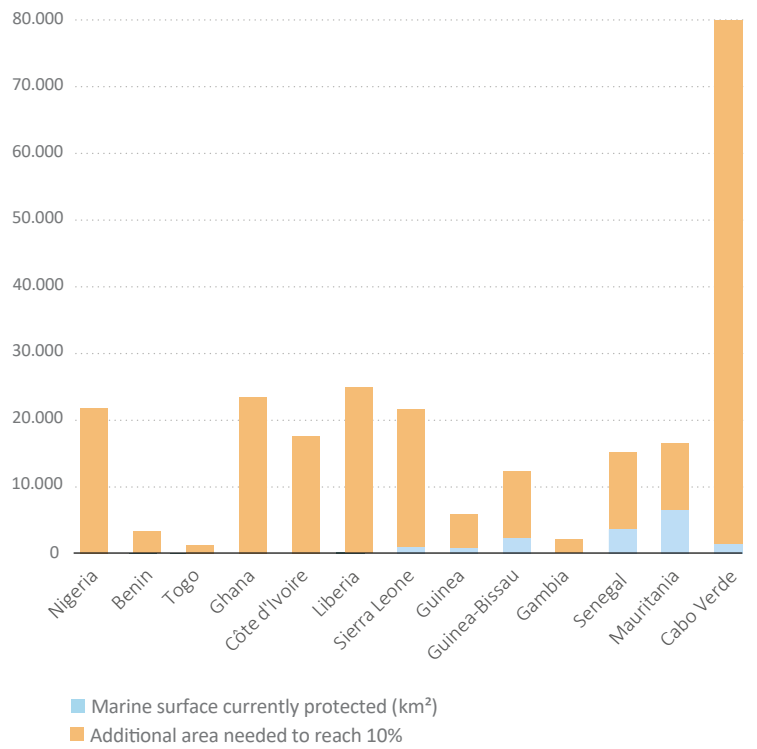


© Régis L'hostis, Aerial view MPA Sangomar, Senegal



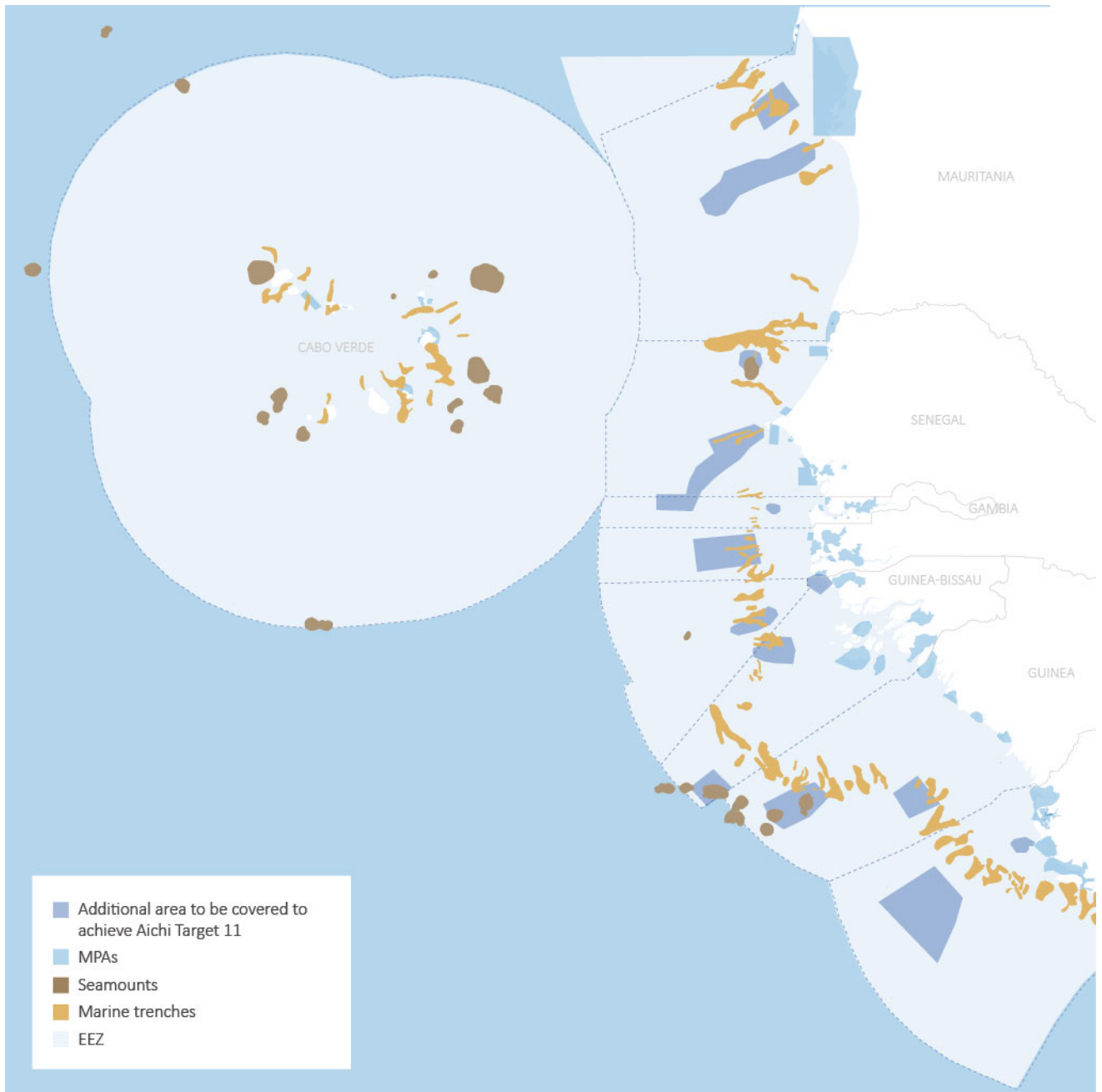
**Figure 2.20 Percentage of the EEZ in MPAs, by country**

Source: created from data collected by the authors



**Figure 2.21 Situation of the countries with regard to the 10% protected EEZ objective**

Source: created from data collected by the authors



**Figure 2.22 Additional marine areas to be covered for each country in view of Aichi Target 11**

Note : by adding the existing areas and the additional areas to be covered, each country reaches the protected EEZ of 10%. The location and outline of additional MPAs are free and virtual. These MPAs are usually placed arbitrarily relative to seamounts and sea trenches. Source: Failler et al., 2020 and <https://bluehabitats.org/>



© Hello & Van Ingen, Bijagós, Guinea-Bissau

## 2.4.2 Ecological representativeness

Previous studies (Tendeng, 2012 then Failler et al., 2018) for RAMPAO MPAs have shown the coastal nature of the network, with a low representativeness of deep areas and open sea areas, the good representativeness of coastal habitats such as mangrove ecosystems, seagrass beds, beaches but weak protection of deep-sea habitats such as canyons, seamounts; cold water reefs and permanent upwelling areas. These two studies propose the areas to be protected as a priority.

## 2.4.3 Connectivity

Connectivity issues between MPAs are essential: a large majority of marine species release their eggs into the environment and the larvae are transported by the currents. In addition, many species have migratory behaviours during their life cycle between different geographical areas, allowing them to maintain the functions necessary for the survival of the population which are growth (habitats, refuges, feeding area) and reproduction (spawning areas, nurseries). In the absence of local persistence, the maintenance of the species is due to the connectivity of the protection zones with other so-called source sites, ensuring the regional persistence of these species (Guizen, 2014).

We will resume here the very recent work of Assi et al., 2021. The results of this work, based on a biophysical model integrating high-resolution ocean currents and contrasting dispersion periods to predict connectivity through the MPA network in West Africa, reveal that “connectivity differs sharply among distinct ecological groups, from highly connected (e.g., fish and crustacea) to predominantly isolated ecosystem structuring species (e.g., corals, macroalgae and seagrass) that might potentially undermine conservation efforts because they are the feeding or nursery habitats required by many other species. Regardless of their dispersal duration, all ecological groups showed a common connectivity gap in the Bijagós region of Guinea-Bissau, highlighting the important role of MPAs there and the need to further support and increase MPA coverage to ensure connectivity along the whole network.”.

This publication shows the key role that the MPAs of Cabo Verde, Guinea, Senegal and Sierra Leone can play “in connectivity in the face of future environmental changes, by acting as springboards for the dispersal of propagules between different islands or regions/countries”. It provides “key insights for the future management of the Network of MPAs in Western Africa, highlighting the need to protect and ensure continuity of isolated ecosystem structuring species and identifying key regions that function as stepping-stone connectivity corridors.”.

### 2013: Analysis of network gaps in Mauritania

Four new Zones of Interest for Biodiversity (ZIBs) in addition to existing conservation areas:

- Habitats at depths of less than 20 metres (neritic zone)
- Cold-water coral reefs off Nouakchott in the Mauritanian EEZ (ZEEM)
- The permanent upwelling cell in the northern zone of the EEZ
- The “Timiris Canyons” system in the EEZ

It contains a variety of marine and coastal habitats (canyons, coral reefs, mangrove seagrass beds, delta and Sebkhass), supporting a very high level of biological diversity and constituting a contact zone between species with a temperate affinity and species with a tropical affinity. Recent inventories of the fauna<sup>1,2</sup> include :

- 703 species of fish (pelagic, demersal and benthic), 49 of which are on the International Union for Conservation

of Nature (IUCN) Red List, classified as Near Threatened, Vulnerable, Endangered and Critically Endangered;

- 30 species of marine mammals (whales, dolphins, etc.), 6 of which are classified by the IUCN as threatened with Extinction, Vulnerable and Endangered, including the monk seal, which is threatened with extinction;
- 6 species of marine turtle;
- 269 species of coastal birds found in the national parks on the coast (Banc d’Arguin and Diawling National Parks) and 47 species of offshore birds found in the deep waters of the slope zone. Eleven bird species found on the coast and at sea have been included on the IUCN Red List in the categories Near Threatened, Vulnerable, Endangered and Critically Endangered.

*Source: Ministry of Environment and Sustainable Development of Mauritania, 2013. National strategy draft for the establishment and management of a national network representative of marine and coastal protected areas (2014 – 2020)*

<sup>1</sup> 4th National Report of the CBD, MEDD 2012 & Vulnerability Atlas, IMROP 2013.

<sup>2</sup> Information on the flora is rare and fragmentary. There is a real need for inventory and appropriate monitoring. Overall, this point should be introduced into research actions on ZIBs (action A.2.2 of the Action Plan provides for monitoring of biodiversity, and in particular floristic aspects).

## Box 2.2 A national strategy for the establishment and management of a network of marine and coastal areas in Mauritania

*Djibril LY*

Mauritania has an Exclusive Economic Zone (EEZ) of 165,000 km<sup>2</sup> and a coastline that extends over 720 km, with an area of inland waters and a terrestrial part of the coastline of 57,442 km<sup>2</sup>.

Mauritania's marine and coastal ecosystems are recognised as some of the most productive in the world due to the upwelling of deep waters rich in mineral salts, wind-borne inputs of mineral salts from the Sahara and the presence of unique marine and coastal habitats (seagrass beds, mudflats, cold-water coral reefs, seamounts, canyons, mangroves, delta and Sebkhass), supporting a very high biological diversity.

Three marine protected areas, the Banc d'Arguin National Park (PNBA), the Cap Blanc Satellite Reserve (RSCB, managed by the PNBA) and the Diawling National Park (PND) currently have protection status and effective management structures and tools (PAG). Their surface areas represent 5.46% of Mauritania's EEZ. With a view to extending its national network of ecologically representative and well-connected marine protected areas to at least 10% of its marine and coastal zone (CBD Aichi Target

11), Mauritania drew up an initial draft "national strategy for the establishment and management of a representative national network of areas of interest for marine and coastal biodiversity (2014-2020)" in 2013. This strategy identified four areas of biological interest, covering bottom habitats of less than 20 metres (neritic zone), the cold-water coral reefs off Nouakchott, the permanent upwelling cell in the northern zone, and the Timiris canyon system.

A feasibility study for setting up a network of MPAs on the seabed of Mauritania's continental slope was also carried out in 2017. It proposes the establishment of a network of five zones covering the full diversity of benthic biotopes on the continental slope. Although these various initiatives have made it possible to lay the scientific and operational foundations for the establishment of the MPA network, they have not led to political validation. The Ministry of the Environment and Sustainable Development has recently launched a study to update the national ZIB strategy, with a view to recognising and classifying the five zones of biological interest.

*Source: Mauritania Ministry of the Environment and Sustainable Development, 2013. Draft national strategy for the establishment and management of a representative national network of marine and coastal protected areas (2014-2020)*



© Nathalie Cadot, Banc d'Arguin National Park, Mauritania



## 2.5 Conclusions

The geographical area covered by this EdAMP is exceptionally rich in terms of habitats and biodiversity, but also in terms of ecosystem services provided to local populations.

The absence of reliable data on MPAs, the dispersion of these data and the immense difficulty in collecting information and solid data, has made it difficult to analyse in depth the state of the network of MPAs in West Africa., and many data are still questionable.

The surfaces are not known for several MPAs, in particular the marine and terrestrial proportion of these; they must be calculated with precision. Thus, after having stabilized the list of MPAs with the countries, a precise mapping of all the MPAs in West Africa and their zoning must be carried out, to clearly distinguish the terrestrial and/or marine character, to identify the zones of strong protection, and thus readjust the figures by country and at regional level.

The Aichi target 11 is very far from being achieved as shown by the percentages displayed at the national level, with values below 1% for 8 countries out of the 13 considered in the EdAMP. With currently around 16,000 km<sup>2</sup> of protected marine surface area, the region therefore has less than 1% MPA coverage, knowing that there are large differences between countries. The extension of protected areas should therefore cover nearly 230,000 km<sup>2</sup> to reach 10% across all EdAMP countries. The next targets of the post-2020 global biodiversity framework will be even stricter, both in terms of percentage of protection (30%) and connectivity and therefore even more difficult to achieve without a drastic extension of protected areas. The AMP surface area must therefore be greatly extended on:

- AIEB and KBA sites identified but not protected;
- Poorly represented habitats: canyons, seamounts, etc.;
- Structuring habitats (e.g. seagrass beds, corals, etc.);
- Habitats playing a key role in carbon sequestration (seagrasses, mangroves in particular);
- Areas of importance for the life cycle of species (e.g. living areas, breeding areas, nurseries, migration corridors, etc.) which must be listed, as has just been done on small pelagics (Atlas Sub-Regional Small Pelagic Critical Sites – PRCM); and
- Offshore areas, provided that these can be monitored and protected from exploitation and fishing activities.

The network of MPAs to be extended should make it possible to improve connectivity, with particular attention to transition zones (Guinea-Bissau for example) and source zones.

**Transboundary protected areas** promote sub-regional integration and will undoubtedly promote sub-regional cooperation, while strengthening the conservation status of marine and coastal biodiversity in West Africa.

Strong **protection zones** must be inventoried, multiplied and extended.

Habitats are essential to the survival of species and their protection is a priority objective. The management of MPAs in West Africa should **strongly focus on ecosystem structuring species** (e.g. corals, sponges, macro-algae, mangroves and seagrasses), which are the essential habitats nursery and food for many commercial and essential subsistence species, threatened species (Assi et al., 2021). Habitats that are less well known today (reefs, coral communities) must be more precisely surveyed.

The **follow-up of the evolution of these habitats**, of their surface area and their state, which is lacking, in particular for the structuring habitats, must be organized on the scale of the region and the data banked and saved, an imperative objective to report conservation efforts and management performance; as well as the **monitoring of species populations**, especially endangered species.

RAMPAO has an important role to play in ensuring the consistency of the MPA network and in **setting up minimum habitat-species-governance monitoring, harmonized at the regional level, which can easily be completed by managers**, with, at lower frequencies, more detailed monitoring by scientists from the region. RAMPAO must keep a **solid database of MPAs in the region up to date**, with precise GIS data, and have a **network development strategy**.

Significant work remains to be done to support countries in the work of **IUCN categorization** of their MPAs and ensure correct categorization, faithfully meeting IUCN criteria.

The integration of MPAs into a **broader marine and coastal spatial planning context** remains essential to protect them. Finally, **monitoring issues are central**, without which MPAs are only paper MPAs. Particular attention must be paid to them (see fishing chapter).

Finally, in addition to the extension zones of the MPA network within the EEZs, the recent work of the TARA foundation on oceanic plankton has brought out the concept of “KOPAs” (Key Ocean Planktonic Areas), **oceanic regions of great biological importance, and climatic**, based on the quantification of ecosystem services provided by plankton. This characterization leads to the identification of spatio-temporal zones with high planktonic density, of random duration, having significant impacts on the carbon cycle and on biodiversity. Their existence coupled with upwelling phenomena (and this is the case in West Africa) multiplies their impact. Their location most often outside the national EEZs makes them a problem of global governance of biodiversity management (in connection with the debates on BBNJ) and of global management of the carbon pump of the oceans. These are perhaps other forms of MPAs, those of tomorrow, whose political, climatic and halieutic stakes are considerable (F. Henry pers. com.).



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## Part 2 - Governance and management of marine protected areas

### Chapter 3

## Knowledge and monitoring at the heart of decision-making in the creation and management of West African marine protected areas

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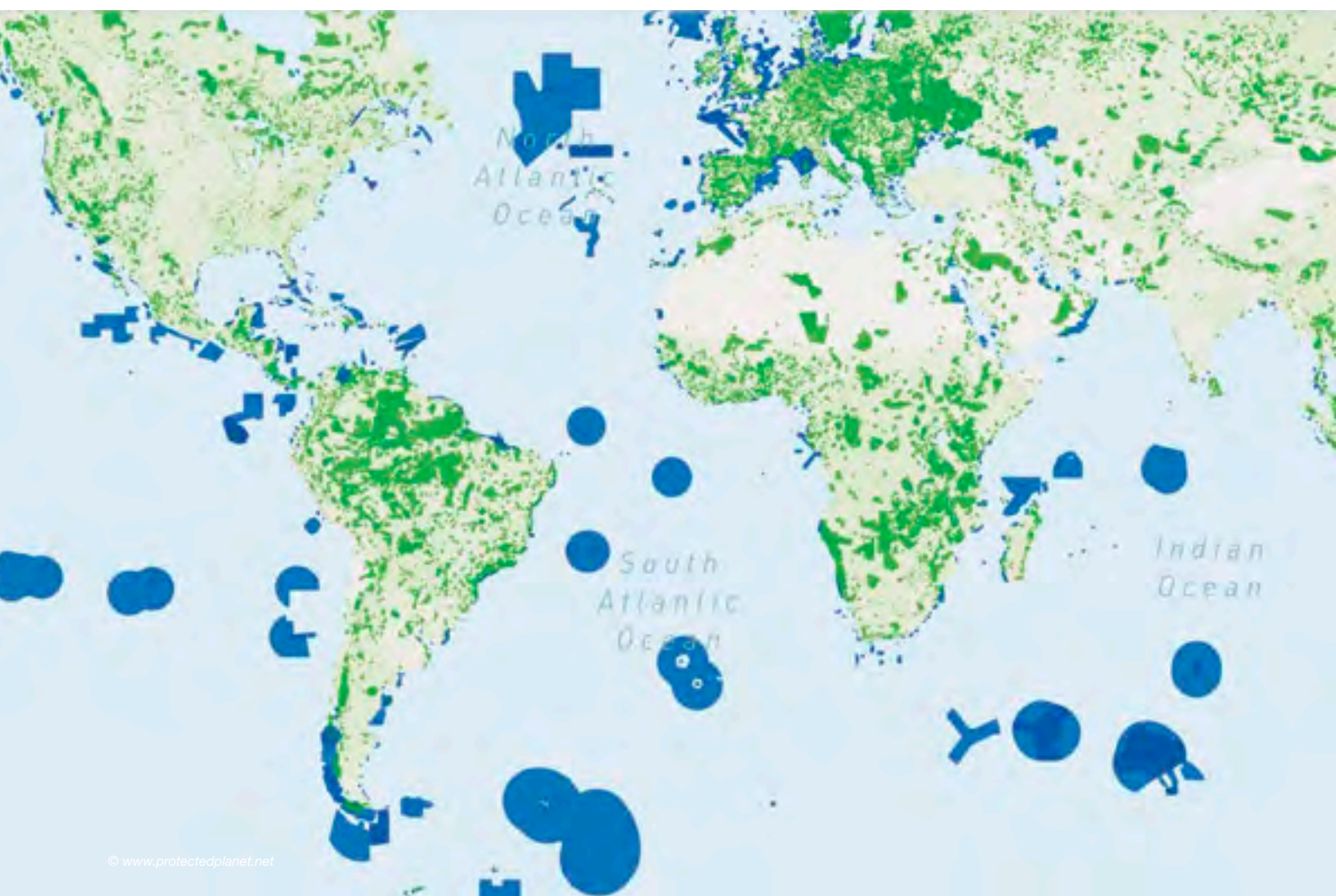
This chapter highlights the importance of knowledge in decision-making and the major role of exchanges between science and decision-makers. It presents concrete examples of the region:

- The interest of collecting data on biodiversity and MPAs to guide decision-making, the role of such data at global and regional level and the issues of data updating and quality.
- The role of international databases and the Biodiversity and Protected Area Management (BIOPAMA) programme in this context.
- The current level of knowledge available via platforms and websites and the representation of marine protection using global information from these tools.
- The level of protection of key habitats in the region and an overview of the conservation status of fish species.
- It also points out that scientific research is a key factor in integrating stakeholders within MPAs and maintaining conservation dynamics on the ground.

### 3.1 Introduction

Effective conservation requires knowledge exchange among scientists and decision-makers to enable learning and support evidence-based decision-making. In the last decade, knowledge exchange research has also begun to explore the relationship between science and decision-making specifically in relation to marine ecosystems and resources. Growing awareness of the importance of knowledge transfer has also led to increased efforts by global and regional initiatives in creating web platforms and regional hubs where scientific information can be stored, analysed and translated in a more understandable format (i.e. WDPA and BIOPAMA Reference Information System). Information systems, following an integrated approach where diverse kinds of data are combined, aim to facilitate decision-making processes and designing suitable alternatives to promote conservation strategies and community livelihoods.

For proper marine protected areas planning and action plan development, a comprehensive resource database needs to be formulated across countries and at regional level; hence, this chapter aims to provide a regional overview of the state of MPAs in the West African region. As regards the regional thematic analysis presented in this chapter, we used only World Database Protected Areas (WDPA) that are spatially defined as polygons, as it would be impossible to define the exact geographies that characterise point features. To highlight the important role of the regional and/or local geospatial information, a case study is included showing differences and strengths of relevant data collected by researchers reinforcing the important role of knowledge exchanges between science and decision-makers.



### Box 3.1 Global and regional MPA datasets

#### The Protected Planet Initiative

The Protected Planet Initiative is the authoritative source of data on protected areas and other effective area-based conservation measures by area and the effectiveness of protected area management. The database is updated monthly with submissions from governments, non-governmental organisations (NGOs), landowners and communities, the website hosts several comprehensive databases that users can access and consult, including:

- The World Database of Protected Areas (WDPA)
- The World Database on Other Effective Area-based Conservation Measures by Zone (WD-AMCEZ)
- The Global Database on Protected Area Management Effectiveness (GD-PAME)

The data can be used by a wide range of stakeholders for information-based decision-making, policy development and both business and conservation planning. Mandated by the United Nations, data are used to indicate, monitor and report on progress towards international biodiversity targets.

#### The Biodiversity and Protected Areas Management Programme (BIOPAMA)

The BIOPAMA programme is an initiative of the African, Caribbean and Pacific (ACP) Group of States financed by the European Union's 11th European Development Fund, and jointly implemented by the International Union for Conservation of Nature (IUCN) and the Joint Research Centre of the European Commission (JRC). The programme assists ACP countries to address their priorities for effective conservation and guide policy decisions, through a range of tools, services and capacity development.

Each region has its own Regional Observatory (RO), responsible for collecting, analysing and producing reports, enabling stakeholders to monitor national and regional progress towards international targets, assessing the performance of local protected areas and analysing conservation scenarios. The Observatory for Biodiversity and Protected Areas in West Africa (OBAPAO) is BIOPAMA's Regional Observatory for West Africa.

## 3.2 Why collect data on biodiversity and marine protected areas?

### 3.2.1 The importance of biodiversity and data related to marine protected areas data

Marine ecosystems are home to numerous different species and provide a multitude of ecosystem services important to human well-being (Sala and Giakoumi, 2017). This important role has increased demand for marine resources and led to loss of biodiversity and habitat depletion (Markantonatou et al., 2021). Many coastal communities rely on marine biodiversity for their livelihoods, as well as recreation. Marine ecosystems, such as seagrasses and mangroves, have been shown to provide a natural barrier slowing down waves and preventing coastal erosion, sequestering carbon, and provide a habitat to commercially important fish species (Li et al., 2019; Lo Iacono et al., 2008; Ondiviela et al., 2014). Hence, the need to better protect and conserve marine biological diversity will become crucial and the space allocation for reserves need to be the result of a rigorous process to avoid user conflicts and to sustain an ecosystem-based management of ocean and seas.

Defining key sites of marine biodiversity value and implementing the spatial management measures required to secure them is critical for preserving marine biodiversity and maintaining essential ecological processes. This is especially important as countries seek to expand their blue economies by intensifying and diversifying ocean-based activities (Jouffray et al., 2020). Furthermore, identifying areas of

relieve for marine biodiversity can contribute to enhancing the sustainability of some ocean-based activities, e.g., fishing (Roberts et al., 2005; Lenihan et al., 2021). The value of identifying and securing key areas for marine biodiversity is recognized globally in frameworks such as the Convention on Biological Diversity (CBD) and the 2030 Agenda for Sustainable Development. Global targets have previously been agreed to conserve a specified proportion of the ocean space through effectively and equitably managed, ecologically representative, and well-connected systems of protected areas and other effective area-based conservation measures, with an emphasis on areas of importance for biodiversity (CBD, 2010a). New, increased protection targets of 30% by 2030 are currently being debated by the signatories to the CBD in the context of the forthcoming Global Biodiversity Framework (CBD, 2021).

The West African coastline is home to many vulnerable and crucial marine habitats such as mangroves, seagrasses, cold coral reefs and saltmarshes (UNEP-WCMC 2022). There are ten marine Key Biodiversity Areas (KBAs) within the region, in the national waters of Senegal, the Gambia, Mauritania, Guinea-Bissau and Cabo Verde. These areas, however, are threatened by human activities such as agriculture, aquaculture and unsustainable biological resource use (KBA website). Similarly, to marine regions across the globe, such human activities are disturbing marine habitats and driving declines in marine biodiversity (IPBES, 2019).

Key considerations to take into account to depict the regional situation of West Africa are:



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- Fishing is a key disturbance. Other important threats included pollution, climate change, human disturbance, coastal development, energy production, mining, and transport;
- Socio-ecological states are country specific;
- Scientific knowledge on marine ecosystems, threats and human uses need to be included in the decision-making processes for better managing marine natural resources.

To protect, restore and sustain species and habitats, marine protected areas (MPAs) and other effective area-based conservation measures (OECMs) are two key conservation tools. Both forms of geographically defined areas, MPAs are established and managed with the primary objective of conserving nature, while OECMs achieve sustained, positive conservation outcomes, despite potentially having alternate management goals (IUCN-WCPA Task Force on OECMs, 2019).

The benefits of protected and conserved areas vary. There are a wide range of MPA types with various levels of protection, conditions of use and effectiveness in biodiversity conservation outcomes. Extractive activities and resource uses may be permitted to varying degrees, with lower protection potentially leaving more rights to local communities to benefit from the environment, and higher protection leading to increased recovery of ecosystems. The strictest protection can prohibit extraction of any living or dead natural resources, including all methods of fishing, dumping, dredging or construction within so-called “no-take zones (NTZ)” (Groud-Colvert et al., 2021).

Alternative approaches to management lead to vastly different results for local marine biodiversity, with highly protected areas resulting in greater fish biomasses, higher abundance of previously exploited species, and successful restoration of local ecosystem complexity (Sala and Giakoumi, 2017). Conserving and protecting ecosystems can in turn lead to increased tourism, enhanced fish stock in neighbouring areas, and other ecosystem services, such as coastal protection, benefiting people (Groud-Colvert et al., 2021).

The management effectiveness evaluation is defined as an assessment of how well protected areas are managed – primarily the extent to which management is protecting values and achieving goals and objectives (Hockings et al., 2008). Inconsistencies in management, protection and outcomes highlight the importance of adequate data to inform conservation actions. Understanding both the distribution and effectiveness of MPAs allows us to plan coherent and ecologically connected networks.

As well described in chapter 1 of this report, according to the January 2022 version of the WDPA, in West Africa both international and national sites were considered as marine protected areas (either partially or completely within the marine environment) and several regional programmes aim to improve and/or implement the marine natural resources management. Some examples are the Mami Wata Project: “Enhancing marine management in West, Central and Southern Africa through training and application”, the Regional Partnership for Coastal and Marine Conservation in West Africa and the IUCN Central and West Africa Programme (PACO).

### Box 3.2 Assessing the effectiveness of protected area management

Over the last three decades, several methodologies have been developed to monitor and evaluate the effectiveness of protected area management. One example is the Global Database on Protected Area Management Effectiveness (GD-PAME), which collects evaluation data from around the world. According to GD-PAME, as of September 2022, the West African region has recorded 263 evaluations. The Protected Area Management Effectiveness (PAME) module, implemented in the global and regional Reference Information System (RIS), aims to help protected area managers and national agencies improve the effectiveness of protected area management to better achieve conservation outcomes. The filters in the PAME module allow the user to view relevant statistics from protected area management effectiveness assessments at different spatial scales (regional, national and local).

The Protected Area Management Effectiveness Dashboard is a one-stop shop for key information and resources on the tools most commonly used to assess protected area management effectiveness.

Management effectiveness tools are essential for improving stakeholder engagement and participatory processes. Marine protected areas are essential not only to guarantee conservation strategies, but also to ensure the conservation and protection of traditional culture and the rights of local and indigenous populations, who should participate in the governance and management of protected areas in order to achieve biodiversity and cultural conservation objectives.

### 3.2.2 Role of data globally and regionally

Marine protected areas (MPAs) are the primary area-based tool for conserving marine ecosystems and are key for monitoring global progress to sustaining nature. To help combat biodiversity declines, governmental and intergovernmental organisations have developed Multilateral Environmental Agreements (MEAs) with corresponding targets and goals to measure progress. For example, the United Nations Sustainable Development Goals (SDGs), the Convention on Biological Diversity (CBD) Aichi Biodiversity Targets (CBD, 2010) and the post-2020 Global Biodiversity Framework (GBF).

Understanding where protected areas and conservation measures are already implemented is crucial to tracking progress towards area-based conservation targets, allowing governments and non-government bodies to effectively respond to gaps in protection (IPBES, 2019). The Protected Planet Initiative reports on coverage and effective management, allowing stakeholders to follow and report on national and global progress, and incorporate biodiversity considerations into policy development and management decisions (UNEP-WCMC and IUCN, 2021). Mandated by the United Nations, the World Database on Protected Areas (WDPA), within the Protected Planet Initiative, is the most comprehensive global database of protected areas within terrestrial and marine environments. Together with the World Database on Other Effective Area-based Measures (WD-OECMs), the two databases are used to indicate progress towards the CBD targets.

However, it is not just coverage with MPAs that is important – the goals above specifically refer to effective and equitably managed, ecologically representative and well-connected protected areas. A multitude of indicators to measure these is underway, with the World Database on Protected Area Management Effectiveness (GD-PAME) listing all protected areas that have undergone management effectiveness assessments (see Box 3.2).

**Table 3.1 Data analysis from the WDPA shows that less than 1% of the marine areas within the EEZ are under protection in the West African Region**

Surface area	Total surface (km <sup>2</sup> )	Protected area (km <sup>2</sup> )	% protected	% Not protected
WA EEZ	242 2049,42	16044,59	0.662	99.338

*Data source: WDPA and Maritimes Boundaries*

### 3.2.3 Data updates and accuracy

Data on protected areas can only be used if they are reliable, which means regular and frequent updates. The situation on the ground, within a single MPA or across MPAs network can change rapidly, which must be reflected in datasets to support the users' needs.

The WDPA, which is mostly used for large-scale monitoring and progress at national, regional and global level, is updated monthly. However, smaller scale data that are used for data-driven decision making, such as adaptive ecosystem-based management, should be kept up to date more frequently to allow dynamic conservation actions. Management decisions at local, national, regional and global levels are often taken based on the status quo, as well as agreed and defined goals and indicators of success.

All data-driven decisions can only be as reliable as the data they are based on. Key knowledge gaps make it harder to determine progress towards international targets. Knowing where MPAs are helps with the implementation of new MPAs, so they can correspond to the ecological coherence and representativeness of the MPAs network. Data standards are important to ensure consistency in reporting and quality of the data, to enable comparisons between what works, and what does not.

Globally, data submitted to the WDPA, primarily by national governments, has shown a significant increase in the establishment of protected areas, with the largest increase in coverage seen across



the marine environment. As of January 2022, there were 17,959 MPAs recorded in the database, covering 7.92% of the global ocean and a total surface area of 28,714,608 km<sup>2</sup> protected. This includes an increase from approximately 2 million km<sup>2</sup> in 2000 to 28.7 million km<sup>2</sup> in 2021, with the majority of protection implemented within National Waters.

Despite the positive trend in the protection of National Waters at global level, West African countries are unlikely to achieve the Aichi target 11 for their Exclusive Economic Zone (EEZ) waters. Only 1% of EEZs marine areas of West African countries, corresponding to 2,427,256 km<sup>2</sup>, are protected (see Table 3.1).

Two out of ten of the Africa's largest MPAs can be found in the West African countries, Guinea-Bissau and Mauritania, with 9% and 4.2% of their national waters protected respectively.

However, global coverage within MPAs, as recorded by the WDPA and BIOPAMA Regional Observatories is not the only important factor. Data on how the biodiversity of an MPA develops over time, which species are present and absent and how abundant they are, are all important to determine baselines for biodiversity intactness, and to influence MPA management decisions. Long-term monitoring at the site and regional scale is especially important to facilitate adaptive ecosystem-based management plans that effectively protect biodiversity. Sustainable financing of long-term monitoring is key to determining impacts and threats, and to responding to changes in the environment.

Local datasets can be aggregated up towards global datasets, such as the IUCN Red List of Threatened Species, to give an accurate

and up-to-date picture of which species are the highest priority for conservation and restoration action.

The following case study represents the distribution of the Monk Seal, an endangered species along the West African coastlines. Using the global IUCN Red List data, it was possible to depict the last remaining population occurred in Cap Blanc, Northern Mauritania.

### 3.3 Current level of knowledge available via online platforms and tools

The availability and reliability of biodiversity data have become, in the last decades, the strategic pillar to policy and decision-making process. There is a strong need for biodiversity data and information to better evaluate progress towards conservation goals and to tailor new evidence-based conservation strategies.

The availability of data increased in the last years but there is still not enough to support decision-makers in the process of prioritising actions and choices in conservation strategies. Complex scientific data needs to be translated into clear, transparent and understandable information easily and ready to be used to make informed decisions.

In order to enhance the availability and accessibility of data and knowledge on the state of biodiversity and to promote regional and national engagement to make policy-related data available, the Joint Research Centre (JRC), through the BIOPAMA Programme, has developed a publicly available online platform for supporting policy- and decision-makers to monitor the progress towards conservation goals and to set new targets. The Reference Information System

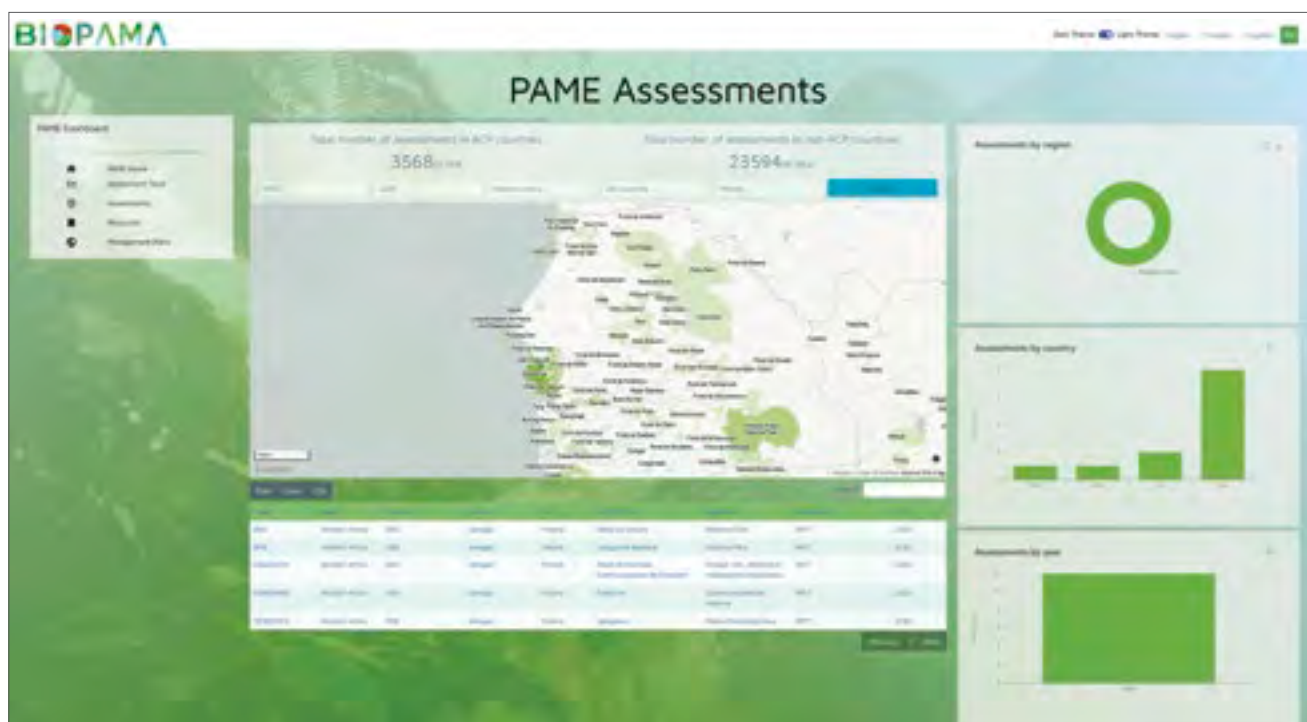


Figure 3.1 Dashboard on the effectiveness of protected area management Source: <https://iris.biopama.org>

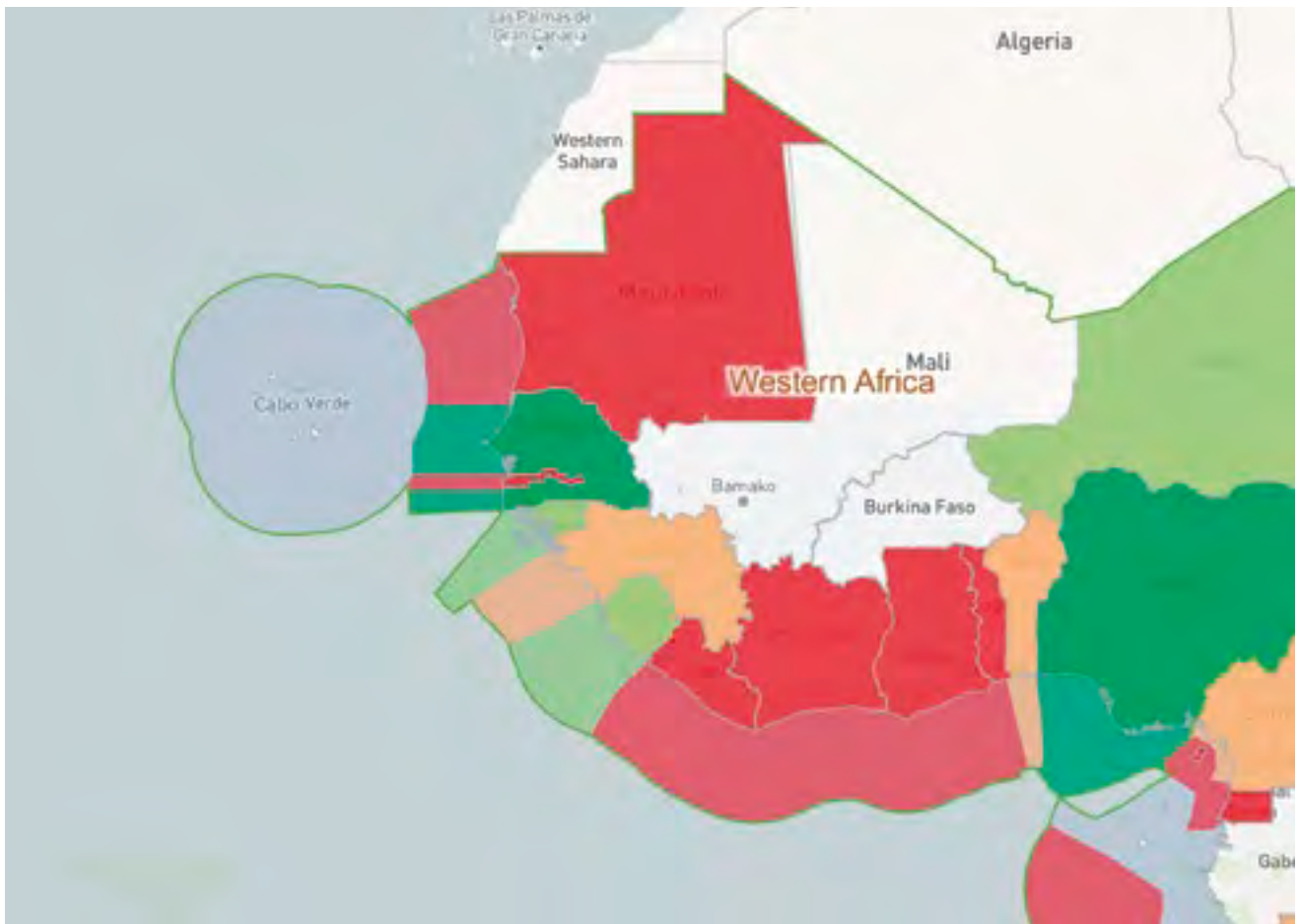
(RIS) for Protected Areas of African, Caribbean and Pacific region is an online information system composed of a suite of map-centric tools aimed at gathering all the best available scientific data on biodiversity conservation and management and at increasing the impact of biodiversity data in decision-making process. Thanks to their several modules and tools, users are able to explore information and indicators, linked to biodiversity targets, processed and made available at different scale levels, from global to site-specific level. The several modules will support decision making on conservation strategies and tracking protected and conserved areas progress towards conservation targets (see Figure 3.2 and Figure 3.3).

### 3.3.1 The representation of marine protection using global information

Recent studies (Marine Policy, 2020 issue) reported that figures in the official UN backed World Database on Protected Areas (WDPA) are consistently higher or not more representative than those reported in other source such as the Atlas of Marine Protection (MPAtlas.org) which adjusts the official figures to count only what they regard as strongly protected and fully implemented MPAs. Consequently, Sala et al. (2018) reported a figure of 3.6% of global ocean as protected within 'actively managed' MPAs. Underlying these conflicting reports is relevant for the conservation strategies in the region and marine spatial planning initiatives; hence, we examined those conflicts in the following sections where we compared the global information of Cabo Verde with the data of a national inventory compiled by researchers (Box 3.3 Global vs local MPAs data in Cabo Verde).



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**Figure 3.2 Percentage of the West African manatee's geographical range protected by country in July 2021**

Source: Conservation Tracking Tool, a global reference information system ([https://iris.biopama.org/conservation\\_tracking](https://iris.biopama.org/conservation_tracking))



**Figure 3.3 The IUCN Governance Types classify protected areas for the West African region**

Note : According to who holds authority, responsibility, and accountability for them. Protected areas exist under the authority of diverse governance actors, including indigenous peoples, local communities, private actors, governments, and combinations of these. Marine protected areas Dashboard - Reference Information System. Source: <https://iris.biopama.org/dashboard>



### Box 3.3 On MPAs in Cabo Verde

Global data can be used to compare countries and highlight trends and the effects of conservation strategies. However, exclusive reliance on global data presents significant challenges, particularly when global datasets are used to monitor biodiversity indicators at national and sub-national levels.

Despite continuous improvements in the accuracy of remote sensing data, field data is still needed for verification and validation. However, field data and information from in situ reports are often difficult to compare between countries due to methodological differences in data collection and processing. Therefore, an appropriate approach to integrating global and local data is needed to obtain a satisfactory and reliable set of data and information to guide conservation actions. As such, BIOPAMA is working with regional observatories to promote the integration of data from remote sensing and in situ data collection in protected and conserved areas in African, Caribbean and Pacific countries. Figure 3.4 show the spatial

distribution of marine and coastal protected areas in Cabo Verde based on the global and national inventories. The community agents involved in the research also find occasional employment opportunities. They pass on their empirical and often in-depth knowledge of environments and species to the researchers and wardens; in return, they receive information and knowledge that enable them to better understand the functions of the protected areas, knowledge that they in turn are likely to pass on to their communities. Their presence in the collaborative process also helps the rangers to better understand how local people perceive the park and its management measures.

This type of collaboration, in which each person's skills are harnessed and mutually reinforced, promotes dialogue and understanding between stakeholders while producing knowledge and management tools that are essential to the vitality of marine protected areas.



**Figure 3.4 According to the WDPA, Cabo Verde protects 0.002% of the marine environments in its EEZ. According to the national inventory, MPAs cover 0.17% of the EEZ of the national territory**

Source: <https://data.humdata.org/dataset/cod-ab-cpv/> / Etat de référence des aires marines protégées RAMPAO

### 3.3.2 Ecological data: marine key biodiversity habitats

Mangrove forests, seagrass beds and coral reefs are among the most important ecosystems in terms of biodiversity richness and productivity. These ecosystems are highly interconnected and their protection can ensure and enhance marine ecosystem functioning and services, crucial for a healthy planet. Understanding the state and trends on changes of these ecosystems and tracking the progress towards national and international targets, is fundamental for conservation outcomes.

Mapping and monitoring spatial-temporal changes in key ecosystems is essential for supporting conservation strategies to ensure their sustainability (Figure 3.7). We used a global dataset from UNEP-WCMC (2022) Ocean+ Habitat to calculate the extent of mangrove forests, seagrass beds and cold coral extent in Western Africa EEZ waters and their protection (Table 3.2 and Figure 3.5).

According to Global Mangrove Watch Dataset, in West Africa, mangrove forests in 2016 covered approximately 15333,19 square kilometres while in 1996 their extent was 15528,14. The region lost 9.13% of its mangrove forest ecosystem between 1996 - 2016 (Figure 3.6).

By January 2021, approximately 10% of seagrass habitat and 24.47% of mangrove forests in West African EEZs will be covered by protected and conserved areas, helping to achieve Aichi Target 11. Cold-water coral reefs are unlikely to meet the conservation target with less than 1% protection.

Table 3.2 The habitat of seagrass beds and mangrove forests

Habitat	Surface area (km <sup>2</sup> )	Protected habitat (km <sup>2</sup> )	% of protection
Seagrass beds	46532,282	4663,871	10,02%
Cold Coral	114,841	0,998	0,86%
Mangroves	15333,19	3752,03159	24,47%

Source: UNEP-WCMC (2022)

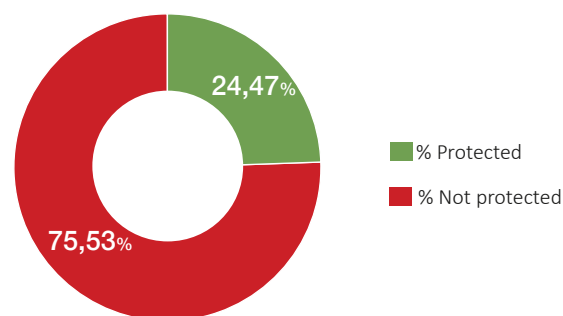


Figure 3.5 Mangrove forests protection in the West African region Source: Global Mangrove Watch Dataset

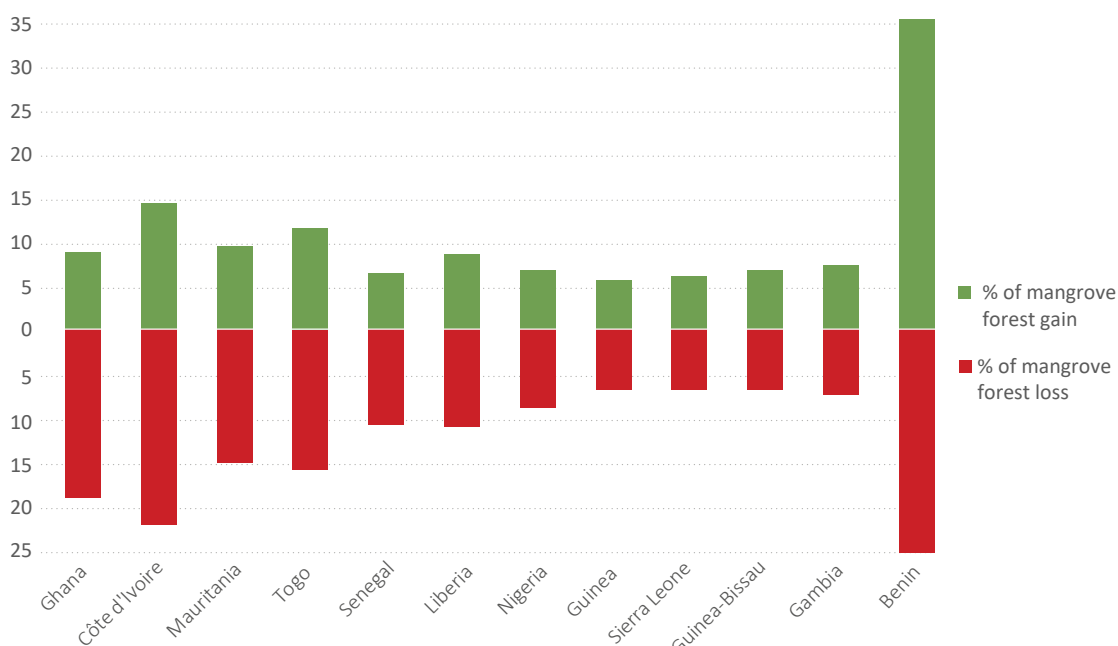
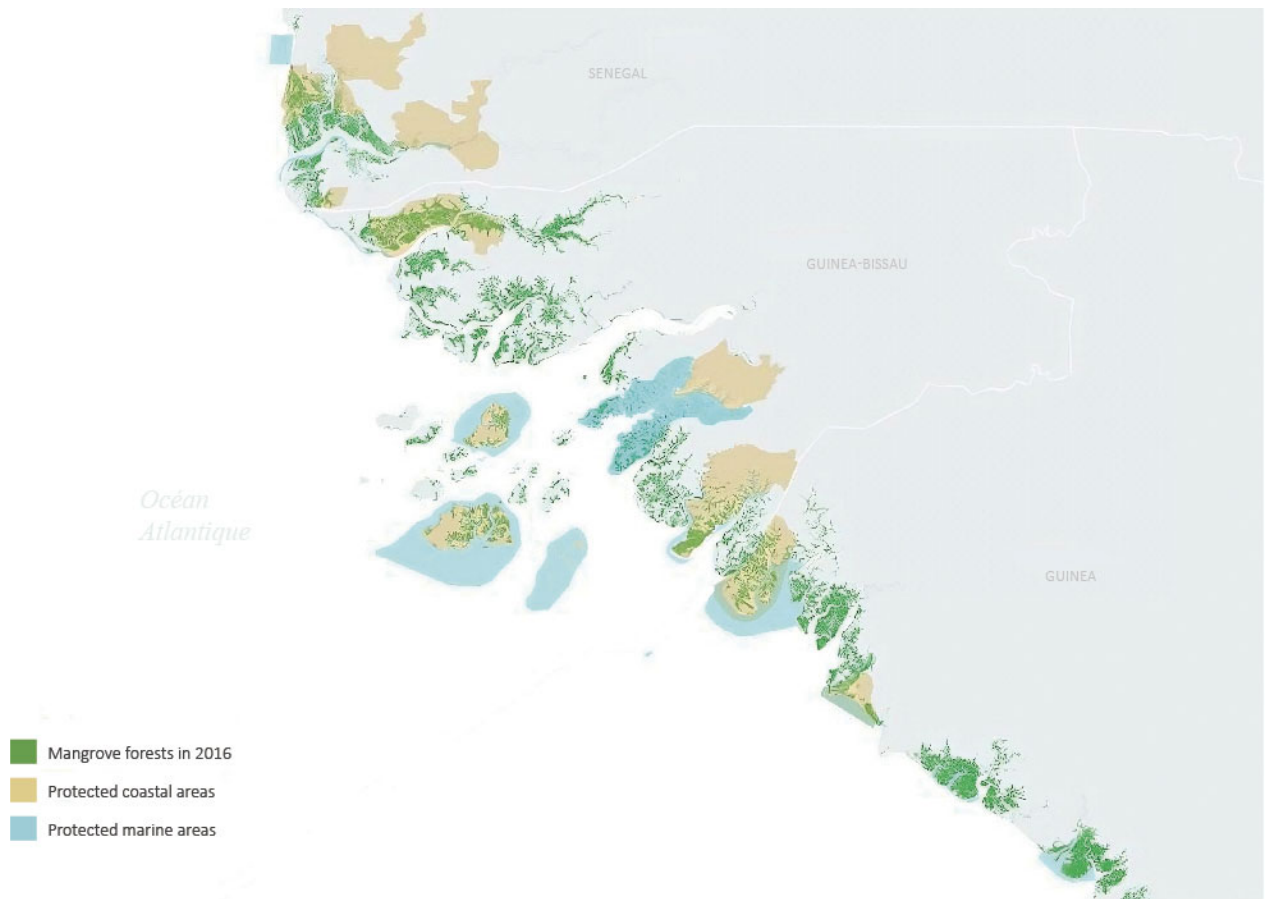


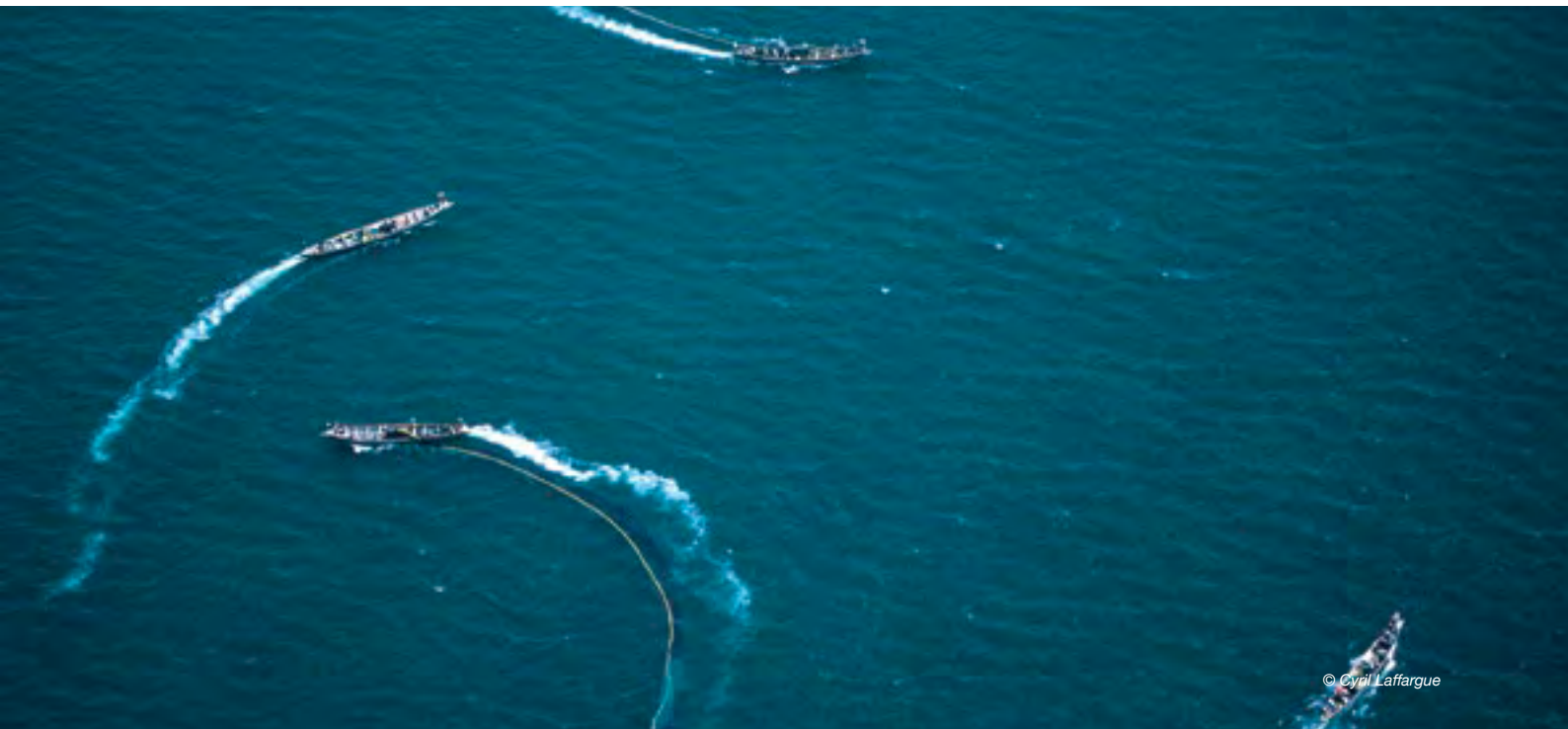
Figure 3.6 Mangrove forest loss and gain between 1996-2016 Source: Global Mangrove Watch Dataset



**Figure 3.7 Mangrove forests distribution** Source: Global Mangrove Watch Dataset



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### 3.3.3 Socio-economic data: A regional overview of fisheries and the state of conservation

Fisheries have a crucial role in feeding the global population. They could be managed in a sustainable way, to ensure the welfare of the ecosystem functions biodiversity, services and food security. Statistics and analyses suggest overfishing has increased, becoming one of the most significant drivers of decline in ocean wildlife populations. The unsustainable and industrial fishery has a direct impact on the seabird and cetacean population, and thus on all of us. Small-scale fishing is the principal livelihood for millions of people around the world. The global capture fisheries has increased over the last 50 years as the consumption of seafood has doubled. This has increased pressure on fish stocks across the world. According to the State of World Fisheries and Aquaculture 202 (FAO 2020), the global capture fisheries production rose 14% from 1990 to 2018 and in 2018 it reached 96.4 million tonnes.

A fundamental requirement for productive fisheries is maintenance of the biodiversity that offers natural systems resilience against changing conditions (FAO, State of World Fishery and Aquaculture 2020). Threatened marine fish species can be legally caught. According to FAO, the annual estimate of fisheries interactions is at least 20 million individuals of endangered, threatened and/or protected species.

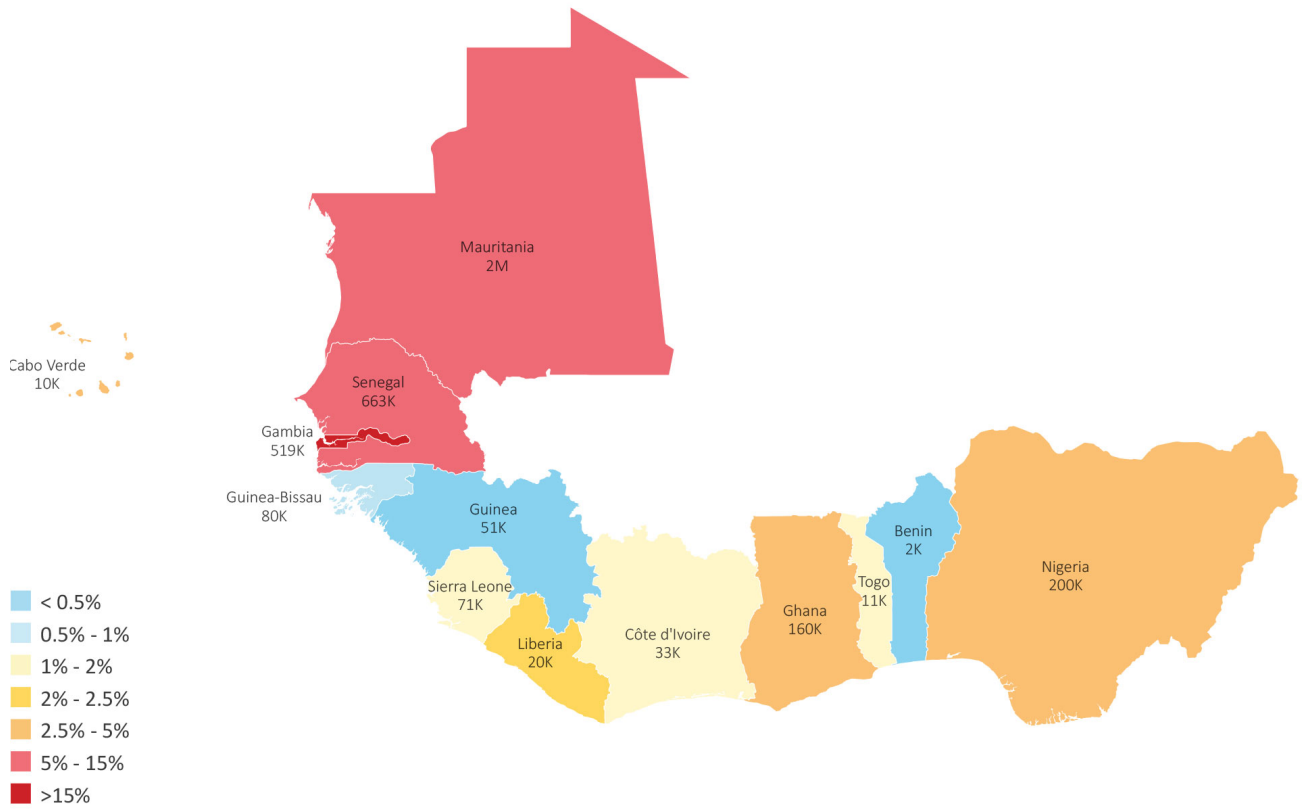
We analysed the total (estimated) fishery catches in the waters within the Exclusive Economic Zones of the 13 West African countries. We used the Sea Around Us catch database to explore the total catch volume in the countries' waters since 1950. We focused on the total catch volume between 2008-2018 using the catch reconstruction of countries for four fishing sectors (industrial, artisanal, subsistence and recreational), two catch types (landed versus discarded catch) and two types of reporting status (reported versus unreported) for

the Exclusive Economic Zones (EEZs). Using Fishbase dataset, we linked the conservation status information to each species to estimate the volume and percentage of all threatened species caught relative to total catch over 2008-2018. We found more than 40 global threatened species caught by industrial and small-scale fishery for an amount of 3 million and 767,000 tonnes that corresponds to the 5.7% of total catch: 26 Vulnerable, 16 Endangered and 6 Critically Endangered species. *Sardinella maderensis* is the most overfished threatened species caught along the coast of West Africa, with more than 2 million tonnes over the last 10 years (Figure 3.9).

Over the decade 2008-2018, the Gambia was the country that reported the highest percentage (22% respect the total catch volume) of threatened species catch in its EEZ, followed by Mauritania (10%) and Senegal (9%) (Figure 3.8).

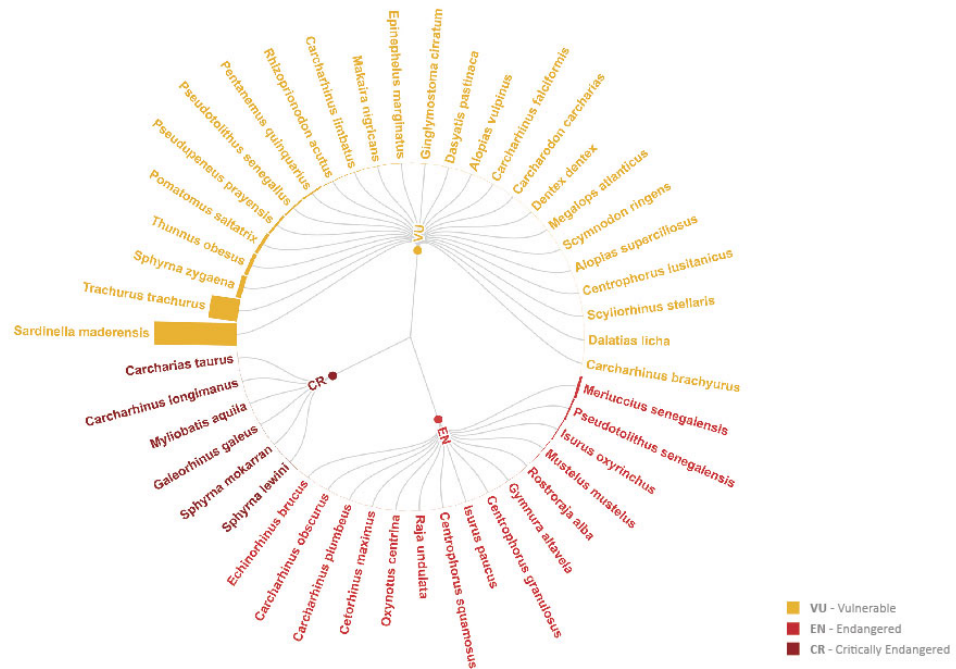
Despite many calls for extensive MPAs that are off-limits to fishing (e.g. Roberts et al., 2005) there has long been a tacit acceptance on the idea that as the extent of MPAs grows, ways must be found to reconcile tensions between conservation and exploitation within MPAs boundaries. The assumption in Kelleher (1999), that larger MPAs would be zoned into multiple-use and strictly protected areas, represented recognition of the need to address these inherent tensions. But in practice, the matter remains the subject of serious contention and debate in which quite distinct interests clash from national policy through to local management levels. Consequently, among the approaches to marine conservation, the designation of a protected area, most of all, generates strong interactions between social, economic and ecological imperatives, and each individual MPA plays out in microcosm the general challenge of sustainable development in the marine environment (Humphreys and Herbert, 2018).





**Figure 3.8** Percentage of threatened fish species caught in the last 10 years in relation with the total catch effort (in tonnes)

Source: searoundus.org



**Figure 3.9** List of threatened fish species caught in West Africa in the last 10 years

Note: The bar indicates the proportion of total catches of each species over the last 10 years. The flat sardinella (*Sardinella maderensis*) is the most fished endangered species along the coasts of West Africa, with more than 2 million tonnes over the last 10 years. Source data: Sea Around Us and IUCN Red List of Threatened Species.

### Box 3.4 Research as a factor in integrating stakeholders within MPAs

*Pierre Campredon*

Experience shows that scientific research is a key factor in integrating stakeholders within MPAs and maintaining the conservation dynamic on the ground. To achieve this, research, monitoring and survey objectives are defined at the outset according to the specific characteristics of the protected area and conservation priorities. Teams made up of experienced researchers, students, protected area staff and community agents are set up in all the components.

While carrying out their work, the researchers supervise the students, passing on their knowledge and methodologies. Together, they produce the knowledge needed to refine management and conservation measures. They provide useful elements for communication and environmental education, and feed into teaching content for the benefit of ecotourism. Through their publications, they make a positive contribution to the visibility of the protected area to the outside world. By their mere presence in the field, they participate indirectly, along with the other players, in the surveillance of the area.

Students learn the practice of research and develop a knowledge of the functioning of ecosystems and the biology and ecology of the species studied in the field: the problems of conservation and the significance of the existence and objectives of protected areas are perceived in a concrete way. At the same time, national levels of competence are raised, which increases the quality and resilience of conservation dynamics at the level of the institution and the country in general.

The staff of the administration in charge of protected areas, conservators and rangers, participate in research activities as technicians, apply monitoring and survey methodologies, understand the meaning of the work they are asked to do, feed the monitoring system by informing the indicators, develop their knowledge with researchers and, in the other direction, provide valuable information based on their own field experience. In this way, they become part of a collaborative dynamic that enhances their role.

The community agents involved in the research find an occasional job opportunity. They pass on their empirical and often in-depth knowledge of the environment and species to the researchers and wardens; in return, they receive information and knowledge that helps them to better understand the functions of the protected areas, knowledge that they in turn can pass on to their communities. Their presence in the collaborative process also helps the rangers to better understand how local people perceive the park and its management measures.

This type of collaboration, in which each person's skills are harnessed and mutually reinforced, promotes dialogue and understanding between stakeholders while producing knowledge and management tools that are essential to the vitality of marine protected areas.



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© Hellio & Van Ingen, Bijagós, Guinea-Bissau



## Chapter 4

# Governance, equity and management of marine protected areas

*Charlotte KARIBUHOYE SAID, Jennifer KELLEHER*

*Contribution: Thierry CLEMENT*

This chapter includes:

- An introduction on the international background to equity and the two dimensions of governance.
- A presentation of governance diversity of MPAs in the region.
- A brief analysis of the other effective area-based conservation measures (OECMs).
- An analysis of governance quality and a presentation of the tools used in the region to measure it.
- A conclusion that includes the emerging trends and recommendations.

## 4.1 Introduction

Healthy biodiversity is an underpinning factor for the survival of humanity and the planet, and its conservation is therefore vital. Effective marine protected areas (MPAs) are important for conserving this biodiversity in the marine and coastal context. They conserve ecosystems, species, genetic diversity and associated values. They restore degraded seascapes and related coastal zones, provide ecological services, livelihood opportunities and offer revenue streams for governments. Globally, protected and conserved areas (PCAs) or, more generally, “area-based conservation” — have long been and remain a key biodiversity conservation strategy, as reflected in international biodiversity law (including under the Convention on Biological Diversity and its Aichi Target 11) and conservation policy (including many IUCN Resolutions). This body of international law and policy also increasingly recognizes the importance of centring governance and equity in area-based conservation, including in MPAs. “Equity” relates to fairness and justice.

Enhancing equity not only contributes to more successful and effective biodiversity conservation, but also increases the contribution of protected and conserved areas to human well-being. ‘Equitable management’ in nature conservation is foremost about governance and by examining area-based conservation through the lens of governance, key and complex issues related to equity can be understood and analysed. Governance concerns how and by whom decisions are made and upheld. The term ‘governance’ refers specifically to decision-making and the “interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken and how citizens and other stakeholders have their say”.

Ultimately governance has been shown to be a major determinant of the effectiveness of management in meeting nature conservation and other social objectives. It is commonly discussed and increasingly assessed in two dimensions: namely governance diversity (or governance type) and governance quality (or good governance). In this chapter, we will explore the meaning and significance of these concepts in more detail, we will examine the extent to which this work has been addressed in West and Central Africa. We will present the current state of governance diversity and quality, findings including an illustration of PCAs from across the region, and identify gaps. We will close with recommendations for further work and research.

## 4.2 Global background on governance and equity

Parties to the CBD adopted voluntary guidance on equity at COP14, which was intended to be applied in any context for nature conservation and sustainable development. Equity is understood as comprising three dimensions, i.e recognition, procedure and distribution:

1. Recognition refers to the acknowledgement of and respect for the rights and diversity of identities, values, knowledge systems and institutions of rights holders and stakeholders;

2. Procedure refers to transparency and accountability and inclusiveness of the governance processes of rule- and decision-making.
3. Distribution refers to mitigating costs that affect Indigenous and local communities and equitable sharing of benefits resulting from the management of protected areas.

As aforementioned, equity is foremost about governance and by examining area-based conservation through the lens of governance, key and complex issues related to equity can be understood and analysed. The key components of this concept or ‘definition’ of governance - i.e. the “how” and the “who” - can be considered at several levels including: at the site level (of a particular MPA), and at the “Systems”-level - a (national, sub-national, regional) network of PCAs. Governance must be distinguished from management although the two terms are closely linked. While management concerns the activities that are carried out to reach certain objectives, such as activities and resources outlined in a management plan, governance is concerned with the decision-making behind the management plan, what values were defined, how the plan was designed and planned and how it is implemented.

A mandate for governance can be legitimised either through de jure (legal) recognition, as in the case of a government protected area agency or by de facto recognition, where certain actors are regarded as legitimately taking decisions (for example, a community adopting their own no-go fishing rules for restoration). In this chapter, we use the term “governance institutions” to describe the complex of structures, organizations, processes, policies, regulations and values by which people take key decisions and ensure their implementation, and respect for valuable territories and areas. These can be remarkably diverse, from councils of elders relying upon traditional practices and cultural values, to elected committees and governing boards, presiding over large staff and budgets, regulated by national legislation.

In order to address these issues more specifically, the concept of governance is further broken down into two elements, i.e governance diversity and governance quality. Governance diversity concerns the variety of governance types or approaches within protected and conserved areas systems. Diverse systems include [and appropriately recognise and support] PCAs of a variety of ‘types’ or approaches. CBD and the IUCN recognise / promote recognition of four ‘types’:

1. **Type A.** Governance by government (at various levels)
2. **Type B.** Governance by various actors together (shared governance)
3. **Type C.** Governance by private individuals and organisations (usually the landholders or their designated)
4. **Type D.** Governance by Indigenous peoples and local communities (often referred to as ICCAs)

Governance type is determined not only by who holds authority in law (de jure), but also who makes decisions in practice (de facto). Governance quality concerns whether the governance is equitable and effective, and is guided by five core principles for PCA governance. Next we will examine each in turn.

## Previous governance decisions of the Convention on Biological Diversity (CBD)

Recognising that governance is a key factor for protected areas to succeed in conserving biodiversity and supporting sustainable livelihoods, the Parties to the Convention on Biological Diversity (CBD) have agreed to take action and improve the governance of protected and conserved areas in collaboration with indigenous peoples, local communities and relevant stakeholders. The Programme of Work on Protected Areas (PoWPA), adopted by the Conference of the Parties to the Convention (COP) in 2004, recognised that “poor governance” was a barrier to achieving the objectives of protected areas and incorporated Programme Element 2 setting targets for governance, participation, equity and benefit sharing. Since then, these have remained important elements in decisions about protected and conserved areas. For example, Aichi Biodiversity Target 11 calls for expanded conservation “through effectively and equitably managed protected areas and other effective area-based conservation measures” (AMCEZ). In addition, Aichi Biodiversity Target 18 and the work on Article 8(j) and related provisions call for the recognition and respect of the rights, knowledge and capacities of indigenous peoples and local communities in the context of protected and conserved areas. Collectively, the recommended actions related to protected area governance under the CBD include, but are not limited to, the following:

- the assessment of governance and the consideration and integration of governance principles;
- the diversification, strengthening and recognition of the contributions of protected and conserved areas of different types of governance, including territories and areas conserved by indigenous peoples and local communities, as well as by private actors;
- strengthening and guaranteeing involvement, in particular through the full and effective participation of indigenous peoples and local communities, and through recognition and respect for their rights, knowledge and capacities;
- the respect and promotion of “prior and informed consent”, “free, prior and informed consent” (FPIC) or “approval and involvement”, depending on national circumstances, of indigenous peoples and local communities [hereinafter FPIC for the purposes of this document];
- assessment of costs, benefits and economic and socio-cultural impacts; avoidance and mitigation of negative impacts; and, where appropriate, compensation for costs and equitable sharing of benefits.

*Source: Extract from CBD/SBSTTA/22/INF/8*

## 4.3 Governance diversity in marine and coastal conservation

Diversity refers to the broad spectrum of actors who might be recognised as decision-makers, ranging from state level actors to local community leaders. Having the full spectrum of governance arrangements recognised within legal and policy frameworks provides the best opportunity for area-based conservation to be contextually and culturally appropriate. This is particularly relevant for West Africa where these areas can vary from large-scale marine protected areas (MPAs) to small community conservation areas, on customary lands. The IUCN recognises four broad governance types (Table 4.1), which between them represent a full spectrum of governance diversity. Importantly, they can serve as a guide to understanding the status and appropriateness of governance arrangements in marine and coastal areas.

Types A and B are generally established by government agencies alone, or in partnership with others, but in West Africa many type B or MPAs under shared governance arrangements were set up through community processes often supported by NGOs. Types C and D may or may not have government support for management. IUCN governance Type D refers to various forms of community conservation areas, including “territories and areas conserved by Indigenous peoples and local communities (ICCAs)” or “territories of life”, where a close association or bond is found between a specific Indigenous People or local community and a territory, area or body of natural resources. According to the World Database on Protected

Areas, Type D is not commonly reported in the region whereas Type C is not reported at all.

IUCN management categories and governance types are independent and can be juxtaposed in the “IUCN Matrix” visualizing a spectrum of area-based options to conserve nature in a given country or region.

In the West African sub-region, like in other regions, protected areas with bio-ecological characteristics of an MPA have been created for a long time, without these sites being named (and in many cases) nor governed and managed effectively as marine protected areas. The term “MPAs” was increasingly used from early 2000 on to the newly gazette sites, particularly in Senegal, which in many cases does not allow today to distinguish the management category nor the governance type.

Currently, the dominant types of governance in West African MPAs are to a large extent closely linked to the evolution of the national and international contexts and in particular to the evolution of the vision and dialogue at the global level on biodiversity conservation and on protected areas governance (Yves Renard & Oussouby Touré 2012). However, the types of governance as officially described are sometimes at odds with the practice in the field. In some cases, for instance, in spite of the official discourse, government representatives generally continue to play a central role in the site’s governance, even in “community-based” protected areas, given that they often are the only ones with some means (teams and budgets) to be dedicated to the MPA management. Overall, however, there is a global trend towards an ever-stronger involvement of local communities in the governance of MPAs.

MPAs created in the 1970s and 1980s in West Africa, in part under the impetus of the signing of the Convention on Wetlands of International Importance (Ramsar Convention) and the World Congress of National Parks in Bali 1982, generally have government-led governance. This is the case, for example, of several national parks such as the Banc d'Arguin National Park (PNBA) in Mauritania, the national parks of the Saloum Delta, the Langue de Barbarie and the Iles de la Madeleine in Senegal or the Niimi National Park in the Gambia.

Several MPAs were established in the 2000s in West Africa, many with support from international NGOs and in connection with the establishment of the Regional Programme for the Conservation of the Coastal and Marine Zone in West Africa (PRCM) in 2001 and the World Parks Congress in Durban 2003. Among those sites are some MPAs with state governance such as the marine national parks of Orango and João Vieira e Poilão in Guinea-Bissau, but also a growing number of MPAs with shared governance models. This is particularly the case with the MPAs of Bamboung, Joal-Fadiouth, Cayar and Abéné in Senegal, Urok islands in Guinea-Bissau or Tristão and Alcatraz islands in Guinea. In fact, since the second half of the 2000s and onwards, there is clearly an evolution towards the strengthening of shared governance in MPAs.

The last category Type 4 of ICCA comprises areas that are: A close association is often found between a specific indigenous people or local community and a specific territory, area, or body of natural resources. When such an association is combined with effective local governance and conservation of nature, we speak of an "ICCA". ICCA sounds like an acronym, but it is not. It is an abbreviation for "territories and areas conserved by indigenous peoples and local communities" or "territories of life". In the last decades, ICCAs have become known and recognised as essential

features for the conservation of nature, sustainable livelihoods, the realisation of collective rights and responsibilities, and the wellness of living beings on the planet. They include cases of continuation, revival or modification of traditional practices, some of which are of ancient origin, and also include new initiatives, such as restoration of ecosystems and innovative uses of resources employed by indigenous peoples and local communities in the face of threats and of opportunities.

In West Africa, governance by indigenous people or local communities has become increasingly essential in MPAs, in particular following the IUCN World Conservation Congress in Barcelona 2008, during which the notion of indigenous and community conservation areas was formally discussed (IUCN 2009). This has prompted the establishment of a growing number of indigenous or community conserved areas or ICCAs, such as the ICCAs of Mangagoulack (Kawawana Box 4.2) and Kapac Olal in Senegal or Bolongfenyo in the Gambia. However, such recognition is hard fought as expressed by Kawawana:

*"In Kawawana, we want to maintain our local governance system and we would like to have legal recognition of our ICCA and not a co-management system. The challenge of co-management is that there is a risk that one day a warden might be the only decision maker. This fear is because the technical staff from government only apply the rules dictated by the state and they can not always take into account local conventions and by-laws. And in that case we would lose not only our identity but also our cultural values".*

**Table 4.1 IUCN governance types for protected and conserved areas**

Governance Type	Sub-types	Example from the region
<b>Type A:</b> Governance by government	National Ministry or a protected area agency Subnational agency (at all levels)	Banc d'Arguin National Park (PNBA) in Mauritania João Vieira e Poilão marine national park in Guinea-Bissau Saloum Delta National Park in Senegal Niimi National Park in The Gambia
<b>Type B:</b> Shared governance by diverse rightsholders and stakeholders together	Transboundary governance arrangements Joint or collaborative governance bodies	Joal-Fadiouth and Cayar MPAs in Senegal Urok islands community-based MPA in Guinea-Bissau Tristão & Alcatraz MPA in Guinea
<b>Type C:</b> Private governance	Individual landowners, Religious entities, Non-profit or for-profit organisations	None reported
<b>Type D:</b> Governance by Indigenous People and/or local communities, (often called ICCAs or territories of life)	Indigenous Peoples' conserved territories and areas – established and run by Indigenous People Community conserved areas – established and run by local communities	Kawawana in Senegal Bolong Fenyo in Gambia

Source: Borrini-Feyerabend et al., 2013

**Table 4.2 IUCN Best Practice Protected Guidelines on Governance of Protected Areas (2013)**

Management Category	A. Governance by government			B. Shared governance			C. Private governance			D. Governance by indigenous peoples and local communities	
	Federal or national ministry or agency in charge	Sub-national ministry or agency in charge	Government-delegated management (e.g. to an NGO)	Transboundary governance	Collaborative governance (various forms of pluralist influence)	Joint governance (pluralist governing body)	Conserved areas established and run by individual landowners	...by non-profit organisations (e.g. NGOs, universities)	...by for-profit organisations (e.g., corporate landowners)	Indigenous peoples' conserved areas and territories – established and run by indigenous peoples	Community conserved areas and territories – established and run by local communities
<b>Ia. Strict Nature Reserve</b>											
<b>Ib. Wilderness Area</b>											
<b>II. National Park</b>											
<b>III. Natural Monument</b>											
<b>IV. Habitat/ Species Management</b>											
<b>V. Protected Landscape / Seascape</b>											
<b>VI. Protected Area with Sustainable Use of Natural Resources</b>											

Source: IUCN Best Practice Protected Guidelines on Governance of Protected Areas (2013)



### Box 4.1 Joal-Fadiouth MPA

The Joal-Fadiouth MPA was established by presidential decree in 2004, with the aim of protecting vulnerable species and key habitats, improving fishing productivity in the region and providing socio-economic benefits for local communities. The Joal-Fadiouth MPA covers a surface area of 17,400 hectares and the applicable legal framework is governed by Presidential Decree no. 2004-1408 of 4 November 2004.

The provisions of the governance bodies of the Joal-Fadiouth MPA, as well as the implementation process, follow the principle of shared governance between a representative of the State and the local communities, who formally share decision-making power and responsibility.

The General Assembly was the very first body created in the process of implementing the GPA and is the supreme governance body; it provides political and strategic guidance to the Management Committee and takes decisions on issues not resolved by the other decision-making bodies. It is responsible for electing members and amending the articles of association and internal rules.

At Joal-Fadiouth, as in most of Senegal's MPAs, the management committee includes wardens assigned by the National Parks Department (recently replaced by the Community MPA Department), representatives of the various parties and stakeholders, including fishermen and representatives of civil society. The management committee is made up of 25 members representing 18 stakeholders, including the warden, the technical departments concerned, coastal and marine resource user groups, the town council, scientists, etc. It is the MPA's executive and main operational decision-making body. It is here that the important issues inherent in the process of participatory management of the MPA, such as monitoring

and the application of sanctions, are debated and "fine-tuned". It is also this body that analyses the proposals for sustainable development initiatives associated with the co-management process that will be submitted to the General Assembly.

This committee has a fairly broad remit, including defining and implementing management measures, managing conflicts, assessing the effectiveness of management, and so on. The chairman of the management committee is chosen from among the committee members.

However, this body has no formal legal status. Its remit is to issue opinions on the management of the protected area. As the official representative of the state, the protected area manager is expected to implement decision-making processes based on consensus and in accordance with the agreed roles and responsibilities of the various stakeholders.

The main challenge remains effective cohabitation and collaboration between local governance bodies and state authorities, and respect for the mandate and roles of the different bodies (Deme et al. 2021). Another challenge relates to the fact that the traditional knowledge and beliefs of the people of Joal-Fadiouth have played an important role in the sustainable management of resources in the past, but this site has undergone significant socio-economic changes and is now the most important fishing landing place in Senegal. Maintaining traditional beliefs and practices is therefore a major challenge in a context where most of the fishermen landing at the site are not originally from the region. This situation makes the application of MPA decisions more difficult than in the past.

*Sources: DAMCP/MEED 2014. Evaluation and update of the Joal-Fadiouth MPA development and management plan 2014*



© Mirek - stock.adobe.com, Joal-Fadiouth, Senegal

## Box 4.2 Mangagoulack (Kawawana) APAC

Established in 2008 by the Mangagoulack rural council on the initiative of the Mangagoulack fishermen's association and officially recognised in 2010 by the local state authorities (regional council and governor), the Kawawana APAC covers a surface area of 9,665 hectares. The legal framework consists of law no. 72-02 of 1 February 1972 on the organisation of local and regional government, as amended; laws 96-06 and 97-07 of 22 March 1996 on communes, which include a Local Government Code and transfers of powers to local authorities (region, council, rural council).

In the Kawawana APAC, community governance and management based on local traditional institutions and customary and/or modern rules have been reinstated or established by the community itself.

Kawawana is governed by a number of bodies, including a General Assembly, a Community Council, an Executive Committee, a Council of Elders and a Scientific Council, in which each of the eight villages involved is represented. The General Assembly approves decisions and ensures that members and the Board abide by the rules. It elects the members of the Bureau, collects ecological monitoring reports and disseminates information. The Bureau makes technical proposals, takes decisions and supervises the monitoring teams. The Community Council, for its part, approves technical proposals and, in consultation with officials from the Ministry of Fisheries, takes decisions related to the APAC. The Scientific Advisory Board provides advice on the governance and management processes of Kawawana, assists in the analysis of monitoring data and helps to promote the Kawawana initiative nationally and internationally. The Council of Elders is active on an ad hoc basis, mediating and arbitrating in the event of conflict; it also advises on governance issues.

Kawawana's governance institutions are empowered to enforce their regulations; 24 local representatives are trained and qualified as watchdogs and empowered to report offences, arrest offenders and report them to the relevant public authorities (fisheries or forestry).

Kawawana's governing institutions are empowered to enforce their regulations; 24 local representatives are trained and qualified as surveillance auxiliaries and empowered to report offences, arrest offenders and present them to the relevant public authorities (fisheries or forestry). This ensures that the rules laid down locally in the APAC are applied rigorously and effectively.

This customary institution is particularly effective in terms of regulation because it is better adapted to the context, better understood by the local population and more effective than modern national regulations, which are poorly applied for a variety of reasons. The success factors are the existence

of a close-knit community that uses a single local language (Diola), the still strong respect for customs and beliefs, and the existence of functional traditional institutions with decision-making powers.

Like many other APACs, Kawawana faces a number of challenges despite, or in some cases because of, its success. Although the legal framework of decentralisation supports their legal existence, APACs are not well known, including to many technicians in official conservation departments, who do not consider them to be part of the protected area network.

Recognition by the local authorities has transferred the governance mandate to APAC, but Kawawana cannot enforce sanctions because its members and volunteer officers are not sworn. This is essential in order to manage and resist external pressures, which are becoming stronger as the results of its conservation successes become more and more evident.

Close collaboration with the relevant technical departments (e.g. fisheries and forestry) is essential to enforce APAC regulations. The commitment and involvement of local government and technical departments, maintaining the balance of power and preserving decision-making by local community institutions, are crucial to the very existence of community conserved areas.

Source: Consortium. 2021. *Living Territories Report 2021*. Available at the following address: <https://www.iccaconsortium.org/fr/2021/05/29/le-consortium-apac-lance-un-nouveau-rapport-majeur-sur-les-territoires-de-vie/>



Figure 4.1 MPA Kawawana location map

Source: [www.iccaconsortium.org](http://www.iccaconsortium.org)

### Box 4.3 Banc d'Arguin National Park

The Banc d'Arguin National Park (PNBA) was established in 1976 by Presidential Decree with the aim of promoting the harmonious development of resident populations, maintaining the integrity and productivity of the Banc d'Arguin, protecting and conserving terrestrial, marine and island ecosystems, contributing to the prevention of endangered species, including migratory species, safeguarding natural sites of particular scientific, archaeological or aesthetic value, contributing to environmental research and promoting environmental education activities. It protects over 1,204,660 hectares, half of which are in the marine environment. The legal framework comprises three laws: the specific law in 2000 (no. 2000/024 of 19 January 2000); law no. 97-006 of 20 January 1997 repealing and replacing law no. 75-003 of 15 January 1975 on the hunting and nature protection code, and law no. 2000-045 of 26 July 2000 on the framework law on the environment.

The governance and administration of the park are placed under the direct supervision of the Prime Minister. It has the status of a public administrative establishment, whose executive is ensured by a Director, in accordance with the deliberations of a Board of Directors (CA) appointed by the Council of Ministers.

Since its creation, the PNBA has adopted the principles of participatory management and shared governance, involving local communities and various stakeholders in decision-making and the management of the site and its natural resources. In addition, the local development projects initiated in the early 1990s by the PNBA and its partners were also intended to lay the foundations for genuine dialogue around the park's shared governance model and for effective local support for the rules governing resource management.

The PNBA has strengthened this approach over time, introducing a fisheries co-management system in 1998 by involving the Imraguen community and the institutions responsible for scientific monitoring and fisheries management in the definition of conservation decisions and accompanying measures. A participatory maritime surveillance system is in place thanks to the involvement of local communities, the Mauritanian Coast Guard (GCM) and the park administration. Scientific monitoring is being put in place to provide a basis for co-management of the fisheries, through scientific and technical collaboration in the field with the Mauritanian Institute of Oceanographic Research and Fisheries (IMROP) and regular consultations based on the results of surveillance and monitoring.

One of the main pillars in strengthening the shared governance of the PNBA has been the establishment of the Comité Villageois

de Concertation et de Cogestion (CVCG), which brings together representatives of socio-professional groups and resident communities. Today, the CVCG is the main forum for dialogue between the resident population and the management of the PNBA. Representation of this committee (via its chairman) on the park's board should strengthen the wider inclusion of local communities and the various stakeholders on the park's board.

The Scientific Council (CSBA) is an independent advisory body made up of Mauritanian and international scientific figures. It participates in the governance of the Banc d'Arguin and plays an important role in helping the PNBA to make decisions in the fields of conservation, management and development. The CSBA's mission is to define research guidelines for the Banc d'Arguin, validate research programmes and results, and coordinate the activities of research partners. Since it was set up in 1993, the scientific advice issued by the CSBA has prevented a number of potentially high-risk projects from affecting the integrity of the protected area and its resources.

The diversity of the issues and challenges facing the Park also requires a broader range of partnerships and stakeholders to be involved in the shared governance process and in the implementation of conservation and sustainable development initiatives. Dynamic collaboration between the PNBA and the various ministerial departments concerned, as well as with local economic players, is seen as another priority under the new management plan, to preserve the integrity of the PNBA through relevant sectoral policies (PNBA Management Plan 2020-2024).

It is crucial to ensure the effective functioning of the CVCG and to strengthen the capacity for participatory monitoring of the Park's management plan, through regular consultations to discuss various conservation and development issues based on the results of monitoring and surveillance of the MPA. These regular consultation workshops are critical moments for making the shared governance of the PNBA operational and strengthening it, and for maintaining relations of trust between the local communities and stakeholders and the Park administration. Organising these consultation workshops on an annual basis was a challenge; in order to reduce the burden and logistical constraints, it was decided that the workshops would be organised on a bi-annual basis.

*Source: PNBA Management Plan 2020-2024*



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## 4.4 Other effective area-based conservation measures (OECMs)

To refer back to the draft Global Targets under the CBD Global Biodiversity Framework, at the time of writing Parties to the CBD are negotiating the following text:

- **Target 2.** By 2030, protect and conserve through well connected and effective system of protected areas and other effective area-based conservation measures at least 30 per cent of the planet with the focus on areas particularly important for biodiversity.

Building effective systems of protected areas and other effective area-based conservation measures (OECMs) to maintain significant biodiversity values will be central to achieving the draft targets of the Global Biodiversity Framework and contributing to the 2050 Vision of living in harmony with nature. The definition and criteria for OECMs were adopted in 2018 under COP Decision 14/8, supported by IUCN Guidelines and training materials. There is much work to be done to ensure that OECMs are appropriately identified, recognized and supported, so that they meet their potential for biodiversity conservation. Like protected areas, OECMs can have a wide range of governance types, and offer a particular opportunity to recognize and support important biodiversity areas that are governed and managed by indigenous peoples and local communities, as well as conserved areas under private governance. Several CBD Parties

have made significant progress in identifying and recognizing OECMs within national contexts.

For centuries many local communities in West Africa have implemented traditional measures other than protected areas, that contribute directly and indirectly to the preservation of ecosystems. Among those measures are sacred natural sites that have great spiritual significance to people. Sacred natural sites are terrestrial\* or aquatic areas with a special spiritual significance for people and communities.

The primary purpose of sacred natural sites is to maintain cultural identity; they are places that are particularly respected and protected, as they symbolize cultural and spiritual values for these populations. Although the traditional management systems put in place aim primarily to preserve these places of cultural importance, the sacred spaces are preserved because of the worship that takes place there and the various restrictions that surround them, and the natural resources (animals and plants) located in these places thus benefit from this protection.

There are no reported OECMs in the region, although datasets have been received by WD-OECMs.

#### Box 4.4 Sacred natural sites in the Bijagós archipelago of Guinea-Bissau

Sacred natural sites (SNS) illustrate not only the role of the sacred in the creation of traditional territories, but also the form in which traditional societies interact and act with nature.

The Bijagós traditionally follow an animist religion, in which public and natural spaces are considered to be inhabited by supernatural entities responsible for the fate of people and life in general. Similarly, many natural sites (islands, sands and beaches, bush, forests, trees, rivers, the sea) are considered to be spaces where these beings live or which are dedicated to them and used for numerous ritual actions and, as such, considered to be sacred sites. Spaces built by man for religious purposes, such as 'balobas', extremely important and respected cult altars in Bijagó culture, are also considered sacred.

All sites considered sacred are crucial to social life and the survival of culture, resources and ecosystems. The fact that some places are sacred means that they are traditionally protected from disturbance and devastation due to human use. For example, sacred islands are areas protected by taboos, which ensure that human activity takes place there in a regulated manner.

These sites also constitute a form of recognition and legitimisation of customary and ancestral ownership and use rights over local territories.

Responsibility for management and decision-making on SNSs differs from case to case, but it is generally family lines or clans that exercise this right, which is passed down in hereditary form; some SNSs are managed by the village community.

In the Bijagós archipelago, for example, SNSs are managed by initiates, in this case respected elders, headed by the eldest in the line of the village's first occupant. They are responsible for steering the community's destiny, and therefore for managing the village's cult sites and resources.

The dominant rules governing access to and use of SNS resources are based on stories, myths, taboos and traditional practices. Highly respected by local communities, these rules are acquired by each individual in the community over the course of the various phases of his or her life, right up to the initiation phase into the SNS.

Although sacred natural sites are generally well protected by traditional rules, they face a variety of threats, including anthropogenic factors such as tourism, infrastructure development and climate change.

Proper recognition and reinforcement of SNS and local communities' traditional management rights and institutions by conventional protection and governance systems is crucial.

Unlike many other countries in the West African region where SNS are not formally recognised and do not benefit from a legal framework for protection, sacred forests and other sacred sites are considered as a category of protected areas in Guinea-Bissau's law on protected areas. However, this formal protection does not translate into concrete provisions for the protection of these sites in practice. Additional provisions are needed to ensure that the national governance system for protected areas effectively complies with the provisions of the legal framework in this respect.



© Hellio & Van Ingen, green turtle, Bijagós, Guinea-Bissau



© Régis L'hostis, Guembeul Reserve, Senegal

## 4.5 Governance quality

Understanding governance diversity of both MPAs and OECMs, and reporting it, is one part of the picture. It is critical to note that there is no universal and “best” governance arrangement in any given context. It is more realistic to examine how appropriate, legitimate and useful these arrangements are in different circumstances. A governance arrangement for a given area can only be considered as appropriate when it is tailored to its historical and social context, and effective in delivering lasting conservation results and livelihood benefits. At the site level, relevant concerns to this include:

- How are decisions being made and by whom?
- Are those decisions equitable (fair)? Are there losers?
- Which values guide those decisions? Are there rules approved by the community, that apply to decision-making?
- How transparent is the decision-making?
- Have rightsholders (those with legal or customary right to land and resources) been involved? Are there still opponents to the decisions and why?
- Have stakeholders (those with a direct or indirect interest) also been included? Was there an inventory of these stakeholders?
- To what extent are women involved in decision-making, so as to secure their rights and livelihoods?
- Are there rules that apply to?

With these questions, we begin to build a sense of governance quality, at times referred to as good governance, drawing on the principles for good governance as summarised in Table 4.3).

The good governance principles ensure rights-based approaches, address gender equity and equality, and the inclusion of marginalised groups, allowing for the better integration of protected and conserved areas into the landscape.

The IUCN Green List of Protected and Conserved Areas Standard (IUCN WCPA, 2017) is the new international sustainability standard to benchmark protected and conserved areas that are both effective and equitable (Hockings et al., 2019). The first component of the Standard focuses on good Governance or governance quality, which draws on the following good governance principles: Legitimacy and voice; accountability and transparency; and governance vitality. This concept of governance vitality examines the extent to which planning and management draw on best available knowledge of the social and ecological context of the site, and uses an adaptive management framework that anticipates, learns and responds to change in its decision-making. In particular, it focuses on whether there are procedures in place to ensure that the results from monitoring inform management decisions. These principles offer a point of departure for analysing weaknesses or challenges in governance of the conservation area. In addition, several CBD Decisions and related guidance call for the assessment of governance with reference to the principles of good governance.

**Table 4.3 IUCN principles of good governance for protected areas**

Principles	A selection of considerations related to the principles
Legitimacy and Voice	<i>“Enjoying broad acceptance and appreciation in society; ensuring procedural rights of access to information, participation and justice; fostering engagement and diversity; preventing discrimination; fostering subsidiarity, mutual respect, dialogue, consensus and agreed rules...”</i>
Direction	<i>“Following an inspiring and consistent strategic vision grounded on agreed values and an appreciation of complexities; ensuring consistency with policy and practice at various levels; ensuring clear answers to contentious questions; ensuring proper adaptive management and favouring the emergence of champions and tested innovations...”</i>
Performance	<i>“Achieving conservation and other objectives as planned; promoting a culture of learning; engaging in advocacy and outreach; being responsive to the needs of rightsholders and stakeholders; ensuring resources and capacities and their efficient use; promoting sustainability and resilience...”</i>
Accountability	<i>“Upholding integrity and commitment; ensuring appropriate access to information and transparency, including for lines of responsibility, allocation of resources, and evaluation of performances; establishing communication avenues and encouraging feed-back and independent overseeing...”</i>
Fairness and Rights	<i>“Striving towards equitably shared costs and benefits, without adverse impact for vulnerable people; upholding decency and the dignity of all; being fair, impartial, consistent, non-discriminatory, respectful of procedural rights as well as substantive rights, individual and collective human rights, gender equity and the rights of indigenous peoples, including Free, Prior and Informed Consent; promoting local empowerment in conservation...”</i>

Source: Extract from Borrini-Feyerabend et al., 2013

## 4.6 Assessing governance: methods and tools

Reporting on governance diversity and quality using governance assessment tools and approaches has increasingly become a focus of the conservation community. In addition to the voluntary guidance on equity that was adopted at CBD’s fourteenth Conference of Parties (COP14) in November 2018, the CBD invited Parties to report on the governance of protected and conserved areas (Convention on Biological Diversity 14/9, 2018) as a means of addressing equity.

Reporting on the ‘equitable management’ aspect of Aichi Target 11 has proved challenging, particularly across diverse contextual settings. As such, resources for assessing equity and governance are emerging. These governance assessment approaches range from rapid assessment and evaluation to participatory assessments that may comprise deeper research, validation and discussion with a wider variety of actors such as government authorities, rightsholders and stakeholders, as well as conservation specialists. A brief overview of some examples can be seen in Table 4.4.

The IUCN has published a set of best practice guidelines for assessing governance at two scales, national or system level and site level. This publication offers guidance to understand the four main protected area governance types and the set of principles of good governance recognised by the IUCN, on the basis of examples from all over the world. It also offers practical guidance for those willing to embark on the process of assessing, evaluating and improving governance for their systems of protected areas or for individual protected area sites.

A system-level assessment assumes that no protected area will be effective or equitable if it is not considered within its broader landscape. Most threats to protected areas stem from outside the boundaries of the protected area itself, including encroachment, poor connectivity in the wider landscape and a lack of resources. As such a ‘system’ assessment examines the entire landscape or seascape and in particular examines the coordination of these interlocking sectors and land and water uses. This can also examine the extent to which private actors, such as key tourism partners, make significant contributions to area-based conservation, but may not be necessarily reported as part of national targets. While a variety of government agencies are in charge of governing the system of official protected areas, the overall coverage of protected areas and conserved areas may be substantially larger. These may also fall under a system level analysis.

A site-level governance assessment focuses on governance quality in one particular protected or conserved area. SAGE (Site Assessment for Governance and Equity) is a tool for assessing the quality of governance of a protected or conserved area – including equity – using a framework of 10 governance and equity principles based on IUCN and CBD guidance, and meeting the criteria of the IUCN Green List Standard. It is a rapid process that enables stakeholders at a site to identify governance challenges and potential actions to address them, and provides managers at higher levels with an assessment of governance quality that can be used for management oversight, reporting or for the IUCN’s Green List process.

There are several other governance assessment guidelines that may be more appropriate for site-level assessments of Indigenous protected and conserved areas, some focus on self-strengthening but the diversity of Indigenous governance arrangements poses a

particular challenge owing to the different worldviews and cultural interpretation upon which they are based. Developing nationally or locally appropriate approaches for West Africa would be necessary.

#### 4.6.1 Tools implemented in the region

With the exception of the ICCA Self-Strengthening process adopted in the Kawawana ICCA, there is no evidence of implementation of governance assessment tools in the region. Besides the tools dedicated to governance assessment, there are several others tools that are dedicated to the evaluation of the effectiveness of the management of the MPA and several of them include criteria related to governance. However, research has shown that these may not lead to enhancing social outcomes.

These tools are by alphabetical order:

- The EoH tool of the IUCN: Enhancing our Heritage” <https://rris.biopama.org/fr/node/18803>;
- The RAPPAM of the WWF: Rapid Assessment and Prioritization of Protected Area Management;
- The METT of the IUCN: Management Effectiveness Tracking Tool <https://rris.biopama.org/fr/node/18794>;
- The IMET from the European Union: Integrated Management Effectiveness Tool <https://rris.biopama.org/fr/node/18795>;
- The “Rose des vents” radar (RDV) of Oréade-Brèche that the RAMPAO plan to apply to all the MPAs of the network: (lien vers RAMPAO en cours).

Table 4.5 show the use of these tools in the different MPAs of the region.

The “rose des vents” radar and the RAPPAM were the most commonly used tools in the area. The “rose des vents” radar has been adopted by the RAMPAO which, thanks to the PIMFAO project, will have means to expand it in the network. The DAMCP (Direction dedicated to community MPAs in Senegal) use it on a routine basis until 2020 in all its network of MPAs.

Nevertheless, whereas many tools have been implemented in the region over the two previous decades, to evaluate the management effectiveness of MPAs, no comprehensive study was implemented showing to what extent the present management of MPAs is effective or not. Hence, this is a task that remains, and according to us, the RAMPAO should handle it in the coming years to show the results of the efforts done by countries ad their supports.

**Table 4.4 Examples of governance assessment methods and tools**

Tool	Format
IUCN WCPA Best Practice Guidelines No. 20 Governance of Protected Areas (Borrini-Feyerabend et al., 2013)	Guidelines for both system and site level governance assessment with sample questions
Equity Questionnaire (Zafra-Calvos et al, 2019)	A prototype questionnaire developed as part of a broader research project
The IUCN Green List Standard of Protected and Conserved Areas, version 1.1 (IUCN WCPA, 2017)	Global standard on effective protected and conserved areas. The Good Governance component and other criteria assist in the assessment of protected and conserved area quality and outcomes
GAPA Governance Assessment for Protected and Conserved Areas (IIED, 2019)	GAPA is a tool for assessing the quality of governance in protected and conserved areas
ICCA Self Strengthening Process (Borrini-Feyerabend & Campese, 2017)	An ICCA resilience and security assessment, which includes governance assessment, which is done as part of a broader self-strengthening process
SAGE Site Assessment of Governance and Equity (Franks & Pinto, 2021)	SAGE is a tool for rapidly assessing the quality of governance in protected and conserved areas

Source: author's compilation



Table 4.5 Use of evaluation tools of the management effectiveness of MPAs in the area

MPA name	Assessment of management effectiveness	Number
<b>Banc d'Arguin National Park</b>	EoH: 2009 (IUCN), 2016 (IUCN); RAPPAM:2008 (IUCN), 2009 (IUCN), 2010 (RAMPAAO), 2013 (UNDP), RDV: (FIBA); 2013 (PNBA): IMET:2016 (IUCN); METT (indéterminé); RAPPAM: 2017 (Go Wamer); RDV: 2017 (Go Wamer); RDV: 2017 (FFEM);	<b>13</b>
<b>Orango National Park</b>	RAPPAM: 2007 (IUCN), METT: 2007 (IUCN); RDV 2008 (FFEM); 2010 (RAMPAAO), RDV 2011 (FIBA); 2013 (UNDP); IMET: 2016 (IUCN); RAPPAM: 2017 (Go Wamer); RDV: 2017 (Go Wamer); RDV: 2017 (Go Wamer);	<b>10</b>
<b>Bamboug Community-Managed MPA</b>	RDV: 2007 (FFEM). RDV: 2008 (FFEM). RAPPAM: 2010 (RAMPAAO), 2011 (WWF), 2013 (UNDP); RAPPAM: 2017 (Go Wamer); RDV: 2017 (Go Wamer); RDV: 2020 (DAMCP); RDV: 2022 (DAMCP);	<b>9</b>
<b>Cayar MPA</b>	RAPPAM: 2010 (RAMPAAO), 2011 (WWF), 2013 (UNDP); IMET: 2016 (IUCN); RAPPAM: 2017 (Go Wamer); RDV: 2017 (Go Wamer); RDV: 2017(FFEM); RDV: 2020 (DAMCP), RDV: 2021 (DAMCP)	<b>9</b>
<b>Managed Natural Reserve of the Tristão Islands</b>	RDV 2008 (FFEM); RAPPAM: 2008 (IUCN); METT: 2009 (IUCN); RDV: 2011 (FIBA); 2013 (UNDP); RAPPAM: 2017 (Go Wamer); RDV: 2017 (Go Wamer); RDV: 2017 FFEM);	<b>8</b>
<b>João Vieira e Poilão National Park</b>	RDV 2008 (FFEM); RAPPAM: 2007 (IUCN), 2010 (RAMPAAO), RDV 2011 (FIBA); 2013 (UNDP); RAPPAM: 2017 (Go Wamer); RDV: 2017 (Go Wamer); RDV: 2017(FFEM);	<b>8</b>
<b>Rio Cacheu Mangroves National Park</b>	RAPPAM: 2007 (IUCN), RDV 2008 (FFEM); 2010 (RAMPAAO), 2013 (UNDP); RAPPAM: 2017 (Go Wamer); RDV: 2017 (Go Wamer); RDV: 2017(FFEM);	<b>7</b>
<b>Joal-Fadiouth MPA</b>	RAPPAM: 2010 (RAMPAAO), 2011(WWF), 2013 (UNDP); IMET: 2016 (IUCN); RAPPAM: 2017 (Go Wamer); RDV: 2017(FFEM); RDV: 2020 (DAMCP);	<b>7</b>
<b>Urok Islands Community MPA</b>	RDV 2008 (FFEM); RAPPAM: 2010 (RAMPAAO), RDV 2011 (FIBA); 2013 (UNDP); IMET: 2016 (IUCN); RAPPAM: 2017 (Go Wamer); RDV: 2017 (Go Wamer);	<b>7</b>
<b>Djoudj National Bird Park</b>	EoH: 2009 (IUCN), 2010 (IUCN); RAPPAM:2009 (IUCN), 2011 (WWF), IMET:2016 (IUCN); METT (Unknown)	<b>6</b>
<b>Diawling National Park</b>	METT:2007 (IUCN); RAPPAM: 2008 (IUCN), 2010 (RAMPAAO), 2013 (UNDP); IMET: 2016 (IUCN)	<b>5</b>
<b>Saloum Delta National Park</b>	RAPPAM: 2010 (RAMPAAO), 2011 (WWF), 2013 (UNDP); IMET: 2016 (IUCN); RAPPAM: 2017 (Go Wamer);	<b>5</b>
<b>Niumi National Park</b>	RDV 2008 (FFEM); RAPPAM: 2010 (RAMPAAO), RDV 2011 (FIBA); METT: 2013 (PARCC); RDV: 2017 FFEM);	<b>5</b>
<b>Loos Islands/White Island Wildlife Sanctuary</b>	RAPPAM: 2008 (IUCN), METT: 2009 (IUCN); 2013 (UNDP); RDV: 2017 (Go Wamer); RDV: 2017 (FFEM);	<b>5</b>
<b>Saint-Louis MPA</b>	RAPPAM: 2011 (WWF), 2013 (UNDP); IMET: 2016 (IUCN); RDV: 2020 (DAMCP); RDV: 2022 (DAMCP)	<b>5</b>
<b>Palmarin Community Nature Reserve</b>	RAPPAM: 2011 (WWF); IMET: 2016 (IUCN); RDV: 2021 (DAMCP); RDV: 2022 (DAMCP)	<b>4</b>
<b>Somone Nature Reserve of Community Interest</b>	RAPPAM: 2011 (WWF); IMET: 2016 (IUCN); RDV: 2020 (DAMCP); RDV: 2021 (DAMCP)	<b>4</b>
<b>Tanji shores and Bijol island Reserves</b>	METT: 2013 (PARCC); RAPPAM: 2010 (RAMPAAO), 2013 (UNDP)	<b>3</b>
<b>Tanbi National Park</b>	METT: 2013 (PARCC); RAPPAM: 2010 (RAMPAAO), 2013(UNDP)	<b>3</b>
<b>Langue de Barbarie National Park</b>	RAPPAM: 2010 (RAMPAAO), 2011 (WWF), 2013 (UNDP)	<b>3</b>
<b>Popenguine Nature Reserve</b>	RAPPAM: 2011 (WWF),2013 (UNDP); IMET: 2016 (IUCN)	<b>3</b>
<b>Cartanhez National Park</b>	RAPPAM: 2007 (IUCN); IMET: 2016 (IUCN); RDV: 2017 (Go Wamer);	<b>3</b>
<b>Madeleine Islands National Park</b>	RAPPAM: 2011 (WWF), 2013 (UNDP)	<b>2</b>

MPA name	Assessment of management effectiveness	Number
<b>Bao Bolong Wetland Reserve</b>	METT: 2013 (PARCC); RAPPAM: 2013 (UNDP)	<b>2</b>
<b>Cap Blanc Satellite Reserve</b>	RAPPAM: 2010 (RAMPAO); IMET 2016 (IUCN)	<b>2</b>
<b>Gandoule MPA</b>	RDV: 2020 (DAMCP); RDV: 2022 (DAMCP)	<b>2</b>
<b>Kassa-Balantacounda MPA</b>	RDV: 2020 (DAMCP); RDV: 2022 (DAMCP)	<b>2</b>
<b>Niamone Kalounayes MPA</b>	RDV: 2020 (DAMCP); RDV: 2022 (DAMCP)	<b>2</b>
<b>Sangomar MPA</b>	RDV: 2020 (DAMCP); RDV: 2021 (DAMCP);	<b>2</b>
<b>Cufada MPA</b>	RDV: 2017 (Go Wamer); RAPPAM: 2017 (Go Wamer);	<b>2</b>
<b>Yawri Bay MPA</b>	RDV: 2012 (WI)	<b>1</b>
<b>Dulombi MPA</b>	RDV: 2017 (Go Wamer);	<b>1</b>
<b>Abéné MPA</b>	RAPPAM: 2013 (UNDP); RDV: 2021 (DAMCP)	<b>1</b>
<b>Santa Luzia Integral Marine Reserve</b>	RAPPAM: 2013 (UNDP)	<b>1</b>
<b>Alcatraz Integral Marine Reserve</b>	RAPPAM: 2008 (IUCN)	<b>1</b>
<b>Kaalolaal Blouf Fogny MPA (To be created)</b>	RDV: 2021 (DAMCP)	<b>1</b>

Source: Failler P Université de Portsmouth completed by Clément T Oréade-Brèche



© Julien Semelin, manatee observatory, Pointe-Saint-Georges, Senegal

## Box 4.5 Successful co-management model: the case of the Saint-Louis MPA in Senegal

The Saint-Louis Marine Protected Area (MPA) is located in the Saint-Louis division, on the seafront of the Ndiébène Gandiole councils, Gandon in the Rao subdivision (eastern boundary of the MPA), and Saint-Louis, on the Langue de Barbarie between the old mouth of the Senegal River and the fishing district of Guet-Ndar.

The Saint-Louis MPA is part of the network of protected areas managed by the Direction des Aires Marines Communautaires Protégées (DAMCP). It is one of a series of MPAs set up by decree in 2004 to resolve the thorny issue of the drastic decline in fish stocks and the degradation of marine and coastal ecosystems. It covers an area of 49,600 hectares and was created with the aim of conserving the structure, functioning and diversity of ecosystems, rehabilitating degraded habitats, improving fishing yields and the socio-economic spin-offs for local communities.

### Governance model

The current governance model is Participatory Resource Governance implemented by the State and local communities. The implementation of this model has resulted in the establishment of two governance bodies made up of:

#### 1. The General Assembly (GA)

This is the supreme body in the system of participatory management of the MPA's natural areas and resources. It is made up of all the stakeholders and players with a direct or indirect interest in the resources (stakeholders, local elected representatives, technical services, administrative, customary and religious authorities, NGOs, schools and private tourism companies, etc.). It is the body that defends the MPA's interests vis-à-vis the authorities and external users, and that considers and decides on issues that go beyond the local population's own interests, including joint investment projects. It adopts policies that safeguard the collective interests of stakeholders and takes decisions on issues that have not been resolved by other decision-making bodies. The AGM meets regularly once a year. An absolute majority of members constitutes a quorum. Decisions are taken, if possible by consensus, and if this is not possible, by a majority of the members present.

#### 2. The Management Committee (MC)

Set up in 2005, the Saint-Louis MPA Management Committee has 22 members. It is the executive body of the system and the main decision-making body for the MPA. The Management Committee implements the Development and Management Plan. It is within this body that the important issues inherent in the participatory management process of the MPA are

debated and "fine-tuned", such as surveillance, monitoring, improvements, etc., as well as the application of sanctions. It is also this body that analyses the proposals for sustainable development initiatives associated with the co-management process that will be submitted to the General Assembly. The Management Committee works in association with all those involved in the MPA. It creates the conditions for an integrated approach by providing a forum for discussion, information and reflection on the issues facing the MPA and changes in the marine environment.

Its stakeholders are: the curator, representatives of technical services at decentralised level, representatives of socio-professional categories, the local authority representative, the CRODT<sup>1</sup> representative and the press representative.

In order to improve the efficiency of its operations, an executive committee has been set up within the association, comprising a chairman, a secretary general and a treasurer and their deputies, as well as the five chairmen of the technical committees (surveillance and sustainable fishing, management of the environment and natural resources, development, awareness-raising-communication-training, conflict management).

The executive committee meets twice a month, convened by its chairman or at the request of half the members, according to a predefined agenda. Decisions are taken by a simple majority of the members present.

The Executive Board is chaired by the sector that is most representative of the MPA's stakeholders, in this case one of the MSEs involved in fishing.

Board members are elected from among the representatives of the MPA's direct stakeholders by consensus or by ballot to nominate candidates. The ex-officio members are the representatives of the stakeholders who are directly involved in the management and exploitation of the resources of the Saint-Louis MPA. They each have one vote, with the chairman having the casting vote. Advisory members take part in debates during committee sessions, but do not have the right to vote.

1 Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT)

### Box 4.6 Successful co-management model: Examples of the impact of co-management on the Saint-Louis MPA

Aissatou Niasse

The effectiveness of this governance system can be seen in its impact on resources and on relations between stakeholders. These include:

- The legitimacy and greater representativeness of stakeholder groups in decision-making bodies;
- Greater involvement and ownership of biodiversity management by local communities;
- Greater consensus on MPA management and fewer conflicts between stakeholders.

The impacts of conservation can be seen in the increase in the number of species, which rose from 89 to 120 between 2015 and 2020. This increase, which corresponds to a rate of 44.57% in 5 years, is shown in Figure 4.2.

The most abundant species are the petit capitaine (*Galeoides decadactylus* or “*Sikket mbao*” in Wolof), the ceinture fish (*Trichiurus lepturus* or “*Talar*” in Wolof), the Capitaine (*Pentanemis quinquarius* or “*Ndiao ndiao*” in Wolof) and the machoiron (*Arius heudoliti* or “*kong*” in Wolof).

Taking the families into account, the *Carangidae Selene Dorsalis* (“*Fanta mbai*” in Wolof), *Chloroscombrus Chysurus* (“*Lagne lagne*” in Wolof), *Caranx rhonchus* (“*Diai*” in Wolof), *Haemulidae*

*Pomadasys jubelini* (“*Sompat*” in Wolof), *Brachydeuterus auritus* (“*Faiour*” in Wolof), *Plectorhinchus mediterraneus* (“*Bande bounioul*” in Wolof), *Sparidae Pagellus bellottii* (“*Ouaragne*” in Wolof), *Mugilidae Liza spp* (“*Guis*” in Wolof) and *Ariidae Arius spp* (“*Kong*” in Wolof) are the best represented families.

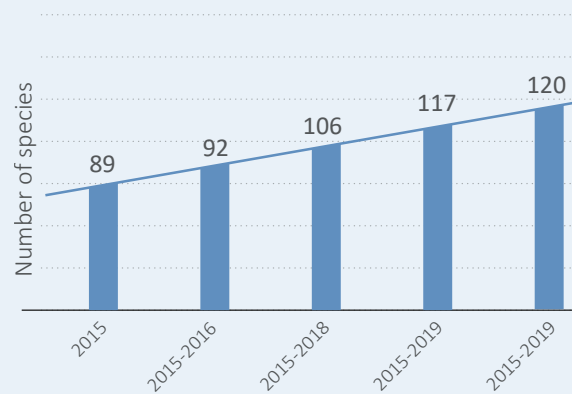


Figure 4.2 Changes in species richness in the Saint-Louis MPA from 2015 to 2020 Source: DAMCP



© Régis L'hostis, Saint-Louis MPA, Senegal

## Box 4.7 Management effectiveness scorecard for the Banc d'Arguin National Park (PNBA)

*Aissatou Niassé, Djibril LY*

In October 2017, the Management of the Banc d'Arguin National Park (Mauritania) announced the development of its very first environmental monitoring tool: the "Tableau de bord de l'efficacité de gestion du PNBA".

This tool was initiated as part of the preparation of the Park's third Development and Management Plan (PAG 2015-2019), in order to meet the objective of "providing reliable scientific knowledge that is useful for the conservation and promotion of the ecological, economic and heritage values of the PNBA", a major priority for the establishment. It also meets the Mauritanian government's commitment as a signatory to the Convention on Biological Diversity (CBD). One of the decisions adopted at the 10th Conference of the Parties in Nagoya (Japan) encouraged member states to strengthen the evaluation of the effectiveness of the management of their protected areas.

Implementation of the project effectively began in January 2016 with the creation of a steering committee made up of the institution's executives and technical advisers from the French and German cooperation agencies.

At the start of the work, a key question arose: what Type of Dashboard (ToB) do we really want? A management effectiveness scorecard or an environmental monitoring scorecard? It was decided to develop a ToB that would meet both objectives and be adapted to the challenges facing the protected area.

In the case of natural heritage, for example, the biodiversity values that led to the Banc d'Arguin being listed as a World Heritage Site were used to select the indicators (endemic marine birds, vulnerable marine species, monk seal, selachians and dorcas gazelle).

Once the ToB format had been approved, the work of developing the tool was organised into four phases:

**Phase 1:** Considering the many areas that could be monitored, the committee asked itself a number of questions to guide its thinking. The aim was to establish a hierarchy of monitoring priorities for each of the Park's areas of activity (conservation, local development, governance and management of the institution), with particular reference to the Park's missions as set out in Law 2000-24 and the guidelines set out in the 2015-2019 PAG.

**Phase 2:** In order to provide answers to these questions, around thirty knowledge summary sheets were drawn up. They provide a baseline based on scientific publications and reports produced in recent years. These summaries recall the changes that have

already taken place, and seek to identify initial situations in order to assess the effects of the Park's action.

**Phase 3:** Two workshops were organised, one to complete and validate this state of knowledge in a participatory manner and to identify priority issues, the other to identify a selection of relevant and operational priority indicators based on the issues identified.

**Phase 4:** 23 "indicator" sheets (9 for the natural heritage, 7 for the socio-economic dynamics and 7 for the governance of the PNBA) were drawn up. Each indicator was the subject of one or more sheets specifying the measurement and monitoring protocols. Finally, phase 4 gave rise to an assessment for each of the indicators, with 2016 as the reference year (to be completed - unsatisfactory, average or satisfactory). This assessment presents a fairly realistic picture of the overall management of the PNBA. This was the steering committee's main objective: to be transparent by identifying management shortcomings but also by highlighting successes.

As a result, the management effectiveness scorecard for the PNBA is a tailor-made environmental monitoring tool designed by the Park team to respond to the various challenges facing the protected area. To our knowledge, it is the first of its kind to be developed for an MPA in West Africa. The MPAs in the RAMPAO network will, if they so wish, find a concrete example from which to draw inspiration. The PNBA team is willing to share its experience.

This long-term project has received financial support from the Fonds Fiduciaire du Banc d'Arguin et de la Biodiversité Côtière et Marine (BACoMaB). It's a worthwhile investment from every point of view, because in addition to being a decision-making tool for the establishment, this dashboard is an excellent tool for sharing information.

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This is the fourth edition of the PNBA's Management Effectiveness Dashboard. The last "TdB 2020" report was not published until 2022 due to the health situation (COVID-19). Environmental monitoring is now continuing as normal. The next edition of the Dashboard will be produced in December 2023 and will enable the progress made in monitoring and managing the protected area to be assessed.

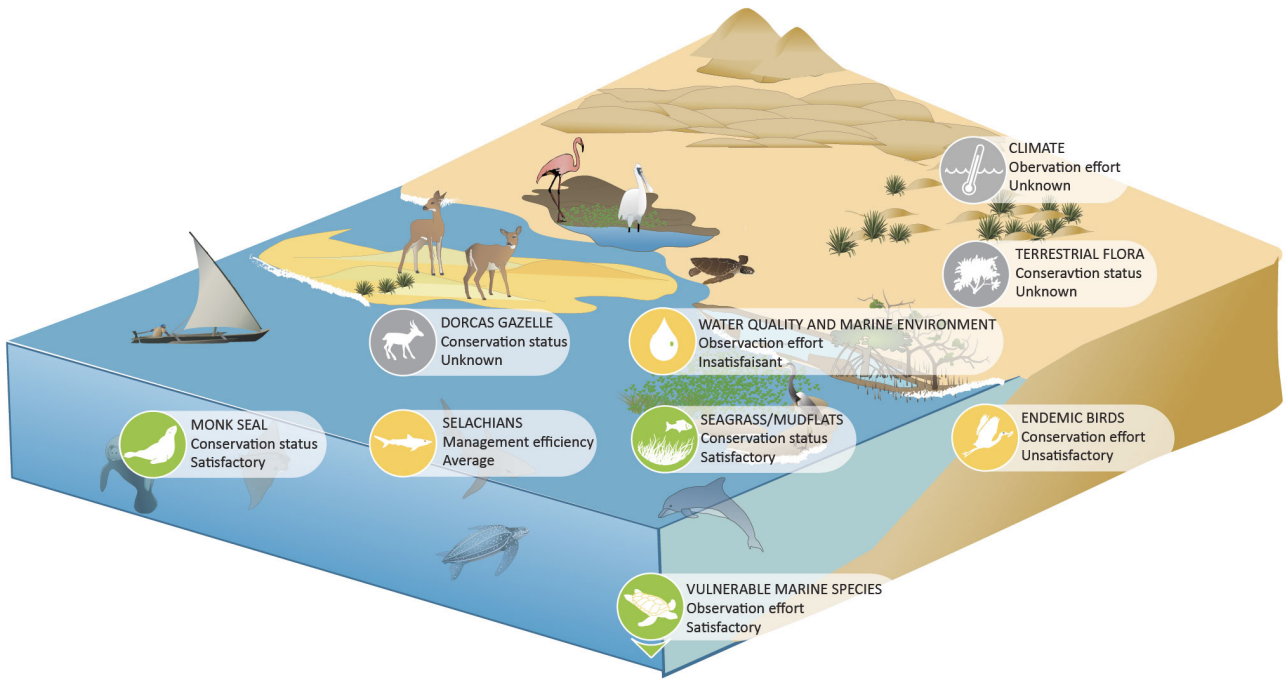


Figure 4.3 Banc d'Arguin 2020 management effectiveness dashboard. Inventory "Natural heritage" section »

Source: © Djibril LY, Amadou KIDE, Hadramy Ahmed DEIDA

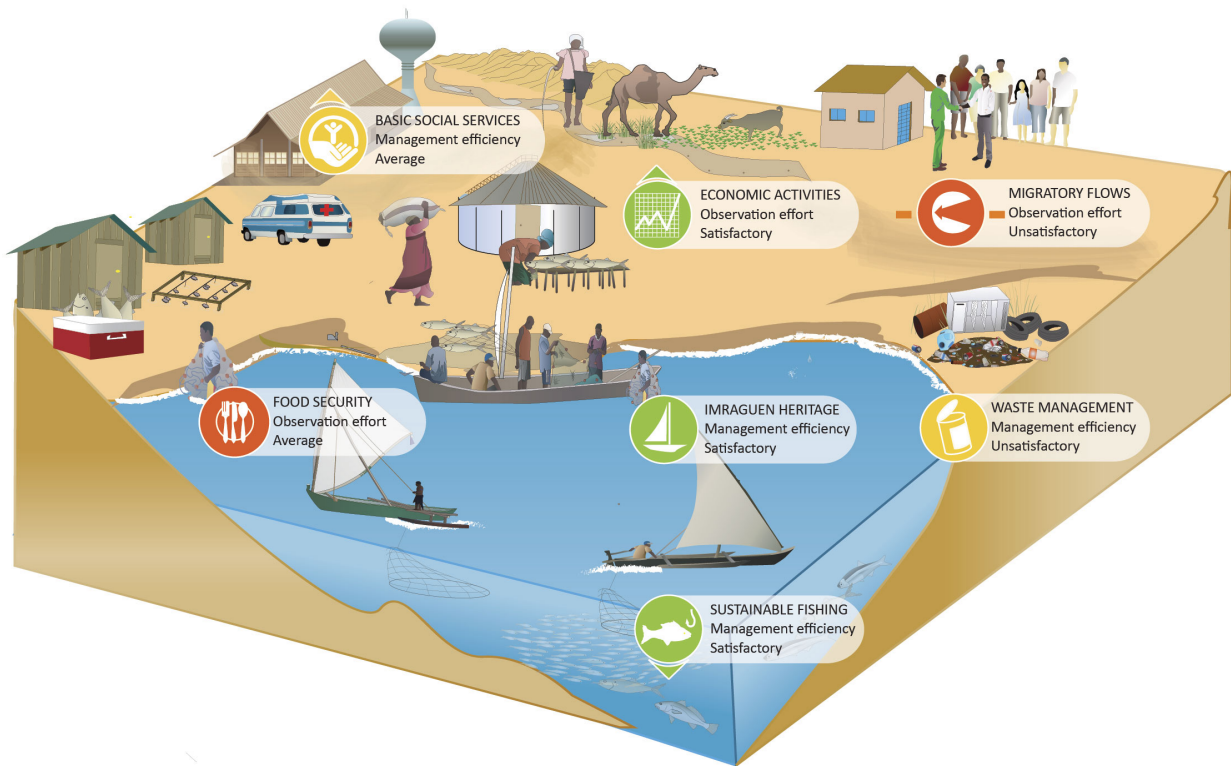


Figure 4.4 Banc d'Arguin 2020 management effectiveness dashboard. State of play "Socio-economic dynamics" section

Source: © Djibril LY, Amadou KIDE, Hadramy Ahmed DEIDA

## 4.7 Conclusion

This chapter has conducted a succinct and non-exhaustive review of the trends related to governance diversity and quality in the region.

The region appears to be characterised by government led MPAs, shared governance and some instances of reported community conserved areas. However, much needs to be done to improve reporting from national to the global level. The findings show that there are two main governance types emerging in the region, models of shared governance, that range from devolved community initiatives and shared decision-making between various levels of government. As regards MPAs, there is a need to provide data on the governance type and management category, so as to ascertain the kinds of support that the MPAs might need. In many “community-based” labelled MPAs, the organisational fragility of management bodies, the delicate coexistence between the community and governmental approach and the need for greater coherence of the fisheries governance framework at the local level are some of the main constraints. Unsurprisingly, there remains a large gulf between the guidance of the CBD and IUCN and what is happening in practice and being reported at national levels.

This lack of legal recognition is articulated by the Joal-Fadiouth MPA:

*“I am particularly proud today to see that we, the local players are recognized and respected, not only for our local and traditional knowledge, but also because we have developed our capacities and are able to sit around a table with directors, ministers and talk about MPAs in all their forms. Our main challenge is the legal recognition of local leaders and to have an adequate representation of all the actors”*

Remarkably there are not reported privately protected marine areas. With ICCAs, there is a delicate cohabitation between official structures and traditional system. While enabling legal frameworks exist in some places, there is an issue of these areas falling under public domain and limits to decentralization mechanisms to fully empower local actors.

Miguel de Barros/Tiniguena — Urok islands community MPA remarks:

*“In contexts of institutionally fragile states, the biggest challenge is the discontinuity of sectoral public policies subject to the calculations of political interests. One of the main achievements of protected and conserved areas is the inclusion of traditional and local actors and structures at the center of governance, not only as members of community site management, but above all as members with formal and public recognition of MPA decision-making spheres. This new political positioning of these important, previously neglected actors, has contributed to the continuity of co-management processes, ensuring the conservation of natural, cultural and economic heritage, as well as the vitality of the participatory governance process itself.”*

OECMs remain relatively less well known both in terms of their contribution to marine conservation, and what kind of recognition and support they would need. This demonstrates a gap or opportunity for further research and inquiry.

Overall, progress has been made in recent years in terms of diversifying the governance types of MPAs in West Africa; the main challenge remains the establishment and maintenance of governance quality, with appropriate mechanisms that are not only legitimate and useful, but also adapted to the context.

The « rose des vents » radar and the RAPPAM were the most commonly used tools in the area to measure the management effectiveness of MPAs. nevertheless, whereas many tools have been implemented in the region over the two previous decades, to evaluate the management effectiveness of MPAs, no comprehensive study was implemented showing to what extent the present management of MPAs is effective or not. Hence, this is a task that remains, and according to us, that the RAMPAO should handle in the coming years to show the results of the efforts done by countries and their supports.



© Régis L'hostis, salt wells, Palmarin Community Nature Reserve, Senegal





*Régis L'hostis, ecotourism campsite, Banc d'Arguin National Park, Mauritania*



## Chapter 5

# Sustainable financing mechanisms for West African marine protected areas

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This chapter outlines the different types of public and private financing deployed in the region or likely to be deployed, as well as the sources of funding from economic activities that can support this funding.

It also provides a series of recommendations based, among other things, on a study carried out within the framework of the project titled “Small initiatives and financial mechanisms for the conservation of marine and coastal biodiversity in West Africa” (PIMFAO) on the financing needs of MPAs in the West of the area, co-funded by the Fonds français pour l’environnement mondial (FFEM) and MAVA Foundation.

## 5.1 Introduction

West Africa's marine and coastal ecosystems are of global importance (OECD, 2018). Indeed, they play an essential role in the well-being of populations through the ecosystem services they provide (Kabelong, 2019; Marcos et al., 2021). They also play an important role in maintaining regionally and globally threatened biodiversity. These ecosystems are home to flagship ecosystems and species, namely sea turtles, seals, a diversity and abundance of fish species, migratory birds and mangroves (OECD, 2018).

These ecosystems are also of immense value to local economies and livelihoods. Fishing activities contribute to Gross Domestic Product (GDP), provide livelihoods to fishers and processors, are a source of hard currency (from exports of fish products) and increase government revenue through fisheries agreements and taxes (de Graaf and Garibaldi, 2014). In addition, fish contributes at least 20% of total animal protein intake in West African coastal countries (FAO, 2009).

The creation of protected areas (PAs) for conservation purposes restricts human activities, such as the exploitation or extraction of natural resources, within the targeted ecosystems (Bohorquez et al., 2019). PAs can therefore preserve biodiversity in key areas, allow degraded ecosystems to restore themselves and increase resilience to climate change impacts (O'Leary et al., 2018). The growing popularity of PAs in recent decades is evidenced by the multiple global initiatives that have come into effect to expand their area around the world. These different initiatives generally have distinct objectives for marine protected areas (MPAs) and Terrestrial Protected Areas (TPAs). Aichi Target 11, set in 2010 under the Convention on Biological Diversity (CBD), aimed to protect 10% of oceans (in Exclusive Economic Zones or EEZ) and 17% of land by 2020. Following the CBD goals, the United Nations has set a goal of conserving 10% of all oceans by 2020 as part of Target 5 of SDG 14. IUCN has recommended an additional long-term goal of protecting 30% of the oceans by 2030. In comparison, TPAs coverage goals have a particularly long history spanning several decades, including the IV Congress of Parks under the aegis of the IUCN in 1992 which aimed to have 10% of each biome protected by 2000 (IUCN, 1993).

PAs provide diverse ecosystem services to local, national and global populations (Bruner et al., 2004). The latter play a fundamental role in the conservation of biodiversity but also have become an indicator of sustainable development efforts (Mansourian and Dudley, 2008). PAs are home to threatened species, specific ecosystems or rare environments and help preserve these environments in a relatively intact and sometimes natural state. PAs also provide many goods and services for many communities, for medicine, food and shelter, as raw materials for subsistence use or sale. They provide environmental services such as nutrient recycling, soil stabilization, water filtration, carbon dioxide absorption, etc. As global attention focuses on climate change, it should be noted that protected forest areas, which represent more than 40% of the world's heritage of protected areas (Chape et al., 2003), constitute a considerable source of carbon. Thus, in the context of climate change, improving the management of these protected areas is a subject that is attracting more and more interest worldwide.

### Box 5.1 “Financing gap or deficit”

Studies carried out between 2010 and 2014 allow us to estimate that the total national public funds paid to the MPAs of the RAMPAO network is estimated around 900 000 €/year. It would be necessary to update these estimates and compare them to the total needs of the MPAs in the network. It is clear that at present, public funding, although essential, does not provide the necessary means to develop and effectively manage MPAs.

In a context based on project or programme management and in a context of absence of an information centralization mechanism, it is difficult to determine the gap in terms of financing, but evaluations exist on the APTs. The definition of the amounts, coming from the national authorities, received by the MPAs, the comparison of public funding country by country and the invitation to all member states of the MPA networks to provide greater efforts remain essential for the years to come, in order to strengthen and secure the quality of conservation in and around MPAs in the region.

*Source: Diouf, 2014*

Despite the growing interest and multiplication in number and area of MPAs and TPAs observed in Africa, these essential tools for conservation face increasingly scarce financial resources. The analysis of total costs per unit area of MPA, benefiting from an effective management, varies according to some criteria, among which the geographical situation and the local communities located in the area of the MPA. In the Mediterranean, for example, the sum of current expenditure plus the estimated gap ranging from €933 per km<sup>2</sup> per year to almost €79,327 per km<sup>2</sup> per year, with an average of €25,784 per km<sup>2</sup> per year (Binet et al., 2015). These amounts also vary depending on the level of the country. In West Africa, there is a lack of data on the values related to the MPAs financing gap. A recent project funded by the FFEM titled “Small initiatives and financial mechanisms for the conservation of marine and coastal biodiversity in West Africa” has provided data on key information related to the state of funding MPAs in the sub-region and to propose varied and innovative solutions to secure/sustain this funding. Indeed, funding for MPAs comes from multiple sources, and it is difficult to have an overview of the situation. RAMPAO has a key role to play at this level, for the benefit of all its members, beneficiary countries as well as technical and financial partners.

Despite the commitment and the asserted will of the states, the establishment of a network of protected areas requires long-term political and financial commitments that go well beyond the simple declaration of the creation of PAs (Hockings et al., 2000). For protected areas to be managed effectively, they must be integrated into long-term planning and financing strategies.

At present, while parties to the CBD have expressed a willingness to improve their protected area networks, these often remain underfunded. This underfunding can be explained by various factors, including the lack of resources in sub-Saharan African countries, the lack of a real strategy for funding protected areas, the lack of



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adoption of effective methods and tools that can support current mechanisms, etc. Without sufficient funding, MPAs cannot achieve their biodiversity conservation objectives and provide the inherent ecosystem goods and services, thus contributing to the well-being of the local populations.

Studies carried out on a global scale show that, for most countries in Africa and Latin America, there is a financing deficit for TAs systems. Indeed, the demand for funding in most national PAs systems far exceeds the supply of funding. This gap is set to increase over time, particularly in African and Latin American countries.

Despite the lack of sufficient funding for the sustainable management of PAS systems, conservation actors are working to implement instruments to fill the gaps. Instruments intended to provide financial

support to PAs and/or PAs systems include the Conservation Trust Funds implemented in Africa in the early 2000s. These instruments use a variety of funding mechanisms, including, endowment funds, sinking funds, revolving funds or debt-for-kind swaps. There are also other mechanisms such as internationally funded projects, public budget allocations, taxes, park revenues, etc. These different mechanisms are described later.

## 5.2 Study on the development of business plans for RAMP AO's marine protected areas (April 2022)

To support these conservation efforts, RAMP AO aims to provide users and managers of MPAs with financial planning tools, through the project titled "Small initiatives and financial mechanisms for the conservation of marine and coastal biodiversity in West Africa (PIMFAO). Co-financed by the French Facility for Global Environment (FFEM) and the MAV A Foundation, the PIMFAO project aims to preserve and strengthen the resilience to climate change of marine and coastal ecosystems in the region, through the consolidation of RAMP AO, technical and financial support to member MPAs and the promotion of sustainable financial mechanisms to guarantee the financial sustainability of conservation activities. The development of business plans for the MPAs of The Gambia, Guinea Conakry, Guinea-Bissau, Mauritania, and Senegal falls within this framework and aims to consolidate the financial data available at the level of each MPAs, to determine the sources of existing funding, and to plan medium and long-term financial needs to ensure realistic management and development of MPAs. The following 37 MPAs were concerned by this budget planning exercise in West Africa.

The budget planning was based on a realistic scenario corresponding to the financial needs necessary for the proper implementation of the Development and Management Plans (DMPs) of these 37 MPAs. Insofar as some of the MPAs included in this financial planning work presented either an outdated or non-existent DMP when this work was carried out, the financial planning was based in these cases on hypotheses of future objectives stated by the managers regarding the various past or current objectives not formalized in a DMP. Funding needs to achieve these objectives and activities have been identified and analysed. The financial needs have been defined for 10 years, from 2021 to 2030. To date, this study is the most comprehensive on the financial needs of MPAs. Although it is limited to 37 MPAs in 5 countries, it can be considered to be very representative of the region.

### Summary of MPA costs (as part of the PIMFAO study)

The total average annual expenditure for these 37 MPAs over 2021-2030 is over 13 million euros. Average annual expenditure varies from one country studied to another. There is also a strong disparity from one country to another, with average annual costs per MPA varying between 62,050 euros in The Gambia, 129,000 euros in Guinea Conakry, 247,167 euros in Senegal, 2,453,485 euros in Mauritania and 482,247 euros in Guinea-Bissau and annual costs per country which vary between 310,000 euros in The Gambia (for 5 MPAs), 645,000 euros in Guinea Conakry (5 MPAs), 2.4 million euros in Guinea-Bissau (5 MPAs), and 4.9 million euros in Mauritania (2 MPAs) and Senegal (20 MPAs).

There is also a significant disparity in cost per hectare, including between the MPAs of each country. These costs per hectare are inversely proportional to the surface area of the MPAs, with:

Table 5.1 MPA budget planning exercise

Pays	AMP
<b>Gambie</b>	Réserve de Zones Humides de BAO BOLONG
	Réserve communautaire de faune de BOLONG FENYO
	Parc national de NIUMI
	Parc national des Zones Humides de TANBI
	Réserve Ornithologique de TANJI
<b>Guinea-Bissau</b>	Parc naturel TARRAFES de CACHEU
	Parc national marin JOÃO VIEIRA E POILÃO
	Parc national ORANGO
	Parc national CANTANHEZ
	Aire marine protégée communautaire des ÎLES UROK
<b>Guinea</b>	Sanctuaire de faune des ÎLES DE LOOS
	AMP de KONKOURE
	Réserve naturelle gérée de RIO KAPATCHEZ
	Aire protégée du RIO PONGO
	Réserve naturelle gérée des ÎLES TRISTÃO et ALCATRAZ
<b>Mauritania</b>	Parc national du BANC D'ARGUIN
	Parc national du DIAWLING
<b>Senegal</b>	AMP de JOAL-FADIOUTH
	AMP de SANGOMAR
	AMP de CAYAR
	Réserve naturelle de POPENGUINE
	Réserve naturelle communautaire de PALMARIN
	AMP de GOREE
	Parc national des ÎLES DE LA MADELEINE
	Réserve naturelle urbaine de la GRANDE NIAYE de PIKINE et DEPENDANCES
	AMP de la SOMONE
	AMP D'ABÉNÉ
	AMP de KAALOLAL BLOUF-FOGNY
	AMP de GANDOULE
	Parc national de la BASSE-CASAMANCE
	Parc national de la LANGUE de BARBARIE
	Parc national du DELTA du SALOUM
AMP de SAINT-LOUIS	
AMP NIAMONE-KALOUNAYES	
AMP de BAMBOUNG	
Réserve ornithologique de KALISSAYE	
AMP KASSA-BALANTACOUNDA	

- Relatively high costs per hectare for small MPAs: example of the Iles de la Madeleine National Park in Senegal with an average annual cost per ha of 4,606 euros for an area of 45 hectares, the Community Wildlife Reserve of Bolong Fenyo in Gambia with an average annual cost per ha of 1,594 euros for an area of 32 ha, or the managed Nature Reserve of Kapatchez in Guinea Conakry with an average annual cost of 7,198 euros for an area of 20 ha.
- Much lower costs per hectare for large MPAs: example of AMPKBF and Sangomar in Senegal with average annual costs per ha of 2.7 euros and 2 euros respectively for total areas of 83,873 ha and 87,437 ha respectively, the Konkoure MPA and the Tristão and Alcatraz Islands Managed Nature Reserve in Guinea with average annual costs per ha of EUR 1 for total areas of 90,000 ha and 85,000 ha respectively, or the PNBA in Mauritania with a average annual cost per ha of 3.4 euros for an area of 1,200,000 ha.

The two most important budgetary items for these 37 MPAs are the wage bill (44% of the total needs of the 37 MPAs over the period of interest) and the expenditure linked to activities specific to the development and management of MPAs (development, ecological monitoring, research, functioning of management bodies, capacity building, partnerships, education & communication, development of natural resources, income-generating activities, or even ecotourism), representing 30% of the total needs of the 37 MPAs over the period of interest. The distribution of the main items of expenditure varies from one country to another.

### Main existing revenue

The main recipes are as follows:

- Public funding through state grants in the countries concerned, with the payment of the salaries of agents by the public service,

as well as the provision of annual operating budgets. The budget is estimated to increase, from 3.5 million euros in 2021 to 5.96 million euros in 2030.

- External funding through donor funding, which is relatively high until 2024 and then declines substantially.

Self-financing is mainly observed for MPAs in Senegal and those in Mauritania. This self-financing corresponds to tourist income (entrance fees with distribution key in place), or the collection of taxes (tax/royalty on tourist infrastructures, on beekeeping activities, share of fines resulting from infringements of artisanal fishing) As a general rule, this self-financing represents a limited percentage of an MPA's income (maximum 20 to 25%) and the probability that this percentage will increase is relatively low. A feasibility study specific to these self-financing mechanisms could be carried out in each country to assess the growth potential of these sources of financing.

Other funding mechanisms are relatively limited. They include income from trust funds, the Banc d'Arguin trust fund and coastal and marine biodiversity in Mauritania (BAcoMaB Trust Fund) essentially (possible future funding for BioGuinée in Guinea-Bissau is not known) or donations and contributions from local authorities (which could also be counted as self-financing).

Public funding remains, for its part, the most sustainable source of funding, and is expected to increase over the next few years. Other self-financing and partnership mechanisms should continue to be put in place over the long term to ensure the sustainability of the funds obtained, especially if the public funding mobilized turns out to be lower than estimated.

In some countries (the Gambia and Guinea), there is currently no funding diversification for MPAs.



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## Findings

The financing gap to be filled to achieve the conservation objectives established in the management and development plans of the RAMP AO network's MPAs is around 6 million euros over the 2022 – 2030 period (based on business plans carried out for 37 MPAs in West Africa). The financing gap is relatively stable over time and represents about 45% of the total annual budget of these MPAs. **It is therefore necessary to initiate the implementation of effective financial strategies in order to sustainably reduce this funding gap for marine conservation in West Africa.**

To reduce this financing gap, a three-level financial strategy must be developed:

1. At the local level (MPA scale), managers should be able to:
  - a. Reduce and optimize their costs.
  - b. Develop clear advocacy and communication documents, based on the business plan, to convince donors to fund their activities.
  - c. Build skills in drafting responses to calls for projects, in order to diversify their sources of income.
  - d. Set up self-financing mechanisms complementary to current sources of financing, to diversify their income. Feasibility studies, at the local or national level, must be carried out to estimate the relevance of the implementation of certain mechanisms (particularly, in connection with tourism) according to the contexts.
2. At the national level (at the scale of the MPA network within a given country), the national authorities in charge of MPAs management must:
  - a. Use as an advocacy tool the financial information of the national network of MPAs consolidated in the national business plans, which make it possible to obtain precise and detailed data on the national financing gap for marine conservation and update them on a regular basis.
  - b. Promote and supervise the implementation of national projects allowing the pooling of the costs of the network of national MPAs and the achievement of substantial donor budgets.
  - c. Conduct feasibility studies related to the creation of national trust funds for the strengthening of MPAs, following the example of BACoMaB in Mauritania.
  - d. Increase the budgets allocated to MPAs, in particular by following the trend curve of increase in human resources dedicated to marine conservation.
3. At the regional level (at the scale of the RAMP AO network), it will be necessary to:
  - a. Promote the development of regional financing mechanisms, such as “blue carbon” financing for the conservation of mangroves and conduct a feasibility study on the development of such financing mechanisms.
  - b. Conduct a regional feasibility study on the possible self-financing mechanisms to be promoted, based on a capitalization of the self-financing mechanisms in place at the local level.
  - c. Bring the voice of the regional network to international donors, through clear advocacy based on national business plans.



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### 5.3 State funding

West African government budgets are a significant source and can be a major source of funding for MPAs. States are struggling to mobilize funding internally for the conservation of biodiversity. The situation varies from one country to another, but the reasons for the weak mobilization are diverse. Indeed, States have many priorities in terms of social, infrastructure, security, etc. To this end, the budgets allocated for MPAs are for the most part insufficient and represent a minimal portion of funding.

The analysis of the available data, which however remains very difficult to obtain, shows that the national budgets allocated to the conservation of biodiversity in general vary from one country to another and from one year to another (Table 5.2). The minimum national budget granted in 2020 is US\$ 0.261 million for Togo and the maximum value is US\$ 9 million by Mauritania. Côte d'Ivoire has allocated about US\$ 2 million, or about 0.01% of its annual budget in 2020.

Despite the fact that public resources are not high, they represent an important source in terms of total figures, and a secure and long-term source of financing. The three fundamental concerns regarding PAs funding are: total amount, governance and sustainability of funding. In this regard, government funds can provide a “security blanket” for PAs. But these budgets allocated by the States represent a small proportion of the financing needs.

**Table 5.2 Public budget allocated to PAs conservation**

Country	Protected areas	Budget MUS\$ (Year)	Most recent budget MUS\$ (Year)
Togo	All protected areas	0.090 909 (2015)	0.261698 (2020)
Côte d'Ivoire	All protected areas	30.44 (2015)	2 (2020)
Guinea	All protected areas	2.3 (2015)	2.02 (2020)
Mauritania	All protected areas	8.45 (2015)	9 (2020)

Source: (CBD, 2021 and Survey, 2021)



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## 5.4 Funding of non-government organisations (NGOs)

Non-governmental organisations (NGOs) have for some years become key players in the sustainable management of biodiversity and natural resources through their technical and financial support. The financial flows of NGOs are difficult to estimate due to the diversity of actors, but also due to the lack of coordination at national and regional level which should help in the centralization of data. However, Central and West Africa has received a lot of funding from NGOs. Apart from funding from philanthropic organizations, most funding from NGOs comes from funds from bilateral or multilateral partners, led by the Global Environment Facility (GEF), the European Union, the World Bank and the KFW (establishment of German public reconstruction credit law).

In West Africa and particularly for MPAs, several NGOs provide funding in the start-up or creation phase of these PAs, but once the MPAs have been created, operating funding remains difficult to mobilize. Funding flows mobilized by NGOs are difficult to quantify although some data exist. However, this funding is mobilized within the framework of projects and programs, which has a limited impact over time.

This type of financing (“short-term project approach”) by international organizations makes it possible to cover the costs of certain specific projects. It seems important to anticipate and forecast which current donor funding can be renewed/secured, but also to identify new funding from donors who are not yet involved in funding marine conservation in the region.

## 5.5 Conservation Trust Funds (CTFs)

Conservation Trust Funds (CTFs) are defined as “private, legally independent grant-making institutions that provide sustainable financing for biodiversity conservation”. They often fund part of the long-term management costs of a country’s PAs system as well as sustainable development initiatives outside of PAs. CTFs raise and invest funds, leverage them in international markets, and provide grants to NGOs, community-based organizations, and government agencies (such as a national park management committee) or other conservation stakeholder.

There are three different types of funds:

- Endowment Fund: The capital is invested in perpetuity.
- Sinking Fund: Capital and interest are disbursed over a fairly long period.
- Revolving Fund: Income regularly replenishes the fund.

Trust funds are independent, non-governmental, local biodiversity conservation funding structures from private institutions that pool public and private funding for NGOs, community-based organizations and/or government agencies. Faced with the difficulties linked to the financing of PAs in Africa, several financing mechanisms have emerged, including trust funds. In 2014, there were about 60 biodiversity conservation trust funds around the world. At the origin of these funds, a triple ambition: (i) generate sufficient funds for the protection of nature, (ii) make them more predictable and sustainable, (iii) create viable and local conservation institutions, breaking with the “foreign” monopoly on conservation funding (Alvarez et al., 2014). In 2011, these funds would have mobilized more than 800 million euros of capital, including more than 100 M€ for African environmental funds. These funds have mobilized sustained and considerable resources for the conservation of biodiversity for several years.

Table 5.3 Example of trust funds in Africa

Foundations	Budget mobilised	MPAs	Country
BioGuine Foundation	US\$ 26.977.7 trillion	Doulombi – Boé – Tchéché complex	Guinea-Bissau
Foundation for Parks and Reserves of Côte d’Ivoire (Fondation pour les Parcs et Réserves de Côte d’Ivoire or FPRCI)	US\$ 37.47 million (2016)	14 national parks and nature reserves	Côte d’Ivoire
West African Savannah Foundation (Fondation des Savanes Ouest Africaines or FSOA)	US\$ 25.97 million	Pendjari and W National Parks in Benin, and Arly and W National Parks in Burkina Faso.	Benin
Banc d’Arguin and Coastal and Marine Biodiversity Trust Fund (BACoMaB)	US\$ 13,399,642.78 (2014) US\$ 21,399,642.78 (2015) US\$ 21,399,642.78 (2016)	Banc d’Arguin National Park (PNBA), Diawling National Park (DNP) and Civil Society Organisations	Mauritania

Source: Kabelong et al., 2021



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## Box 5.2 BACoMaB: A sustainable financing mechanism for MPAs in Mauritania

Ahmed Lefghih

The Banc d'Arguin and Coastal and Marine Biodiversity Trust Fund (BACoMaB) is a sustainable financing mechanism created in 2009 to preserve the exceptional natural and human capital of the Mauritanian coastline and sea. Its objective is to guarantee sustainable financing of the recurring costs of the conservation of Marine and Coastal Protected Areas.

Like many Conservation Trust Funds, BACoMaB is a Foundation under English law, recognized as a "Charity" in the United Kingdom, with a headquarters agreement allowing it to carry out its activities in Mauritania, where it has been recognized as being of public utility since December 2010.

The BACoMaB's current capital (32.6 million euros) comes from the sectoral support of the fisheries agreements between the Mauritanian State and the EU (3.1 million euros), the Swiss MAVA Foundation (6 million euros), the German Financial Cooperation through KfW (15.2 million euros), and the French Global Environment Facility FFEM and the French Development Agency (AFD, 8.3 millions of euros).

The financing of biodiversity through fishing agreements with the EU constituted a pioneering example making it possible to mobilize so far more than € 3 million for the benefit of the BACoMaB in addition to the direct financing granted to AMP. This support is called to continue under the new fisheries agreement.

This capital is invested in ethical and socially responsible financial markets, generating profits which will be used to finance, in the form of grants, conservation and destruction activities . sustainable development of the Banc d'Arguin National Park (PNBA), the Diawling National Park (PND), the Monk Seal Conservation Program (PCPM) and marine and coastal areas in Mauritania.

Investment income makes it possible to finance the essential activities of the MPAs, the operation of the BACoMaB and the constitution of reserves to cope with disruptions in the financial situation. On all beneficiary sites, the activities subsidized by BACoMaB aim to:

- Promote the conservation, protection and improvement of the physical and natural environment.
- Promote sustainable development.
- Promote the education of populations in the field of biodiversity, conservation and sustainable management.

BACoMaB also aims to promote transparency, financial accountability and governance of protected areas. The first grants were awarded to the PNBA in 2014 and the cumulative amount of funding granted until 31 December 2021 will reach

over 3.1 millions of euros. The financed activities concern: maritime surveillance, shared governance, the observatory and the Scientific Council of the PNBA; ecological restoration and monitoring of the PND; and support for local initiatives in parks and monk seal conservation. These amounts are expected to increase with the increase in capital returns to achieve a target of 1 million euros per year, or around 90 % of estimated needs.

The added value of BACoMaB consists of guaranteeing a regular and permanent financial flow which makes it possible to cover an increasingly significant part of the recurring costs of conservation. To this end, it contributes to perpetuating essential surveillance, research, monitoring and monitoring activities and to improving the governance of beneficiaries.

of MPAs, the eligibility criteria examined regularly allow us to have a fairly clear vision of the technical and financial management tools and the overall governance of the institutions. Furthermore, the grant application, resource management and monitoring-evaluation tools put in place by BACoMaB make it possible to standardize procedures and ensure greater transparency.

Among the objectives assigned to the BACoMaB figures the creation of a network of marine protected areas representative of the exceptional biodiversity of the Mauritanian sea through the carrying out of technical studies and advocacy with the authorities national authorities and other stakeholders. In this context, a study was launched in 2022 in order to update the national strategy of marine protected areas and to identify new areas of biological interest likely to be erected as MPAs. \_ Such an approach should make it possible to conserve critical sites for biodiversity and fisheries resources such as the upwelling cell and cold water coral reefs.

Finally, BACoMaB carried out an evaluation of the ecosystem services provided by the Banc d'Arguin, which made it possible to arrive at a partial estimate of the economic and ecological values of this site . This study showed that the conservation of this site made it possible to provide ecosystem services whose economic value was of great importance for Mauritania, the region and the planet. This concerns in particular the reproduction and nursery of fish and vulnerable species (turtles and seagrasses) as well as the sequestration of carbon thanks to seagrass meadows.

In conclusion, BACoMaB has made it possible to strengthen the conservation of Mauritania's MPAs by providing them with increasingly significant funding for essential surveillance, ecological monitoring and monitoring activities. He also contributed to strengthen their governance and the effectiveness of their management with the establishment of appropriate and transparent management procedures and tools. He finally contributed to the emergence of environmental education and a partnership with civil society interested in marine biodiversity.

### Beneficiary sites (current and future) of BACoMaB funding

#### **The Cap Blanc Satellite Reserve and the Seal Coast Reserve**

- These two sites constitute a refuge of almost 2 km<sup>2</sup> for the largest colony in the world, and the only structured population of monk seals, a species in critical danger of extinction.

**Offshore and Deep-Water Ecosystems** -The seabed near the continental slope hosts fragile assemblages of deep - sea corals and sponges, as well as the largest barrier of coral mounds longest in the world. These are fragile ecosystems, which play a primordial role in the reproduction and protection of marine resources. These sites were identified by a scientific report which recommends the creation of a string of protected areas representative of all environments in the EEZ. They currently have the status of Areas of Interest for Biodiversity and are the subject of a study on the identification of new marine protected areas, financed by AFD and supported by BACoMaB and the Ministry of the Environment.

**Baie de l'Étoile in Nouadhibou** -This shallow lagoon colonized by eelgrass beds communicates with a deep valley forming a river, covered with meadows of cordgrass. The entire site constitutes a very favourable environment for seabirds, waders, fish and marine mammals. The classification of this site, threatened by urbanization, has been recommended for several years and has been relaunched since 2018.

#### **The Banc d'Arguin National Park (PNBA)**

- Created in 1976 and listed as a UNESCO World Heritage Site in 1989, the PNBA is one of the largest marine protected areas in Africa . It covers almost a third of the coastline of Mauritania with an area of 12,000 km<sup>2</sup>, including 5,400 sailors. This site is home to many species of fish and crustaceans and is home to more than two millions of migratory birds. It is a refuge for emblematic threatened species such as the monk seal, the humpback dolphin, sea turtles, or the Dorcas gazelle. Its shallows, mudflats and seagrass beds give it a unique ecological value. The quantified economic valuation of the services provided by these ecosystems is estimated at nearly 200 million euros per year. The park is also the territory of traditional Imraguen fishermen.

#### **Diawling National Park (PND)**

- Since the creation of the Park in 1991 and the establishment of hydraulic infrastructures allowing the restoration of estuarine functioning, the Diawling National Park is a mosaic of diversified natural environments, which play a capital role in the migration of marine and estuarine species of fish and crustaceans . It is also home to more than a hundred species of water and migratory birds, including large colonies of nesting flamingos, cormorants, spoonbills and pelicans , as well as mammals, and numerous reptiles.



© Régis L'hostis, ecotourism campsite, Banc d'Arguin National Park, Mauritania

## 5.6 Resources generated by marine protected areas

The resources generated by marine protected areas (MPAs) are essentially linked to tourism. These mechanisms, which can take several forms (entrance fees, concessions for tourist activities, etc.) represent a significant financial windfall in areas with strong tourist appeal. Considering the exchanges with the various managers, it seems that at present the cost/benefit ratio of the implementation of such mechanisms is not optimal for the RAMPAO network's MPAs. Nevertheless, an in-depth analysis of the future development of the tourism sector in the countries concerned, as well as the use of tools for the implementation and analysis of self-financing mechanisms, could make it possible to anticipate future trends. Even if the current context does not lend itself to it, it is important to carry out these reflections upstream, the establishment of such mechanisms taking several years and generally requiring significant advocacy work.

### 5.6.1 Tourism

The global tourism industry had a remarkable growth rate before the Covid-19 health crisis (WTTC, 2020). It contributed 5.8% of all exports and 4.5% of global investments (Christie et al., 2013). However, in 2020, Covid-19 halted this improvement and tourism fell sharply everywhere (UNWTO, 2020a; WTTC, 2021). Various recovery strategies are being considered, the effectiveness of which can only be measured in a few years.

Africa represents about 22% of the earth's surface. But 10 years ago, it received about 4% of international arrivals worldwide for 15% of the world's population. Currently, its share in international tourism has dropped to around 2% while its population now contributes around 19% to the global total (IUCN-PACO, 2010; WTTC, 2020).

Income from tourism highlights the potential of African countries. Countries such as Côte d'Ivoire, Cabo Verde and Senegal have passed the US\$ 500 million mark in tourism-based income. Ghana and Nigeria, on the other hand, have exceeded US\$ 1 billion in tourism revenue (Table 5.5). But there is a great lack of engineering

to attract traditional tourists to ecotourism to boost the income of MPAs and TPAs.

Despite increasingly rising tourism figures, ecotourism does not mobilize as much as traditional tourism. In many protected areas in West Africa, the number of annual visitors does not exceed one hundred people. The weakness of these figures is due to various factors such as the lack of States commitment, the remoteness and the state of deterioration of the communication routes, the non-existence of infrastructures and reception and guide personnel, non-existent marketing, even security problems (Doumenge et al., 2021). Africa also suffers from its image disseminated through the international media, from the lack of reputation and tourist products, tourist culture, infrastructures and reception capacities.

Since the beginning of 2000, the number of visitors to the three Rwandan parks has increased from 3,800 to more than 110,000 tourists, and tourism receipts have jumped from 300,000 to nearly US\$ 29 million (AFN, 2020). Much of this revenue comes from the Volcanoes National Park and gorilla viewing tourism (Doumenge et al., 2021). Many visitors also appreciate the savannah and the large fauna of the Akagera Park: the latter welcomed more than 49,500 visitors in 2019, for record revenues amounting to US\$ 2.5 million; a new luxury lodge was opened that year, further increasing the park's appeal. These revenues make it possible to self-finance the operation of the park up to 90% (APN, 2020).

In Côte d'Ivoire, the protected areas RN Dahliafleur, RN Aghien, RN Mabi-Yaya PN Banco, PN Azagny, PN Iles Ehotilé generated around US\$ 5,500 (Kabelong et al., 2021).

### 5.6.2 Entrance fees

Visitor fees may be charged to visitors of a marine protected area. They include entrance, boat or mooring fees, as well as fees for specific recreational activities such as diving or snorkelling, levied on all visitors. These fees are either collected directly by the services of the MPA, or indirectly by third parties, such as tourist operators who collect the fees from visitors and pay them to the MPA.

Table 5.4 Number of tourists travelling to Central and West African countries

Country	2015	2016	2017	2018	2019
Benin	279 000	292 000	307 000	322 000	337 000
Côte d'Ivoire	1 441 000	1 583 000	1 800 000	1 965 000	2 070 000
Cabo Verde	520 000	598 000	668 000	710 000	758 000
Ghana	897 000				
Guinea	35 000	63 000	99 000		
Guinea-Bissau	43 800	45 200	49 500	55 000	52 400
Nigeria	6 017 000	5 265 000			
Senegal	1 014 000	1 219 000	1 376 000		
Sierra Leone	31 000	60 000	59 000	66 000	71 000
Togo	273 000	338 000	514 000	573 000	876 000

Source: World Tourism Organization Yearbook of Tourism Statistics, Compendium of Statistics and Data Files, 2021

Table 5.5 Tourism-generated income in different countries (in USD)

Country	2015	2016	2017	2018	2019
Benin	148 000 000	129 000 000	160 000 000	175 000 000	
Côte d'Ivoire	214 000 000	477 000 000	509 000 000	566 000 000	
Cabo Verde	380 000 000	397 000 000	451 000 000	520 000 000	567 000 000
Ghana	911 000 000	952 000 000	919 000 000	996 000 000	1 490 000 000
Guinea	27 000 000	16 600 000	16 600 000	4 700 000	10 400 000
Guinea-Bissau			16 440 001	20 000 000	
Mauritania	31 000 000	33 000 000	24 000 000	6 000 000	13 700 000
Nigeria	461 000 000	1 088 000 000	2 615 000 000	1 977 000 000	1 471 000 000
Senegal	417 000 000	439 000 000	470 000 000	557 000 000	
Sierra Leone	37 000 000	41 000 000	39 000 000	39 000 000	
Togo	212 000 000	223 000 000	245 000 000	269 000 000	

Source: World Tourism Organization Yearbook of Tourism Statistics, Compendium of Statistics and Data Files, 2021



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### Box 5.3 FFEM: Community tourism insufficiently supported

Ecotourism and community ecotourism are the forms of tourism sought in and on the outskirts of protected areas, as tools for sustainable development, that is to say an economic development respectful of the environment and the social context, which takes into account the needs of the present without compromising those of future generations (IUCN-PACO, 2010).

Community tourism or community - based tourism refers to forms of tourism offered and managed by local populations themselves.; while community-based ecotourism also involves a commitment to the protection of natural resources (IUCN-PACO, 2010).

In West Africa, experiences of community tourism are limited. These latter have generally been carried out within the framework of projects, however they provide several lessons. The major problem with community tourism, like tourism in general, is the absence of infrastructure, technical resources and visibility. To this end, in order to promote community tourism and mainly community ecotourism which will later have an impact

on the conservation of MPAs, communities must be very well trained and supported until to achieve the required standards. The involvement of different stakeholders is also necessary for the success of such projects. Projects wishing to develop community ecotourism must consider relying on specialists, for work across the entire sector, up to tour operators and local ministerial relays. era of tourism. In fact, these small projects do not have the means to make themselves known abroad, which most often leads to failures or semi- failures . There are so-called community tourism camps in certain MPAs that are abandoned or in poor condition (Bamboung or Casamance MPA in Senegal, Orango in Guinea-Bissau, Mohéli in the Comoros, etc.). Other funds must be sought to finance infrastructure and support. States can make investments if they are convinced of the profitability of such initiatives. To do this, studies must be carried out to demonstrate the relevance and contribution of such projects.

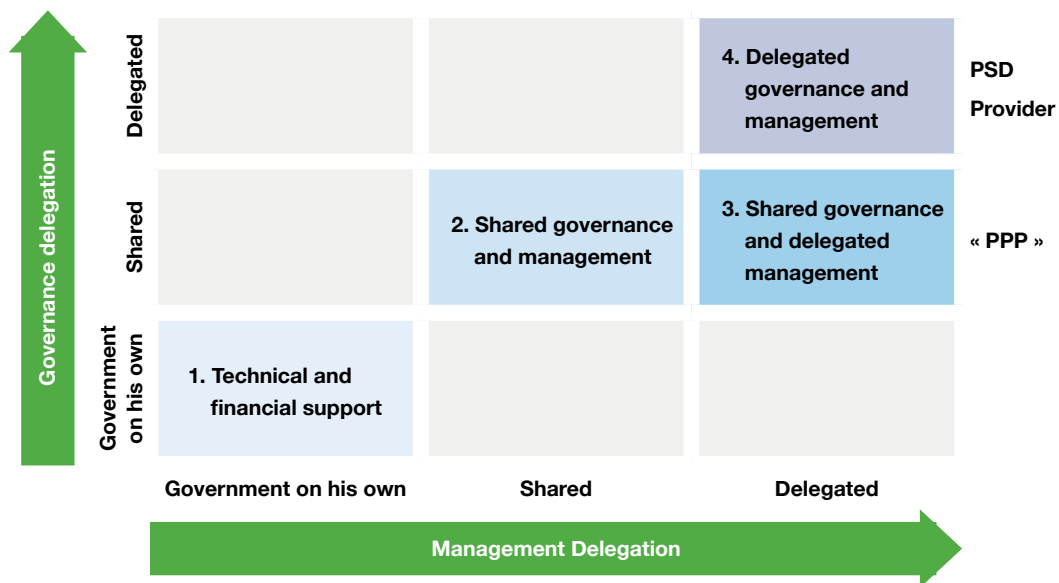


Figure 5.1 Main types of partnerships between a public and a private partner for the management of protected areas

Source : Adapted from M. Baghai (2016).

### 5.6.3 Fishing license

Fishing permits are official documents giving the right to access and exercise fishing in freshwater of the first- and second-degree category, on the banks and shores belonging to a State (rivers, navigable canals) or to riparian owners (rivers, lakes, ponds). The establishment of this authorization is associated with the payment of a tax which aims to preserve natural resources.

In the marine region of West Africa, the EU initiated and signed in 2006 a Fisheries Partnership Agreement with Mauritania. This agreement was the largest EU agreement, both in financial terms (€86 million per year coming directly from the EU) and in terms of fishing opportunities (OECD, 2015). This agreement has made it possible to set up a trust fund which grants large sums for the conservation of MPAs in this country. About 200 licenses were available for European vessels to fish in Mauritanian waters (EC, 2007). The agreement was renewed in 2015, committing €59 million per year to the partnership, including €4 million to support fishing communities, including environmental sustainability, job creation and the fight against pollution, illegal and unregulated fishing (EC, 2015a).

Other West African countries also have fisheries partnership agreements with the EU. These are Cabo Verde, Guinea-Bissau (with more than 9 million euros committed) and Senegal.

In 2009, the total EU contributions were 15 times the national budget for fisheries in Mauritania and accounted for more than 16% of the country's total public revenues; the EU contribution is comparable in Guinea-Bissau (15.6% of total public revenues) (Oceana, 2011). This analysis shows the strong potential of this sector in the mobilization of resources. However, it is important to implement management and monitoring mechanisms for these areas in order to ensure better governance of MPAs.

## 5.7 Public-private partnership

The Public-Private Partnership (PPP) is defined as a contract by which a legal person governed by public law entrusts the management of a public service to a delegated entity (public or private), whose remuneration is substantially linked to the result of the operation of the service (Brugière, 2020). The PPP has been borrowed from the PA governance discourse. In the field of protected areas, the expression Public-Private Partnership is a generic expression that covers different forms of collaboration between a public authority and a non-state partner, whether at the level of governance of the protected area or its operational management. Despite the diversity of PPP formats, Brugière (2020) distinguishes three elements that are fundamentally constitutive of a PPP:

- There is a contractual document between the public partner and the private partner;
- The public partner delegates all or part of its prerogatives to the private partner;
- The private partner provides and manages all the necessary funding for the operational management (investment and operations) of the protected area. This funding can be public (official development assistance (ODA) funds) or private (donor funds).

There are four main types of partnerships between a public partner and a private non-profit partner (Brugière, 2020). They vary according to the level of delegation of governance and operational management of the PA granted to the private partner (Figure 5.1)

Although the very first PPP developed in French-speaking Africa dates from 1990 in the Fazao-Malfakassa National Park in Togo, it was in the early 2000s that this approach was truly developed in ACO. This concept was developed to deal with the difficulties of French-speaking Central and West African protected areas,



namely the growing pressures (massive poaching), the invasion of certain protected areas by refugees, the lack of commitment from the States (lack of financing), the slowdown in project financing. To overcome these difficulties, the “Project” model seemed to have reached its limits and the PPP approach therefore appeared necessary, since it had already shown positive results in Southern Africa. Between 2000-2010, PPPs developed in French-speaking Africa, with the establishment of a management delegation for four emblematic national parks (Garamba and Virunga/DRC, Odzala/Congo, Zakouma/Chad).

In July 2020, Brugière (2020) counted 15 PPPs formalized in French-speaking Central and West Africa. It is:

- PN Garamba (DRC), PN Odzala-Kokoua (Congo), PN Zakouma and adjacent RF (Chad), RNC Ennedi (Chad), PN Pendjari and PN W (Benin), CA de Chinko (CAR) where the private partner is a foundation based in South Africa African Park Network (APN);
- PN Nouabalé-Ndoki (Congo), RF Okapi (DRC) and North-East PA Complex (PN Bamingui-Bangoran, PN Manovo-Gounda-St Floris and associated PAs) (CAR) where the private partner is the NGO Wildlife Conservation Society (WCS);
- PN Virungas (DRC) where the private partner is the Virunga Foundation;
- PN Salonga (DRC) and the Protected Areas of Dzanga Sangha (APDS) (RCA) where the private partner is the NGO WWF;
- Complex of Kundelungu and Upemba NPs (DRC) for which the private partner is the Forgotten Parks Foundation;
- RNN of Termit and Tin Toumma (Niger) for which the private partner is the NGO Noé.

Other PPPs are being negotiated in other PAs in Central and West Africa and new private partners are emerging in this region. For example, the NGO Noé is negotiating a PPP for the Binder-Léré RF in Chad. In Guinea, initiatives have been launched to ensure that the Moyen Bafing National Park, which is being created, is managed via a PPP. However, the concept has not yet been widely applied to the marine environment.

Despite this move towards PPPs, MPAs are not yet committed to this promising financing mechanism, which offers a greater capacity to mobilise resources. PPPs are, however, a highly technical and even political funding mechanism that naturally requires careful negotiation.

## 5.8 Other on-specific mechanisms to marine protected areas

### 5.8.1 Biodiversity offsets

Biodiversity offsets are measurable conservation outcomes to compensate for residual impacts in development projects (IUCN, 2017). In recent years, World Bank projects in Africa have encouraged biodiversity offsetting by governments and businesses, despite the lack of a formal regulatory framework.

Biodiversity offsets and other mechanisms in the mitigation hierarchy have the potential to be a driver for better conservation and the

creation of new protected areas of high conservation value (IUCN, 2017).

In Cameroon, for example, the creation of the Campo Ma'an, Mbam and Djerem and Deng Deng National Parks are compensation for the Chad Cameroon Pipeline project for the first two and the Lom Pangar dam for the Deng Deng National Park. The company in charge of managing Pipeline Tchad Cameroun is providing funding for these two protected areas to the tune of almost 300 million through FEDEC, while the Deng Deng National Park receives funding directly from the Cameroon Electricity Development Corporation (EDC). However, consideration was being given to setting up an organisation to manage the funding.

However, the stakes are high and there are several potential pitfalls. If offsetting is gaining ground and translating into more transparent and accountable policies, then it is likely to have a significant impact.

### 5.8.2 Debt forgiveness

The process of bilateral debt conversion is the cancellation of a government's “sovereign” debts. This is only possible when the level of debt is considered excessive and the creditor considers it unrecoverable. Within their “*Poverty Reduction Strategy Paper*”, it is also possible through the Heavily Indebted Poor Countries (HIPC), to designate the environmental sector as a beneficiary of agreements to cancel this debt, although in the practice, few countries choose to do so.

The ability to negotiate debt swaps is not limited to low-income countries or HIPC countries. Gabon reached an agreement in 2008 with the French government to cancel 50 million euros of France's sovereign debt, in return for an obligation on the part of the Gabonese government to spend an equivalent sum in funds dedicated to forest conservation programs for a defined period. A significant part could thus be implemented thanks to a trust fund which has not yet been set up, at the expense of managing the Gabonese network, for 13 newly created national parks.

Cameroon has also benefited from this financing mechanism through the HIPC Funds, it has thus implemented the project to secure the livelihoods of communities for the sustainable development of Waza National Park and its periphery with a budget of US\$ 2 million for a period of five years. The components of the said project were:

- conservation-friendly micro-infrastructures
- income generating activities
- project management

This mechanism remains complex in the implementation. Indeed, the debts are not remitted regularly. They follow a complex international mechanism on which the financing of protected areas cannot be based. However, there remains a one-time opportunity such as projects in the funding mechanism.

### 5.8.3 Payments for ecosystem services

Despite the enormous potential in terms of ecosystem goods and services contained in the networks of protected areas of Central and West Africa, they have difficulty in attracting substantial funding for their conservation. In 2011, UNDP estimated the economic value of the world's forests at around \$16.2 million (UNDP, 2011). This value is very low compared to the potentials and uses that these ecosystems offer to the world. Ecosystem services provided by Central and West Africa PAs include regulating, provisioning and socio-cultural services.

Ecosystem goods and services vary across ecosystems. These services are not always tangible; however methods exist to determine their value. Funding opportunities exist, all you have to do is find the funding mechanisms. For example, for the construction of dams near protected areas, one could pay for the water regulation service through a tax. There is also the case of carbon sequestration for example in protected areas. Most protected areas located in forest areas store more than 200tC/ha (Kabelong, 2019). This potential could be valued during payments for ecosystem services. The adoption of the Nagoya protocol is also an opportunity to promote genetic resources. Biodiversity in itself constitutes a wealth necessary to attract tourism funding. The indirect use value, which constitutes the most important potential source of financing, is still poorly valued despite the considerable number of environmental services provided by MPAs. Political reflection must go in the direction of the greater valuation of these services through the development of payments for environmental services and the establishment of innovative and sustainable financing mechanisms like the trust funds already underway in the land protected areas.

### 5.8.4 Carbon finance/REDD+

Reducing emissions from deforestation and forest degradation, together with sustainable management of forests, conservation and enhancement of forest carbon stocks (REDD+), is a mechanism whose aim is to reduce the rates of deforestation and associated greenhouse gas emissions. It is a framework through which developing countries, having identified current and/or projected

rates of deforestation and forest degradation, are financially rewarded for their emission reductions. FAO supports developing countries in their REDD+ processes but also helps them to translate their political commitments, as presented in their Nationally Determined Contributions, into action on the ground.

At the core of this work are forests and the fundamental role they play in mitigating climate change by removing CO<sub>2</sub> from the atmosphere and storing it in biomass and soils. It also means that when forests are cut down or degraded, they can become a source of greenhouse gas emissions by releasing stored carbon. It is estimated that globally, the gases resulting from deforestation and forest degradation represent around 11% of CO<sub>2</sub> emissions. Stopping deforestation would be effective in economic terms and would have a clear impact in terms of reducing global GHG emissions.

Marine protected areas are home to mangroves, which are plant formations that store significant carbon biomass. The highest carbonaceous biomasses for the mangroves evaluated in West Africa, of the order of 200 tC per hectare (epigeal 128 tC.ha<sup>-1</sup>; hypogea 77 tC.ha<sup>-1</sup>), are observed near the equator (between 0° and 10° latitude) (Le Pape, 2015). In Central African mangroves, biomass values range from 251 and 505 Mg/ha (Ajonina et al., 2014). This biomass sequestered by these ecosystems is a major asset for MPAs in the REDD+ mechanism. However, it would be important to find more appropriate mechanisms to allow these spaces to benefit from this mechanism. Indeed, despite the potential, only one African country has benefited from funding from the REDD+ mechanism.

Gabon is the first African country to benefit from this funding mechanism. He thus received his first payment in June 2021, amounting to US\$ 17 million. This payment was made as part of the landmark agreement signed with the Central African Forest Initiative (CAFI), a United Nations-managed multi-donor fund, in 2019 for US\$ 150 million over ten years. This mechanism is quite innovative, but it seems complex.



## Box 5.4 Some examples of financing marine protected areas

### In Guinea-Bissau

*Aissa Regalla de Barros*

**Entrance taxes** – An amount is charged per person per boat, costs vary for nationals and foreigners. Amounts are charged per person or per boat.

**Wildlife viewing fees** – These are subject to a code of conduct.

**Tourist sport fishing taxes** – They are also subject to rules. For example, there are no fishing zones or prohibited zones where nesting colonies are located.

**The eco-guide service** – Eco - guides are people trained by the Institute of Biodiversity and Protected Areas (IBAP) but who accompany tourists. The latter are paid according to fixed costs of the service. In case of non-presentation of receipts, they receive a high fine.

**Fishing activities** – Fishing licenses are issued by artisanal fishing services, but fishing in protected areas is prohibited . There is a right of access only for resident communities (a right which also follows zoning rules).

The different costs (taxes and fishing) are distributed as follows:

- 40 % for the operation of the park;
- 40 % for the entity responsible for the management of protected areas;
- 20 % for local communities – community development activities;

**The BioGuinée Foundation** is a non-profit and apolitical foundation created and registered in the United Kingdom in 2012. It is entirely dedicated to Guinea-Bissau. Its existence is justified by the need to provide long-term funding in order to preserve the country's extraordinary biodiversity, promote sustainable community development and improve environmental education. Its main mission is to catalyze sustainable financial resources and partnerships for the benefit of biodiversity conservation, sustainable community development (including community empowerment) and environmental education in Guinea-Bissau.

**REDD: Commercialization of Carbon credit** – The Project to reduce deforestation and degradation of the Cantanhez and Cacheu mangrove forests aims to mobilize revenues from the international carbon market for the community development of sites, sustainable management of protected areas and sustainable financing of biodiversity conservation.

### In Senegal

*Mamadou Diop*

Within the network of the Directorate of Community marine protected areas (DAMCP), several innovative financing initiatives have been implemented:

- **Financing of participatory monitoring by colleges of actors** – This financing model was set up in the Cayar area where the MPA was financially supported by colleges of line fishermen (liners) and purse seine fishermen (seiners) to ensure the financing of surveillance actions with the aim of ensuring compliance with the provisions of the internal regulations and the local convention, particularly during the fishing season, period of biological rest. This funding is allocated annually and paid directly to the management committee. As a reminder, fishing stakeholders are grouped into groups and make contributions in the form of a direct deduction from the product of their fishing or at the pump when purchasing fish. Fuel (consenting collection of 10 CFA francs for each litre of fuel purchased at stations previously targeted by the umbrella organization). The amount collected at these stations is directly donated to the colleges which centralize and redistribute them.
- **Financing through spin-offs from income-generating activities** – In some MPAs, income - generating activities are a good way to finance activities at the site level. This is the case of the Gandoule MPA where the management committee carries out very profitable poultry farming activities in this area in concert with groups of targeted stakeholders. The resources drawn from this poultry farm are channelled into the management of the site according to a distribution key. This is the same case for the Abéné MPA where the management committee implemented activities in the field of bee-keeping. This very profitable activity is being strengthened with the installation of new hives.
- **Financing by the spinoffs of ecotourism activities** – At the level of the Bamboung MPA, in the Saloum delta and the Somone MPA at the level of the small coast, the implementation of activities ecotourism allows management committees to self - finance monitoring, improve governance and participate in different local dynamics. In Bamboung, the operation of an ecotourism camp makes it possible to finance almost all the activities of the MPA and to participate in the social life of the locality. Indeed, the resources resulting from the operation of this camp have been used for several years to finance the conservation activities of the site but also to finance social actions in the neighbouring villages. At the level of the Somone MPA, the organization of walks around the lagoon allowed the management committee to collect additional revenue. In addition, private restaurateurs installed along the lagoon contribute symbolically with

regular payments for the benefit of the management committee. These amounts collected are used to finance the monitoring activities of the MPA but also to organize the monthly meetings of the committee, as well as social actions in the villages.

- **Prospects for financing through the carbon market and corporate social responsibility (CSR)** installed near MPAs. Financing opportunities are being tested regarding carbon credits. The feasibility of such financing options is currently

being studied with partners with the aim of establishing sustainable mechanisms to support MPA activities. There is also the contribution of private and public companies installed around MPAs and which must participate in management as part of their CSR. Well-conducted negotiations will enable these companies to participate in a lasting manner.



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## 5.9 Management plan: the first ever “business card”

It is important that each MPA have a management plan, also called a master plan or a management plan in several West African countries. It is also urgent that existing management plans be updated. Indeed, it is not normal and prudent to manage entities as important as MPAs without vision and direction. The management plan is a frame of reference that establishes the long-term vision, the mission of the MPA, the management objectives, and the means and strategies for implementation (Parks Canada, 2008). It identifies all the actions and projects to be carried out within an MPA.

The management plan is the first ever “business card” of the MPA. It is a foundational document, usually signed by a senior official having the rank of a Minister or Prime Minister (Parks Canada 2008). Because it is the result of synergistic discussions among all stakeholders, the management plan is quite credible with donors and can be very cost effective. Strategically, it is the very first document that MPA managers present to funders. At the operational level, any project to be implemented within the boundaries of the MPA must be compatible with the management plan/ master plan/ development plan, including resource mobilization. Note that the management plan is essential for monitoring and evaluating the impacts of funding and development in and around MPAs.

### Business plans: importance in financial planning

Business Plans are management tools used in all sectors of the economy. As a management tool, Business Plans aim to demonstrate the effectiveness of a given activity in the long term (Landreau, 2012). In the field of conservation, PA authorities are forced to provide innovative options to optimize revenues from the properties they control (Parks Forum, 2012). PAs are still highly dependent on allocations from government budgets to receive funding (Bovarnick et al., 2010). To ensure diversification of MPA income, it is important to develop financial strategies that guarantee transparency and a quantified vision of the ambitions most often recorded in an overall development plan. However, creating a financial strategy does not guarantee that funding needs will be met, but it will greatly increase the possibility that the strategy will be realized.

The development of business plans helps increase budget support. These plans show nature’s contribution to economic sectors (tourism, fishing, water services) and livelihoods. They also make it possible to attract impact investments from private investors, to establish a new PA or extend an existing one, to identify and rectify ineffective areas.

A study carried out by the IUCN in 2012 on 19 MPAs in the West African maritime area network reveals that, although a large part have a management plan, only 5 had a business plan ready or being drafted and only a few of them are able to communicate the exact amount of funding received<sup>1</sup>. However, the situations are quite variable between countries, and we note in particular the substantial effort made in Guinea-Bissau, which has a series of business plans for each of its MPAs, for the Headquarters of the Institute of

Biodiversity and PAs, as well as for the national PA network (data consolidation). Similarly, the two Mauritanian MPAs (Banc d’Arguin National Park and Diawling National Park) have fairly precise business plans. Extending this type of financial approach to the entire network of MPAs in the sub-region would make it possible to better clarify the financial needs that are not covered and to undertake resource mobilization and lobbying campaigns to fill these gaps.

## 5.10 Strategic axes of sustainable financing

The concept of sustainable financing, also known by its English name of “sustainable financing”, is often used in different meanings. However, fundamental elements are found in most definitions. According to the umbrella organization “Swiss Sustainable Finance” (SSF), for example, sustainable finance is an approach to investment and financing that is intended to be long-term. Taking into account environmental, social and governance criteria – known as ESG (Environmental, Social and Governance) factors – is of decisive importance in the decision-making process. By practicing sustainable finance, we try to generate a return not only financial, but also social and ecological.

Thus, sustainable financing makes it possible to cover the operating, maintenance and investment costs of MPAs in the long-term by resorting, in general, to traditional, existing and innovative financing mechanisms (Dia, 2019). To do this, the sustainable financing of MPAs requires a strategy which consists first of all in posing the problem of sustainable financing in a precise manner by estimating the deficit or the gap in their financing which corresponds to the difference between their future costs and income and their current expenses and income. The financing gap which reflects the updated financial dashboard helps to determine the effort required to reduce, close the financing gap or generate surplus income to be injected into the country’s MPA system for example (Dia, 2019).

As we are in the perspective of seeking financial sustainability for MPAs, the generation of surplus income to be injected into the MPA system is favoured. In other words, all possible efforts will be made to maximize the score of the MPA’s financial dashboard, in particular by improving the institutional, political and legal frameworks, reducing the duplication of costs related to activities of MPAs, the optimization of existing financing mechanisms and the diversification of financing mechanisms.

Furthermore, the business approach has been used as a means to an end: a better and more sustainably protected marine area (Park Canada, 2013). The idea being that MPAs should be managed like businesses, with the difference that the objective, in this case, is not to make profits at all costs but rather to make the management of MPAs more viable financially, socio-economically and ecologically to truly benefit from the political and social support they still need (Dia, 2019). Particular emphasis is placed on the monetization of the “goods and services” provided by each MPA.

<sup>1</sup> Chavance, P. 2012. A box of tools to apply the AMP management of RAMPAs in the set up of durable financing mechanisms. IUCN



## 5.11 Conclusion and recommendations

The funding mechanisms for MPAs described above thus present the financial face of MPAs in West Africa (but also at the global level). In other words, they present a profile of MPA finance characterized by:

- limited or insufficient public funding,
- donor intervention limited in time and space,
- a “project” approach that is not always sustainable,
- a weak private sector, an untapped public-private partnership framework and
- a conservation-focused management approach for the conservation of biodiversity and not enough on ecosystem services.

The use of “innovative” mechanisms is still very/too limited at the level of MPAs.

Funding available to manage PAs is generally stagnant. Low levels of funding allocated to biodiversity conservation remain a global problem in general and particularly for PAs in Africa and even more so for MPAs. To manage the growing number and larger size of PAs, conservation management authorities need adequate budgets, resources and innovative resource mobilization mechanisms.

It is therefore necessary to adopt management mechanisms accompanied by management plans as well as business plans.

The mechanisms that can ensure success linked to the sustained financing of MPAs must combine compatible mechanisms on the ground, and involve the various stakeholders (public, private, civil society, international organizations and local communities). However, it is necessary to develop databases of the different financing mobilized at both national and regional level.

The growing reliance on project or programme funding is a problem over time. Today, MPAs remain heavily dependent on international support, including bilateral and multilateral agencies (EU, GEF, GIZ, AFD), large NGOs (Birdlife International, etc.) and foundations (MAVA, etc.). There is still no clear, transparent and comprehensive information on all the projects implemented in the field by the technical and financial partners, which often results in overlaps, inconsistencies in the actions undertaken by the different actors, and, in general, by a lack of coordination and efficiency.

However, it is necessary to initiate institutional, legal and operational reforms that should govern the various financing mechanisms. Indeed, it is fundamentally important to put more emphasis on the mechanisms based on the goods and services that MPAs offer in order to limit the dependence of MPA funding on the international context.

Specific feasibility studies to define and set up complementary financing mechanisms should be carried out, in parallel with the development of the financial strategy of the targeted MPAs, in order to assess the true potential of the financial mechanisms identified, and to propose recommendations and actions for the implementation of these mechanisms.

It is also important to emphasize that there are necessary prerequisites for seeking sustainable funding for marine conservation in MPAs:

- Updating the PAGs of all the MPAs, making it possible to estimate with precision all the activities to be carried out in the short, medium and long-term; and
- Updating business plans, making it possible to accurately estimate all the financing needs to be achieved in the short, medium and long term, as well as the precise existing financing gap by analysing existing income.

This is the prerequisite basis to seek the most appropriate funding sources and mechanisms for each MPA and/or country, allowing national authorities in charge of MPAs and managers to develop a clear plea for both (i) ensure the maintenance and/or increase of state funding and (ii) negotiate potential donors to reduce this funding gap.

## Recommendations

- **Estimate the socio-economic, cultural and environmental values of MPAs. It is important to promote MPAs** as a “financial asset” and, to do so, to know their socio-economic, cultural and environmental value.
- **Evaluate MPA funding needs by estimating the funding gap (to ensure effective management).** Precise data on the costs of MPAs remain fragmentary, not widespread and available. To date, there is no study for West Africa on the funding needs of MPAs at the regional level. Without a better understanding of MPA costs and cost drivers across a variety of MPA archetypes, it will be difficult to accurately determine MPA funding needs. Knowing the financing needs would make it possible to develop sustainable financing strategies accompanied by action plans (action at national and regional levels).
  - Develop for each MPA a management plan together with a business plan or a financial strategy in line with the management plan of the MPA supported by communication and marketing plans on the ecological and socio-economic benefits provided by the MPAs.
- **Strengthen the capacity of local and national MPAs staff and administrations in fundraising, funding mechanisms and fund management.** The technical (and human) capacity to effectively collect, distribute and manage MPA funding is scarce in many contexts.
  - Adopt the commercial or entrepreneurial approach to the management and financing of MPAs based on the needs, expectations and experience of the visitor.
  - Analyse MPAs funding gaps and options for National Biodiversity/MPA Strategies and Action Plans in each country through their National Resource Mobilization Strategy.

## Box 5.5 Find out more

A toolbox to support RAMPAO’s MPAs managers in setting up sustainable financing mechanisms  
<https://webgis.prcmarine.org/documents/panda::boite-à-outils-durabilité-financière-des-amp-du-rampao/explore>

Guide for the development of simplified Business Plans for Protected Areas  
<https://aires-marines.uqar.ca/id/eprint/42/1/Guide%20plans%20affaires%20FIBA.pdf>

Financing mechanisms – A guide for Mediterranean Marine Protected Areas  
<https://bluseeds.org/en/tools/guide-financing-mechanisms-marine-protected-areas/>

Sustainable financing of marine protected areas in the Mediterranean - Guide for MPAs managers  
[http://vertigolab.eu/wp-content/uploads/2017/07/51\\_guide\\_sur\\_le\\_financement\\_durable\\_des\\_amp\\_en\\_mediterranee.pdf](http://vertigolab.eu/wp-content/uploads/2017/07/51_guide_sur_le_financement_durable_des_amp_en_mediterranee.pdf)

The Little Book of Investing in Nature is presented as a practical guide to the various financial mechanisms allowing public and private actors to commit and invest for the protection of biodiversity over the next ten years and beyond.  
<https://www.afd.fr/fr/actualites/biodiversite-les-solutions-du-petit-livre-de-linvestissement-pour-la-nature>

BACoMaB  
<https://bacomab.org>

- Support institutional reforms with a view to better taking into account new financing mechanisms.
- Set up centralized databases.
- Optimize existing financing mechanisms and set up innovative mechanisms adapted to MPAs at the national and regional level.

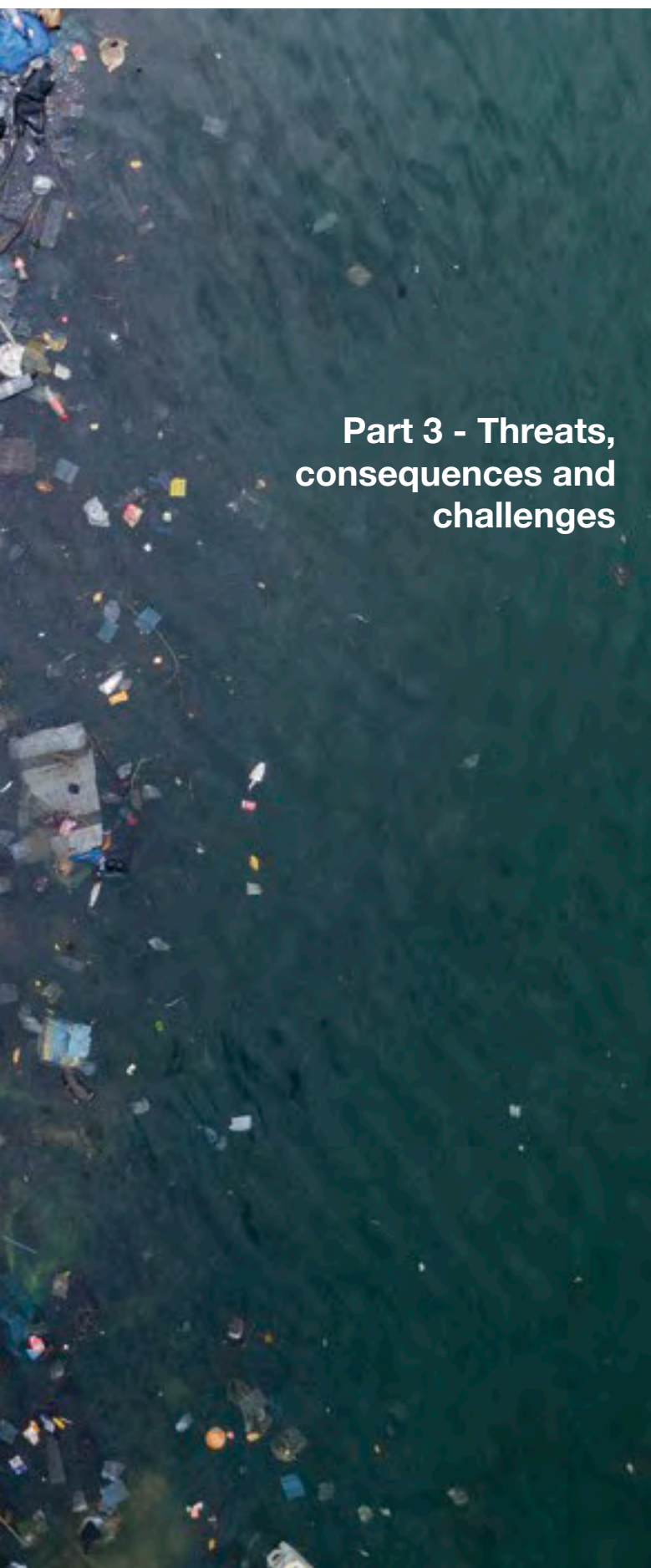


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## Part 3 - Threats, consequences and challenges

## Chapter 6

# Pollution, degradation and threats in West African marine protected areas

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This chapter deals with the following points:

- The various types of pollution that MPAs are facing;
- Drivers contributing to the degradation of MPAs ecosystems and constitute threats and risks, such as the concentration of activities and populations on the coasts;
- A specific sub-chapter on the issue of extractive industries;
- Conclusions and recommendations.



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## 6.1 Introduction

West African marine and coastal areas are home to a multitude of ecosystems of paramount importance for the economies of countries, communities and national, sub-regional biodiversity (migration of fish, sea turtles and birds) and worldwide (migratory birds from Europe and Asia). MPAs that have been created there, because of their management method and legal status, ensure, as best they can, the conservation of habitats and the resources they contain which are essential for maintaining high productivity and the biodiversity of West Africa. Their conservation is essential to ensure the socio-economic development and the maintenance of the biological diversity of the sub-region. However, several threats hang over them. This is particularly the case for pollution and the impacts of extractive industries.

## 6.2 Pollution of marine protected areas

The United Nations Convention on the Law of the Sea (UNCLOS) defines pollution of the marine environment as “the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities;”. It is obvious that

noise in the marine environment is included in this definition as “energy” and should therefore be treated as a form of marine pollution (Ocean care, 2017).

Over 80% of marine pollution is of land-based origin. This pollution comes in marine environments and, consequently, in MPAs, by waterways (rivers and runoff), by winds and/or by direct discharges (industrial and urban ones). Most of the pollution load of the oceans, including urban, industrial and agricultural wastes and run-off, as well as atmospheric deposition, emanates from such land-based activities and has a negative impact on MPAs and affects the most productive areas of the marine environment, including estuaries and near-shore coastal waters. Industrial and urban discharges thus heavily pollute the coast and therefore protected areas located therein (CCLME, 2014).

Contaminants entering marine waters, and therefore MPAs, cause changes through various chemical and/or biological reactions, which modify the characteristics of the environment and thus can constitute serious risks for the health of the ecosystem and public health. They can be absorbed by living organisms (bioaccumulation) and can also evaporate, or degrade, precipitate and join sediments. Biotransformation phenomena can also occur where pollutants interact with each other to form new compounds that are harmful to the environment (CCLME, 2014).

Different types of pollution affect MPAs in West Africa, the main ones are detailed next.

## 6.2.1 Air pollution

### Characteristics of air pollution

Air pollution from MPAs in West Africa is generally attributable to three sources:

- Transport-related human activities (especially for MPAs located next to large cities or adjoining a busy road: the National Park of the Madeleine Islands located along the coast of Dakar (Senegal), the sites of Tanbi and Tanji in near Banjul (Gambia) and the Bao Bolong reserve (Gambia), bordered by a national road near the town of Farafenni).
- Dust from the Sahara (mainly the MPAs of Mauritania, northern Senegal and to a lesser degree from the Senegalese Petite Côte: Banc d'Arguin, Diawling, Djoudj, Saint-Louis, Langue de Barbarie and to a lesser degree and depending on the season, Cayar, Joal-Fadiouth).
- Bush fires and land clearing (Niimi in Gambia and MPAs in the southern part of West Africa, in Guinea for example, approximately 5,000,000 hectares of wooded and grassy savannah are destroyed by fire every year (CCLME, 2014).

In West Africa, particularly in highly urbanized areas, 80 - 90% of air pollution is attributable to motor vehicles. The main pollutants are carbon monoxide and dioxide (CO, CO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), nitrogen monoxide and dioxide (NO, NO<sub>2</sub>), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs). Secondary pollution, such as ozone (O<sub>3</sub>) and very fine particles that penetrate deep into the bronchi also have harmful effects on health (CCLME, 2014).

The African continent, and specifically the area from Mauritania to central Senegal, are continuously experiencing high aerosol loading conditions, often exceeding the World Health Organization air purity standard (Bauer et al., 2019)<sup>1</sup>. The northern part of West Africa, together with the Sahara, holds one of the world's largest sources of desert dust emissions. In the southern part, bush fires and those related to agricultural practices also contribute to the pollution of coastal environments and MPAs. This air pollution is transported to MPAs by the wind.

### Air pollution impacts

MPAs that suffer the most from air pollution are those located near large cities. This pollution has a strong impact on the health of populations living in or around MPAs. Similarly, animals living on the terrestrial parts of MPAs are also exposed to the negative impacts of air pollution. The latter causes lower respiratory tract infections, ischemic heart disease, strokes, chronic obstructive diseases, cancers of the trachea, bronchus and lungs, and type 2 diabetes (Croitoru et al., 2019).

## 6.2.2 Solid waste pollution

### Characteristics of solid waste pollution

Solid waste produced by West African MPAs is often low, limited to that brought in by visitors, resident communities and agents responsible for the management of protected areas. Solid waste comes mainly from inland and is transported by winds, rains, and rivers to the ocean (Oceancampus, 2018). The ocean itself displaces this waste, which can thus reach MPAs. Thousands of tons of plastic are dumped into the sea every year. During storms and heavy rains, the level of the rivers rises and carries most of the waste present on the banks. Crossing agricultural, industrial land or urban agglomerations, waterways carry multiple elements (food packaging, cans, etc.) (Oceancampus, 2018).

Fishing can also contribute to pollution. Nets and other equipment abandoned or lost at sea add to the mass of solid waste affecting natural ecosystems (Garcin et al., 2020).

MPAs located next to highly urbanized and/or industrialized areas are those most affected by pollution by solid waste (MPA of Saint-Louis, Joal-Fadiouth, Madeleine Islands National Park, MPA of Abéné, the sites of Tanbi and Tanji, the reserve of Bao Bolong, Tristão, Alcatraz, Iles de Loos, etc.).

Densely populated cities face serious challenges when it comes to solid waste management. In recent years, the population has grown faster in Africa than in any other part of the world, increasing by 150% over the 2000-2015 period. Urban population growth, which requires solid waste management, has increased at an even faster rate, reaching around 170% over the same period. Moreover, the current trend of rapid migration of labour from rural to urban and coastal areas further accelerates the concentration of population in cities. A rapid increase in population most often results in an increase in the amounts of waste produced. However, the governments of many African countries are still unable to provide waste collection and disposal services that meet the growing demand. This gap is particularly marked in sub-Saharan Africa where about half of the waste is not collected, which affects the sanitary conditions, the environment and the aesthetic aspect of cities (ACCP, 2019) and results in those these in the natural environment.

In highly urbanized West African areas and the MPAs adjoining them, it is common to see waste littering the coast and/or the surroundings of already full waste collection containers. Areas not served by the public collection service, such as vacant lots, are also common sites for the illegal dumping of waste (ACCP, 2019).

In MPAs located in rural areas and/or naturalness is still strong, solid waste is generally less of a problem. Indeed, in this environment, the majority of waste is made up of organic elements, such as food residues and excrement, which can therefore be reused as feed for livestock and wildlife or as fertilizer. Even if waste is over abundant, the excess can be buried in the ground where it naturally decomposes, or in some cases is incinerated on site (ACCP, 2019).

<sup>1</sup> Bauer, SE, Im, U., Mezuman, K., & Gao, CY, 2019. Desert dust, industrialization, and agricultural fires: Health impacts of outdoor air pollution in Africa. *Journal of Geophysical Research: Atmospheres*, 124, 4104–4120. <https://doi.org/10.1029/2018JD029336>

## Impacts of solid waste pollution

Solid waste pollution exists in nearly all West African MPAs arising from the lack of effective domestic waste management measures associated with rapid population growth (Borrini-Feyerabend et al., 2010) and industrial discharges related to the development of raw materials processing and manufacturing activities (Joyeux et al., 2010).

Solid waste, floating on the surface, lining the seabed or washing up on beaches, threatens aquatic ecosystems. Indeed, they can injure or even kill many marine species by hindering their mobility, this is particularly the case for fishing nets lost at sea. They can also transport invasive species or even concentrate many pollutants (Oceancampus, 2018).

Pollution due to macro and micro-plastics, which is present all along the West African coast, but also at sea, causes major disturbances (Failler and Ba, 2017; Failler et al. 2019). Their persistence poses major problems first of all for animal species such as turtles or birds whose stomachs are often filled with plastic, generating numerous intestinal obstructions: 100,000 mammals and 1,000,000 birds die of suffocation each year around the world due to plastic pollution (Goeruy, 2014). If plastics are inert, most of them are associated with additives which represent up to 50% of the mass of the object. However, these are very active (phthalates, flame retardants, bisphenol A, etc.). In addition, plastics concentrate persistent organic pollutants such as polychlorinated biphenyls (PCBs). These hydrophobic molecules attach themselves to the plastics which then play the role of concentrators, with some plastics then

having levels of more than a million times that of the surrounding water. This phenomenon would then explain the concentration of many molecules in the food chain. Thus, while the substance is very weakly concentrated in water, it appears to be very strongly present in isolated human populations feeding on numerous marine animals (Goeruy, 2014). Finally, floating plastic objects allow the increased mobility of certain invasive species such as hydrozoans, molluscs or polychaete worms. Thus, their propagation speed would have doubled in warm seas, as in West Africa, and tripled in recent decades, in cold seas due to the slower decomposition of plastic (Goeruy, 2014).

Waste affecting the coasts and MPAs of West Africa pose complex problems, because in addition to the weak financial and technical capacities to manage them, they concern a wide range of categories, such as municipal, tourist, medical, industrial, demolition, electronic waste which must be treated separately. Inappropriate management of this waste can lead to reduced tourism opportunities, contamination of fish, pollution of groundwater and sometimes even the death of people (Croitoru et al., 2019).

Some plastics break up into tiny particles that mix with sediments that can also be absorbed by plankton (Goeruy, 2014) and the upper links of food chains (see Box 6.1).



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### Box 6.1 Plastic waste

There is an increasing number of plastic waste in our oceans. Every year, eight million tonnes of plastic waste flow from land to sea. In certain parts of the globe, plastic represents up to 95% of the total marine debris. This omnipresence of plastic in our oceans is due to constantly increasing industrial production. In 1950, world plastic production stood at 1.5 million tonnes. In 2015, it was 322 million.

This increase in production is due to plastic being so cheap, resistant and easy to produce. Plastic lives on long after it has been thrown away and a large part of all plastic produced is designed for single use. A minute portion of plastic is recycled. The rest ends up either in landfill or in our natural environment. Plastic never fully degrades. Instead, it becomes fragmented into tiny particles, barely visible to the naked eye. These 'microplastics' are difficult to detect and impossible to remove completely from the environment (Oceancampus, 2018).

With increased urbanization and economic growth, Africa is developing large consumer markets for plastic goods and

plastic packages. Inadequate waste management around river basins—such as the Niger, Congo, and Senegal rivers—also means that these rivers are likely to transport a large quantity of land-based waste, including plastic pollution, as they make their way to the ocean. Senegal, Gambia, Côte d'Ivoire, and Nigeria have high levels of mismanaged plastic waste in Africa, of more than 0.8 kg per person per day. In many countries of the region, more than 80 percent of plastic waste is inadequately disposed of. This has multiple impacts: when discarded plastic bags fill with rainwater, they can attract malaria-carrying mosquitoes; when they are dumped, they can choke and kill marine life and livestock; plastic trash can block storm and cause flooding—a devastating 2015 flood in Ghana caused by plastic-blocked drains killed 150 people. The harmful effects of plastics continue as they photodegrade: microplastics have been found in tap and bottled water, milk, fish and other food—as well as in human stool—thus posing toxicity risks to the global food chain and to human health. (Croitoru et al., 2019).



### 6.2.3 Sewage pollution

#### Characteristics of sewage pollution

In the West African coastal area, most municipal and industrial wastewater is discharged into rivers or the sea, with little or no treatment, increasing the risk of pollution. Less than 10% of African urban areas have properly functioning wastewater collection and treatment systems. Only a tiny part of wastewater is treated (Garcin et al., 2020). As a result, virtually all MPAs located near urbanized or heavily industrialized areas, or near the mouths of rivers are subject to pollution from wastewater. This is the case, for example, of the National Park of the Madeleine Islands, which borders the coast of Dakar and the MPA of Abéné in Casamance with the polluted waters which flow into the protected area from a nearby industrial and expanding zone (Failler et al., 2019).

These discharges along the coasts have increased considerably in recent decades due to the high concentration of populations on the coast and the high demand for water in the agglomerations. Aggressive industrial strategies, observed in many coastal countries, and galloping urbanization, lead to alarming levels of pollution which seriously threaten marine and coastal ecosystems (Kane, 2014).

Pollutants contained in wastewater from West African coastal areas and which affect MPAs in this area are mainly made up of detergents, greases, solvents, nitrogenous organic matter, heavy metals, micropollutants, residues of pesticides, motor oils, fuels, tire residues, faecal germs, etc. (Diouf, 2019).

#### Impacts of sewage pollution

As with air pollution, it is the MPAs that are next to highly urbanized and/or industrialized areas that suffer the greatest pollution from wastewater: MPAs of Saint-Louis, Joal-Fadiouth, the National Park of the Madeleine Islands, MPA of Abéné, the sites of Tanbi and Tanji, the reserve of Bao Bolong, Tristão, Alcatraz, Iles de Loos in Guinea, etc.

Sewage pollution affects the health of fish, which are an essential resource in West Africa and a primary source of protein for coastal populations. It decreases the yield of fisheries through the degradation of the natural habitat, the escape of marine species capable of moving, the increase in egg mortality and the decline in their quality (Garcin et al., 2020).

Fixed benthic species are very strongly affected by wastewater and in some cases they disappear from the most polluted areas of MPAs.

### 6.2.4 Agricultural pollution (pollution by inputs: fertilizers, pesticides, agribusiness waste, etc.)

#### Characteristics of agricultural pollution

West African countries have almost all chosen agriculture as one of the pillars of the national economy, which must be developed. This has resulted in a significant growth in agricultural activities and its corollary, the increase in the use of pesticides, herbicides and fertilizers. The latter, through rain runoff and irrigation canals, end up in the sea or in groundwater by infiltration (Goeury, 2014). This pollution, increasing over time, modifies the ecosystems of MPAs. A typical example is the Djoudj National Bird Sanctuary with the

construction of the Diama dam and the development of irrigated agriculture. The Diama dam, commissioned in 1986 and whose reservoir level was considerably raised from 1992 with the raising of the dykes on the left bank, is the accelerating element of ecological changes. Very high water levels prevent the site from drying out and soften the waters. The contribution of significant quantities of nutrients from agricultural activities and the permanence of fresh water have favoured the development of vegetation, in particular invasive species. Typha (*Typha australis*) has invaded the backwaters and shallow depressions of Djoudj Park (Triplet, 2018).

#### Impacts of pollution by agricultural inputs

Agriculturally-induced water pollution poses a serious threat to human health and the planet's ecosystems. Modern agriculture is responsible for the discharge of large quantities of agrochemicals, organic matter, sediments and saline solutions which ultimately end up in the sea and/or waterways.

Agriculture is the single largest producer of wastewater, by volume. As land use has intensified, countries have greatly increased the use of synthetic pesticides, fertilizers and other inputs (FAO, 2018). Irrigation produces the largest amount of wastewater in the world (in the form of agricultural drainage).

MPAs in West Africa most affected by agricultural pollution are those located near areas where agricultural development, and in particular agribusiness, has accelerated significantly over the past decades. This is particularly the case for the marine protected areas of northern Senegal (Djoudj, Saint-Louis, Langue de Barbarie), southern Mauritania (Diawling) and the Kapatchez Delta Ramsar site in Guinea (Diouf, 2022).

## 6.2.5 Thermal pollution

### Characteristics of thermal pollution

Thermal pollution refers to phenomena in which heat is released into bodies of water or atmospheric air. In this case, the temperature rises more than the norm. Thermal pollution from nature is associated with human activities and greenhouse gas emissions, which are the main cause of global warming (Agromssidayu, 2022).

One of the activities that produces the most marine thermal pollution is the exploitation of offshore hydrocarbons<sup>2</sup>. However, in several West African countries, oil and/or gas deposits have been discovered and are or will be operational in the upcoming years. A significant increase in thermal pollution is expected in MPAs located next to hydrocarbon deposits.

It should also be noted that discharges into the sea linked to industrial activities also contribute to thermal pollution in the MPAs of the West African sub-region located next to industrial concentration areas.

### Impacts of thermal pollution

An increase in water temperature negatively affects living organisms in MPAs. For each of them, there is an optimum temperature at which the population develops best. In the natural environment, with a slow increase or decrease in temperature, living organisms gradually adapt to changes, but if the temperature rises sharply (for example, with a large volume of discharge of hot water from enterprises industrial), they do not have time to acclimatize. They receive a thermal shock that can lead to death. This is one of the most negative effects of thermal pollution on marine organisms.



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<sup>2</sup> A chapter will be devoted to hydrocarbons in more detail.



There may be other, more harmful consequences. For example, the effect of thermal water pollution on metabolism. With an increase in temperature, organisms increase the metabolic rate and the need for oxygen increases. But with increasing water temperature, its oxygen content decreases. When the temperature regime changes, the behaviour of fish also changes, natural migration is disturbed and premature spawning may occur.

In Nouadhibou (Mauritania), the dismantling of slums around the city has been offset by the creation of a new district. This extension of the city along a North-South axis towards the Baie de l'Étoile constitutes a threat to this bay. The consequences are already manifesting themselves by the anarchic multiplication of second homes on its periphery as well as by the marine pollution coming from the many industrial centres that exist there. The two power plants at Nouadhibou use seawater to cool the engines. This water is then found in the sea without prior treatment. The SOMELEC power plant rejects an estimated quantity of 250 m<sup>3</sup>/h and that of waste oil at 50 m<sup>3</sup>/week. The temperature of the water leaving the factory varies between 24 and 28°C. These factories would maintain a microcosm on the coast at a relatively high temperature compared to the most immediate surroundings. Temperature changes mainly affect stenothermic species, which migrate when they cannot adapt. In areas that have suffered such pollution, there is a change in populations through the substitution of more tolerant species (CCLME, 2014).

In Cabo Verde, the discharge of water from desalination which contains high levels of salt and has high temperatures, modifies the physical characteristics of the environment. Changes in the physical conditions of the environment can cause the removal and disappearance of certain biological resources from MPAs (CCLME, 2014).

## 6.2.6 Noise pollution

### Characteristics of noise pollution

The introduction of sound energy into the marine environment and its impact on marine fauna are today considered to be an important issue. Thus, noise pollution is now included in environmental impact studies in the same way as chemical pollution. However, this issue is sometimes difficult to grasp, due to its technical nature and the lack of available information (Persohn et al., 2020).

Noise pollution in West African MPAs is mainly due to:

- The increase in maritime transport (Figure 6.1);
- Exploration and exploitation of hydrocarbons;
- Increase of fishing activities (industrial fishing boats and motorization and increase in artisanal fishing canoes);
- Development of water sports.

### Impacts of noise pollution

Because of the physiology and lifestyle of certain species, exposure to noise can have varying degrees of impact. In the short term, these impacts include behavioural reactions (escape, diving or

surfacing, changes in swimming speed, cessation of feeding, etc.), acoustic masking (which leads to changes in communication patterns), permanent or temporary non-lethal physiological lesions (barotrauma, organ damage, metabolic stress, etc.) and direct lethal lesions (damage to vital organs) or indirect lethal lesions (stranding, predation). In the long-term, underwater noise can cause behavioural disturbances (habituation, adaptation and moving) and influence species demography (Persohn et al., 2020).

Phenomena of disorienting noise pollution (sea turtles), scaring away (fish) or creating strandings of marine animals (marine mammals) have been reported in several West African MPAs: Banc d'Arguin (Mauritania), Saint-Louis (Senegal), Saloum delta (Senegal), Boa Vista (Cabo Verde), etc.

## 6.2.7 Light pollution

### Characteristics of light pollution

Light pollution or photo-pollution encompasses all lights that have negative impacts on wild fauna and flora. Ecological light pollution applies to artificial light which alters the alternation of day and night (nycthemeral rhythm) in ecosystems.

Light pollution in West African MPAs is mainly due to:

- The strong urbanization of the coast;
- The installation of hotel facilities on the coast;
- Offshore oil rigs;
- Lighting the roads along the coast.

Typical examples of light pollution are hotel facilities and city lights that interfere with the orientation of newly hatched sea turtles. This happens for example in the MPAs of the island of Boa Vista in Cabo Verde and in the MPAs of the Petite Côte in Senegal (Diouf, 2022).

### Impacts of light pollution

One of the best-known impacts of light pollution is on post-hatchling sea turtles that are influenced by artificial lights. Indeed, after laying eggs, young turtles return to the sea by finding their bearings on the nocturnal horizon, which is clearer on the water than on land (Kamrowski, 2012). Artificial lights disturb young turtles that crawl in the wrong direction and die from predators and heat after sunrise.

For their laying, turtles avoid illuminated beaches, which has the effect of concentrating the laying in the darkest parts. This leads sea turtles to lay eggs in non-optimal sectors and to generate artificial concentrations of egg-laying with the induced consequences of effects on the sex ratio of the young and excess mortality (Salmon, 2003; Witherington, 1997). The spawning behaviour itself can be disturbed (Sibley, 2008). These impacts are reported in nearly all West African MPAs (Diouf, 2022).

The negative impacts on the avifauna of MPAs in West Africa and the areas that host them are particularly sensitive during reproduction and migration (Sibley, 2008):



Figure 6.1 Global shipping routes Source: [www.shipmap.org](http://www.shipmap.org)

- During the nesting period, birds and juveniles can be attracted by stray light sources, which has the effect of preventing them from returning to their nest or finding their direction. The consequences of traffic lights should not be minimized. Bird glare is an aggravating factor in collisions with vehicles.
- During migratory movements, artificial lights from buildings (such as lighthouses, towers, oil platforms, hotels, human dwellings, etc.) cause very significant mortality either by direct collisions or by disruption of the system causing exhaustion and favouring predation, especially when weather conditions are unfavourable (poor visibility). The majority of migratory birds, especially those migrating to Africa over the Sahara, travel at night. Many birds, such as sparrows and ducks, find their way by the position of the stars. The visibility of the stars is therefore preponderant for the survival of these species (Teyssèdre, 1996). Birds have evolved over thousands of years under natural conditions, with the moon and stars as their only sources of night time light. During bad weather, they head for the stars, which helps them stay above the cloud cover. This behaviour can be fatal in the presence of artificial lights on large buildings. Many cases of mass collisions have been listed, on a wide variety of objects: TV towers, oil platforms, boats, flares, hotels, large buildings, etc. (Siblet, 2008). Migratory birds can also be disoriented when entering the light domes that form over cities at night. They are suddenly dazzled, and, deprived of their celestial map, they go around in circles for hours. They thus deplete precious energy resources that are essential for them to cross the Mediterranean and the Sahara (Baur et al., 2004). Bruderer et al. 1999) further showed that migrating birds were very sensitive to sudden optical stimulation, such as a single beam of light from a 200W lamp directed upwards. The birds react very strongly, change altitude and deviate from their initial route sometimes up to 45°C. The influence of such a light beam can be felt up to 1 km away from the source. Note that this intensity corresponds to that of car headlights, but is well below that of “sky beamers” (1,000 to 7,000 W) For some birds, such as the black-tailed godwit (*Limosa limosa*), light pollution has a much greater impact than noise (Molenaar et al., 2000).
- A large number of fish species living in West African MPAs are sensitive to light pollution. Sea and lake waters close to large cities or brightly lit areas often have a level of lighting 5 to 50 times higher than that of water areas far from urban centers. This level of light corresponds to a permanent full moon night and has an influence on fish and aquatic invertebrates down to about 3 meters depth (Moore and Kohler, 2002). For example, planarians (flatworms) are sensitive to variations in light intensity, and seek shade (negative phototaxis). Their escape speed is proportional to the intensity of the imposed light (Teyssèdre, 1996). Studies have shown an influence of light pollution on the vertical migration of daphnids (Moore et al., 2000) and zooplankton (Pierce and Moore, 1998). Artificial light also disrupts fish migrations. Some studies reveal a phenomenon of attraction by artificial light (Larinier and Boyer-Bernard, 1991), others highlight a sharp increase in nocturnal activity (Nemeth and Anderson, 1992). The increase in predation on species attracted by light due to their concentration should also be noted (Yurk & Trites op. cit). Artificial lighting can lead zooplankton to rise regularly to the surface and, as a result, to be the victim of intense predation (Gliwicz, 1986).

## 6.2.8 Visual pollution

### Characteristics of visual pollution

Visual pollution is any alteration of the natural landscape or anthropogenic perception that negatively affects the viewer. It involves objective and subjective elements in the relationship of human beings with the environment.

The most frequent sources of visual pollution in West African MPAs are:

- Garbage deposits (especially for MPAs located next to large agglomerations or towns, the case for example of the Joal-Fadiouth MPA) generated by local populations and visitors;
- Wastewater discharged directly into the sea (water color and smell) (case of the Iles de la Madeleine National Park which has a wastewater outfall in front of it);
- Smoke or flames from offshore oil rigs and coastal industries;
- Hotel facilities that do not integrate well with the site and industrial facilities close to MPAs (e.g. Loos Islands in Guinea);
- Aerial wiring, electrical or telecommunications towers and various types of antennas.

### Impact of visual pollution

Visual pollution has an objective dimension based on established conventions and a subjective dimension based on personal taste. Therefore, its fundamental impact is of an aesthetic nature and the sensitivity to the visual disturbances that constitute it varies with the individual (Warbletoncouncil, 2022).

Visual pollution affects practically all MPAs in West Africa, especially with bags and other plastic waste that are present on the coasts of all countries. It has a negative impact on tourism, which plays an important role in the national economies of the sub-region. Indeed, in 2014, about two million tourists had visited the countries of the West African Monetary and Economic Union (Mali, Niger, Togo, Côte d'Ivoire, Senegal, Guinea-Bissau, Benin and Burkina Faso), thus generating revenue estimated at CFAF 580 billion, i.e. almost a billion dollars (Bally, 2016). With the COVID-19 pandemic, tourist flows have fallen sharply. It should be noted that tourism generates income, sometimes substantial, for West African MPAs.

## 6.2.9 General considerations

A total of eight sources of pollution have been listed in West African MPAs. Generally, pollution levels are not yet alarming, except for solid waste. Indeed, virtually all coastlines in this area, including MPAs, show a distressing spectacle of piles of garbage on beaches that are not regularly cleaned.

With the growth in oil and gas activities and given the density of maritime traffic in the region, potential risks of oil pollution remain high (Diouf, 2022).

Moreover, the capacities to tackle this pollution are still insufficient and deserve to be strengthened through training on pollution and

how to combat it, adequate equipment for MPAs and collaboration with local authorities.

After reviewing the pollution and its impacts, it is necessary to analyse the other factors contributing to the degradation of MPAs, some of which are in part the effects of the first.

## 6.3 Factors contributing to the degradation of Marine Protected Area ecosystems, threats and risks

### 6.3.1 Global analysis

An analysis of anthropogenic threats to MPAs in the RAMPAAO area (Failler et al., 2019) showed that in terms of severity, pollution is the threat considered the most severe by the managers of these areas. This, certainly because of its visible short-term effects, both on habitats, fauna and flora (mortality, stunted growth) and on populations that depend on these resources (intoxication and contamination, among others) (Toure et al., 2016). Infrastructure, especially dams on rivers, bridges, some roads and tourism, although relatively infrequent threats, are considered to have a tangible impact on MPAs (Failler et al., 2019; Diouf, 2022). The hydrological modification resulting from the dams, in particular the reduction in the flow of rivers and rivers, results in freshwater deficits, modifying the estuarine and coastal habitats (Sakho et al., 2011), this is particularly the case of the delta of the Senegal River (Diouf and Sané, 2019; Diouf, 2022). The sediment deficit induced by these infrastructures is expressed, for its part, by the erosion of the banks and the adjacent coastline (Failler et al., 2019). Since MPAs are all located along coasts, in insular environments and in estuaries, erosion of the coastline or banks is a systematic threat. Its effect is accelerated by the multiplicity of aggravating causes, operating in cascade: climate change induces a drop in precipitation (Descroix et al., 2015), responsible, in turn, for the sediment deficit which weakens the coastline (Faye, 2010) and promotes marine water intrusions inland. To this must be added the rise in sea levels caused by climate change. Anthropogenic threats also amplify the effects of those of natural origin. Dams on rivers, dikes, embankments and other artefacts, clearing for various reasons as well as logging, exacerbate, for example, the deterioration of the coastal strip (Failler et al., 2019). A review of management effectiveness evaluations of West African MPAs (Failler et al., 2019) identified the main threats and pressures facing them.

Overall, the sites least affected by natural threats would be island MPAs (Urok in Guinea-Bissau, Loos in Guinea, Santa Luzia in Cabo Verde) and those sheltered at the bottom of estuaries and made up of mangroves (Bamboung, Kawawana, Casamance MPA in Senegal). The high sediment supply of certain rivers such as the Rio Geba in Guinea-Bissau, for example, guarantees a certain stability of the coastline (Failler et al., 2021).

Overall, among the sources of threats identified in the assessments of the effectiveness of MPAs carried out since 2010 in the sub-region, all present uncontrolled fishing, wood cutting, habitat modification and

erosion as the most common, reinforcing their recurring character over time. The main reason for the recurrence of uncontrolled fishing among the main threats is the lack of drastic measures taken against illegal fishermen. The coast of the study area is subject to the massive influx of fishermen sometimes coming from very far away (Ghana, Côte d'Ivoire) (Binet et al, 2010). In addition, an ever-increasing share of the population is massing along the coasts (Gemenne et al., 2017), depending on fish resources for their protein intake.

Logging is part of the common practices of coastal populations. Changing these practices involves implementing alternatives. However, there are only a few large-scale projects that save wood (oyster farming on ropes, solar ovens, solar salt production, etc.) (PRCM, 2012). On the other hand, reforestation actions are widespread, with often mixed results (Cormier-Salem and Panfili, 2016; Ndour et al, 2012), while the state of the forests seems to be improving slightly in the MPAs of the network (Failler et al., 2018).

Desertification following a rainfall deficit in the 1970-1980s led to a drastic modification of ecosystems within certain MPAs: loss of forest surface, loss of mangroves or even drying up of certain mudflats (Failler et al., 2018). In addition, the reduction in freshwater inputs, accentuated by the construction of dams and dykes, has led to salinization of certain areas at the interface between marine and continental waters (MPAs in the Senegal River delta, the Saloum delta and of Casamance).

In response to these structural changes to habitats, the MPAs in the network are trying to contain this phenomenon by planting mangrove species, which is, all in all, insufficient in view of the growing salinization progression (Failler et al., 2018).



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### 6.3.2 Analysis of aggravating factors

#### Concentration of economic activities in marine and coastal areas (fishing, tourism, industry, agriculture, etc.)

The West African coastal area concentrates a large part of the urban population and economic activities such as fishing, tourism, industries, mining, offshore oil and gas activities. This situation contributes to creating strong pressure and increased risks on the marine environment and the MPAs it shelters (MOLOA, 2021).

Phenomena of upwellings, the supply of nutrients from the rivers that cut into the West African coast and the existence of favourable meteorological and oceanic conditions mean that the coasts of the countries of West Africa constitute a region conducive to fishing activities (industrial and artisanal fishing). The 14 countries in this region (Mauritania, Senegal, Cabo Verde, Gambia, Guinea-Bissau, Guinea, Sierra Leone, Liberia, Côte d'Ivoire, Ghana, Togo, Benin, Nigeria and São Tomé & Príncipe) total approximately 2.85 million tons of annual catches of products caught at sea, i.e. 2.37 million excluding Nigeria. This represents 37% of African production and 3% of world production (excluding aquaculture). Within this region, the share of fishing in the Gross Domestic Product (GDP) varies between 0.5 and 5% depending on the country (MOLOA, 2021). This fishing, through incursions into MPAs in the sub-region, overexploitation of resources, accidental captures of turtles and marine mammals, destruction of seagrass beds (especially trawling), is a major factor in the degradation of protected areas. It should be recalled that West Africa is recognized as one of the world's most affected regions by this environmental and economic scourge of industrial fishing (MOLOA, 2021).

The development of agriculture in West Africa has required the construction of large-scale hydro-agricultural schemes, such as dams and irrigation canals, etc. Dams construction at the level of some rivers has led to a reduction in the volumes of fresh water and a drop in the sediments of sand likely to be discharged onto the coast, with the consequences of the degradation of coastal habitats and an acceleration of coastal erosion (Diop, ND). The permanence of fresh water upstream of the dams and in the irrigated areas of these highly anthropized environments has favoured the development of invasive plants that have become a real factor in environmental degradation. This is particularly the case for the Djoudj National Bird Sanctuary.

The high concentration of industrial activities in the marine and coastal zone of West Africa (example in Senegal, 72% of industrial sector assets) poses real problems for nearby MPAs due to atmospheric, light, and wastewater (Madeleine Islands National Park and Saint-Louis MPA in Senegal; Tanbi and Tanji sites, Bao Bolon reserve in Gambia, etc.).

Maritime traffic is becoming increasingly important in the West African sub-region. Since the 1970s, maritime trade has gradually increased and now is between 80 and 90% of international trade. It goes on accelerating, showing a 4% increase in transported volumes in 2017 (GI CACAF, 2019). Virtually all ports in the West African region show an overall increase in their traffic (Deiss., 2019). Many port expansion, modernization and creation projects (trade, fishing) are dotted along the coasts of West African countries, testifying to the

dynamic development of national and international maritime transport (MOLOA, 2021). This development of maritime traffic increases the risk of pollution (accidents, ballast water) and constitutes an element that jeopardizes the integrity of the marine environment and MPAs.

Tourism is a powerful driver of economic development, considered an engine of growth for many West African countries (MOLOA, 2021). While in some MPAs, such as the Banc d'Arguin in Mauritania, the development of ecotourism does not affect the integrity of their ecosystems too much, in others, such as the Bijagos in Guinea-Bissau, the rise of more aggressive tourism is worrying (MOLAO, 2021). Poorly managed tourism is a factor in disturbing the tranquillity of animals and increasing pollution by solid waste and wastewater, even visual pollution when infrastructures are poorly integrated, or worse, abandoned when business don't work well.

Oil and gas exploitation, which has grown in the last five years, has an impact on marine resources through seismic surveys, oil spills, drilling, installation of equipment as well as waste discharges. This activity can also come into conflict with other economic sectors such as fishing and tourism. However, if this activity is managed correctly, threats and conflicts can be avoided or significantly reduced (Kloff et al., 2010). Oil and gas activities present real risks for MPAs in West Africa.

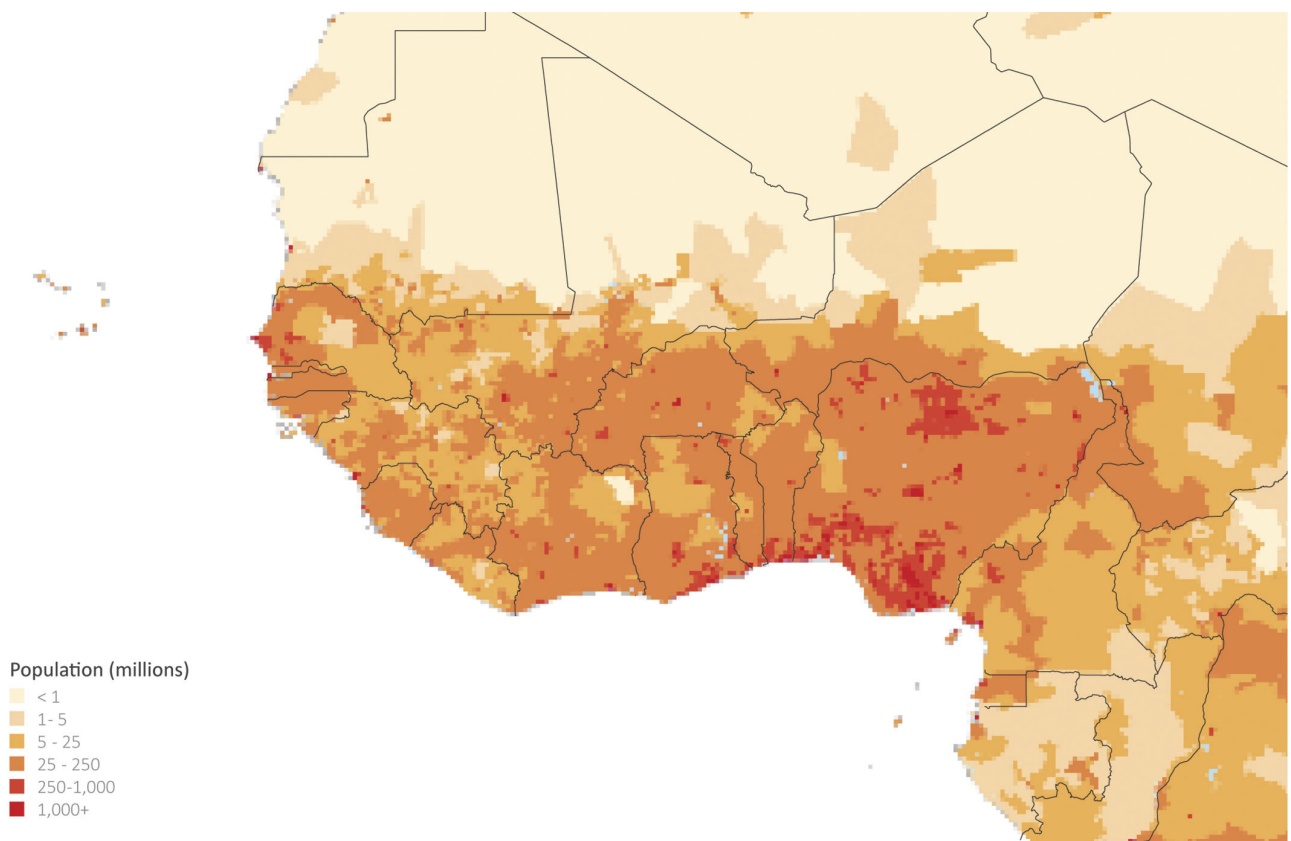
#### Strong urbanization of the coastal zone

In West Africa, coastal environments and ecosystems in general and protected areas close to cities are weakened by coastal urban development, through port, seaside and residential facilities that have an impact on the evolution of the coastline (WACA, 2016). The ports of Nouakchott and Monrovia caused very pronounced coastal erosion downstream regarding the littoral drift. The extraction of beach materials (sand, shells, rocks) is a situation prevailing in practically all major cities in West Africa. All these actions contribute in changing the sedimentary dynamics of the coast, creating risky situations.

Regarding biodiversity, the wetlands of West African coasts and the MPAs they shelter are among the environments most affected by urban development. In Nouakchott (MR), the extension of residential areas in the wet depressions around the Sebkhia and Ryad districts, located in the north-west of the city has been noted. The same situation is noted in cities such as Bissau (Guinea-Bissau), Conakry (Guinea) and Monrovia (Liberia) (MOLOA, 2021).

Urbanization does not exclude protected areas either. In Dakar, it is noted that an area of 78 hectares on the northern strip of filaos has been released for housing purposes. The city of Freetown is also whittling away the Western Area Peninsula National Park land, in the east of the city (MOLOA, 2021).

Urbanization is also accompanied by pollution of MPAs and the surrounding areas housing them by solid and liquid waste. In many beaches in West African coastal cities, the landscape is the same, with solid waste dumping sites and urban effluent discharge. The industrial sector also contributes in this pollution process through discharges into the sea, the consequences of which are harmful to the environment and coastal ecosystems (MOLOA, 2021).



**Figure 6.2 Population density in the region (2015)** Source: <https://sedac.ciesin.columbia.edu/data/collection/gpw-v4>

### 6.3.3 Impact of demographic change in and around MPAs

Nine of the ten cities with more than one million inhabitants in West Africa studied are coastal cities (Figure 6.2). Between 2000 and 2015, the population of coastal cities increased by 81% (MOLOA, 2021).

The strong densification of human populations on the maritime borders has led to a significant weakening of ecosystems and MPAs, through soil degradation, massive urbanization, overexploitation of marine species and ecosystems, forest massifs, soil resources and in water (MOLOA, 2021). Finally, pollution and salinization of soils and groundwater also contribute to destabilizing natural systems and to the scarcity of resources. The weakening of littoral and coastal zones and MPAs makes them more sensitive to climatic hazards, with the consequences of increasing the vulnerability of populations, already aggravated by the increase in inequalities in access to resources and ecological services (CCLME, 2014).

### 6.3.4 External pressures on MPAs (fire, cattle, etc.)

Several external pressures affect MPAs and the environments that shelter them. Among these are bush fires, the effects of stray cattle.

Whether accidental or intentional, bushfires are an integral part of the determining factors that contribute to the degradation of natural resources in West Africa (Garba et al., 2021). The nature of the vegetation, the type of landscape, the climatic and anthropogenic factors mean that the occurrence of fires as well as the extent of the areas burned vary from one country to another (Valea and Ballouche, 2012). In West Africa, bushfires occur for a variety of

reasons. In some localities, they are lit for hunting with the aim of driving down game or smoke burrows or hives (Kana and Etouna, 2006); this mainly concerns protected areas. They can also be lit for agricultural reasons with the aim of clearing fields or pastoral to restore pastures and avoid the closure of the vegetation cover. The fire can also be accidental, when on the edge of the roads, cigarettes not yet extinguished are thrown, or when a campfire is not completely extinguished, whether in parks or unprotected areas in more or less dense vegetation (Takahata et al., 2010).

The trend of active fires during the 2019/2020 season in all West African and Sahelian countries is down slightly, around 2% compared to the average over the past five years.

The effects of fires on MPAs' natural resources, in particular vegetation, soil and biodiversity, vary according to the periods (Garba et al., 2021). Indeed, if they are lit just at the end of the rainy season, the grass is not completely dry and the ground retains some humidity in places. This humidity level reduces the efficiency of the flames and therefore the extent of the burned surfaces (Valea and Ballouche, 2012). This type of fire is said to be early and characterizes the months of October and November in West Africa. It is also less destructive. On the other hand, the fire started during the period from January to April is more destructive, produces high flames and is considered devastating of vegetation and soil (Doamba et al., 2014). This fire also often concerns larger areas (Garba et al., 2021).

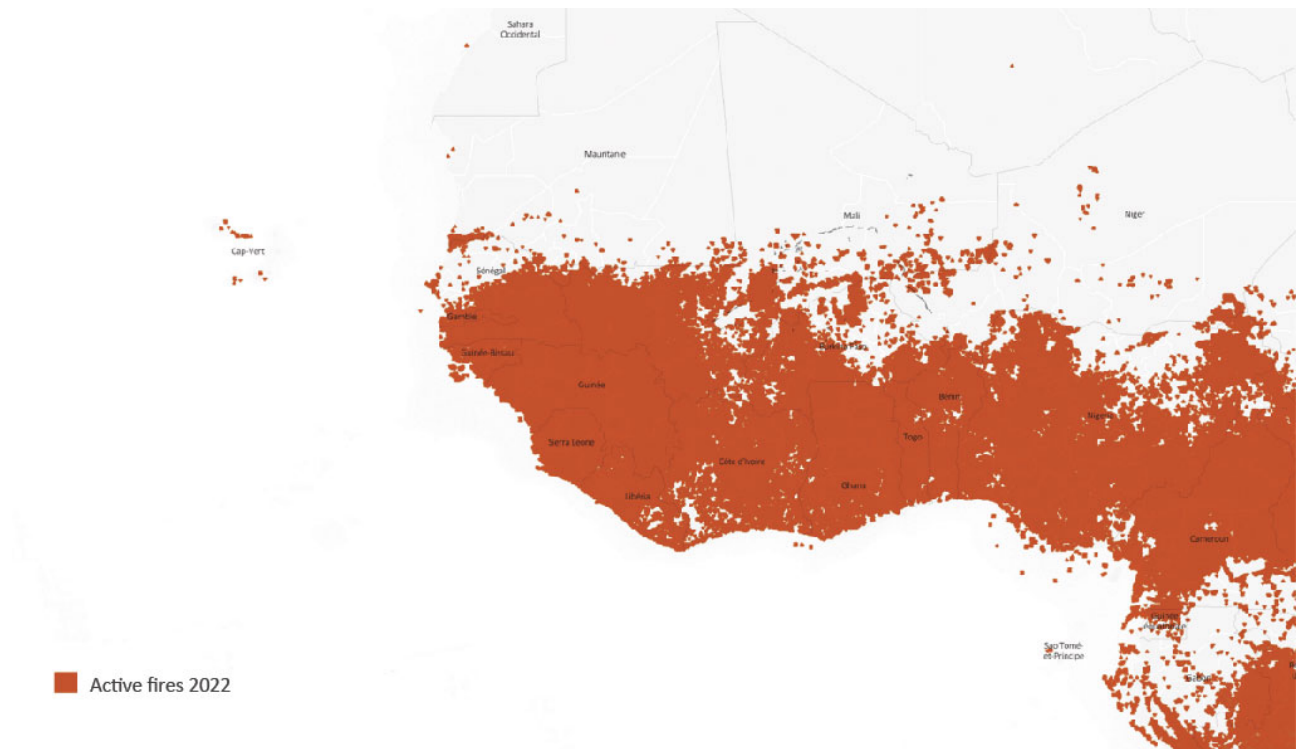
It should be noted that the occurrences of fires recorded in 2019/2020 in coastal areas, which host MPAs, are lower than the average for West Africa (Garba et al., 2021).

Another factor that contributes to the degradation of MPAs is livestock. The coexistence of livestock with wildlife often leads to a reduction in the number of the latter. Indeed, there would be competition between goats, sheep, cattle and wild herbivores that show the same behaviour in the pasture. On the other hand, domestic livestock would contaminate wildlife with contagious diseases (Boutrais, 2006). Many MPAs in West Africa are faced with incursions by livestock from surrounding localities. This is the case for practically all MPAs in West Africa.

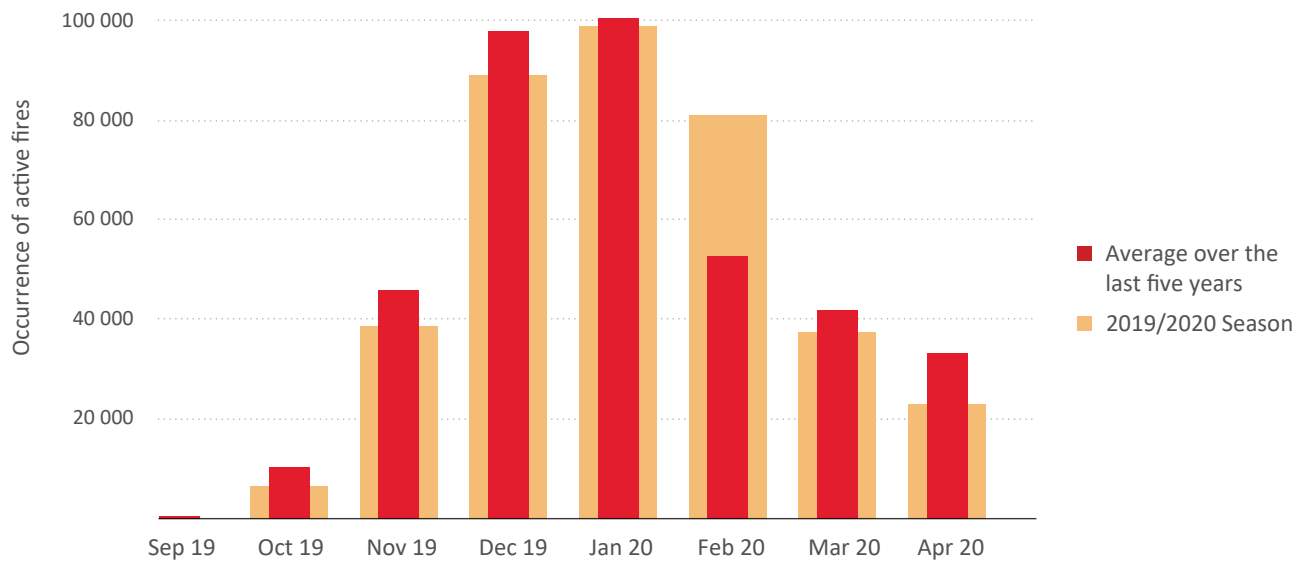
Similarly, wildlife from MPAs occasionally enters villages on their outskirts and attacks livestock or causes damage in the fields. This is the case, for example, of the Saloum Delta National Park in Senegal. This damage caused by wildlife in MPAs is the source of conflicts between the managers of these protected areas and the local populations.



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**Figure 6.3 Density of active fires occurrences for the year 2022 in West Africa and Sahel** *Source: <https://gwis.jrc.ec.europa.eu/>*



**Figure 6.4 Monthly variation in detections of active fires**

*Note: compared to the average of the last five years for all countries in West Africa and the Sahel. Source: <https://sedac.ciesin.columbia.edu/data/collection/gpw-v4>*





© Nik Borrow, Olive Colobus (*Procolobus verus*), in serious threat of extinction

### 6.3.5 Overexploitation and illegal exploitation of natural resources

Illegal exploitation and overexploitation of natural resources promote the degradation of MPAs. Uncontrolled fishing is the threat that affects the largest number of MPAs (Failer et al., 2019) in West Africa. The incursions of artisanal fishing units and industrial fishing vessels into MPAs and the laying of nets in bolongs are the most common forms of illegal fishing (Binet et al., 2012). Along with overfishing and illegal fishing, overexploitation of land-based natural resources (especially wood), pollution, agriculture and industries (factories and, from 2022, oil and gas exploitation) form the bulk of the panorama of degradation factors of MPAs whose occurrence is the strongest. The mangroves of MPAs along the coast and in the estuaries are subject to intensive exploitation for constructions of all kinds, cooking fires, the smoking of fish products and the cutting of roots when harvesting oysters) (Sarr, 2005; Joyeux et al., 2010). An emerging potential driver of degradation is the exploration and exploitation of hydrocarbons off the West African coast (WWF and UNDP, 2014).

### 6.3.6 Invasive alien species

Another factor that contributes to the degradation of West African MPAs is the development of invasive and exotic species. The most frequent causes are the development of infrastructures modifying the ecological functioning of the environments and the MPAs that shelter them (Diouf et al., 2016)<sup>3</sup> and the ballast water of ships (CCLME, 2014). To these two main causes, we must add species that escape from aquaculture farms to colonize the surrounding environment and MPAs.

The typical example of the influence of infrastructures is the case of the Senegal River delta where, due to the Diama dam and the development of irrigated agriculture, fresh water has become permanent in the upstream part and the middle rich in nutrients due to fertilizers, thus promoting the development of invasive plants, such as *Typha australis*, *Salvinia molesta*, *Phragmites* species (Diouf, 2016). The various chemical, mechanical and biological controls administered have not yet completely eradicated these invasive plants (CCLME, 2014).

The threat of ecological invasion due to ballast water is considered very important by the International Maritime Organization (IMO). Ships' ballast water carries up to 7,000 species worldwide (CCLME, 2014). Naturally, the change in temperature between the ports of departure and the ports of arrival, the different ecosystem contexts slow down the development of some of these new species. However, regularly some succeed in adapting to this new environment benefiting from favourable climatic conditions and especially from the absence of predators. In a few years, they colonize the new space, radically transforming ecological balances (CCLME, 2014).

Shrimp species (*Penaeus monodon*, *Penaeus vannamei*) which escaped from aquaculture farms in Guinea and Casamance (Senegal), ended up in the natural environment and nearby MPAs

<sup>3</sup> Diouf PS, Ngom M. and Fall M., 2016. Ichthyofauna and fishing in Lake Guiers and the Ndiaël reserve. IUCN/OLAG, 58 p.

and one of them (*Penaeus monodon*) adapted well and became abundant (Sahel and West Africa Club/OECD, 2006).

### 6.3.7 Infrastructure construction

A summary of studies made on the impacts of infrastructure development in the Banc d'Arguin National Park (Mauritania), the lower delta of the Senegal River, the Saloum delta (Senegal), the island of Boa Vista (Cabo Verde) and the Kapatchez delta (Guinea) gives a good idea of their contribution to the degradation of MPAs in the RAMPAO space (Diouf, 2022).

#### Case of Mauritania

Road infrastructure, particularly the Nouadhibou road and the Mamghar road, has an impact on the ecosystems of the PNBA. For the Nouadhibou road, it greatly improved accessibility to the Park. Even if it opens up interesting prospects for the resident populations of the Park, the potential adverse effects are numerous: development of uncontrollable tracks, influx of traders, wholesalers and other more or less undesirable external stakeholders, etc.

With regard to the Mamghar road, it is the source of several undesirable effects: the increase in the quantity of suspended solids in the air during the dry season; combustion gas emissions and movement of machinery; pollution by liquid waste, sound and vibrations, as well as solid household waste; possible damage to the landscape integrity of the Park through the removal and/or crossing of Neolithic shell middens; increased pressure on park resources; the disturbance of the tranquillity of the fauna of the Park.

The urban developments identified as having a negative impact on the sites of ecological or biological interest of the PNBA are the free zone of Nouadhibou, the city of Chami and the Imaraguen villages.

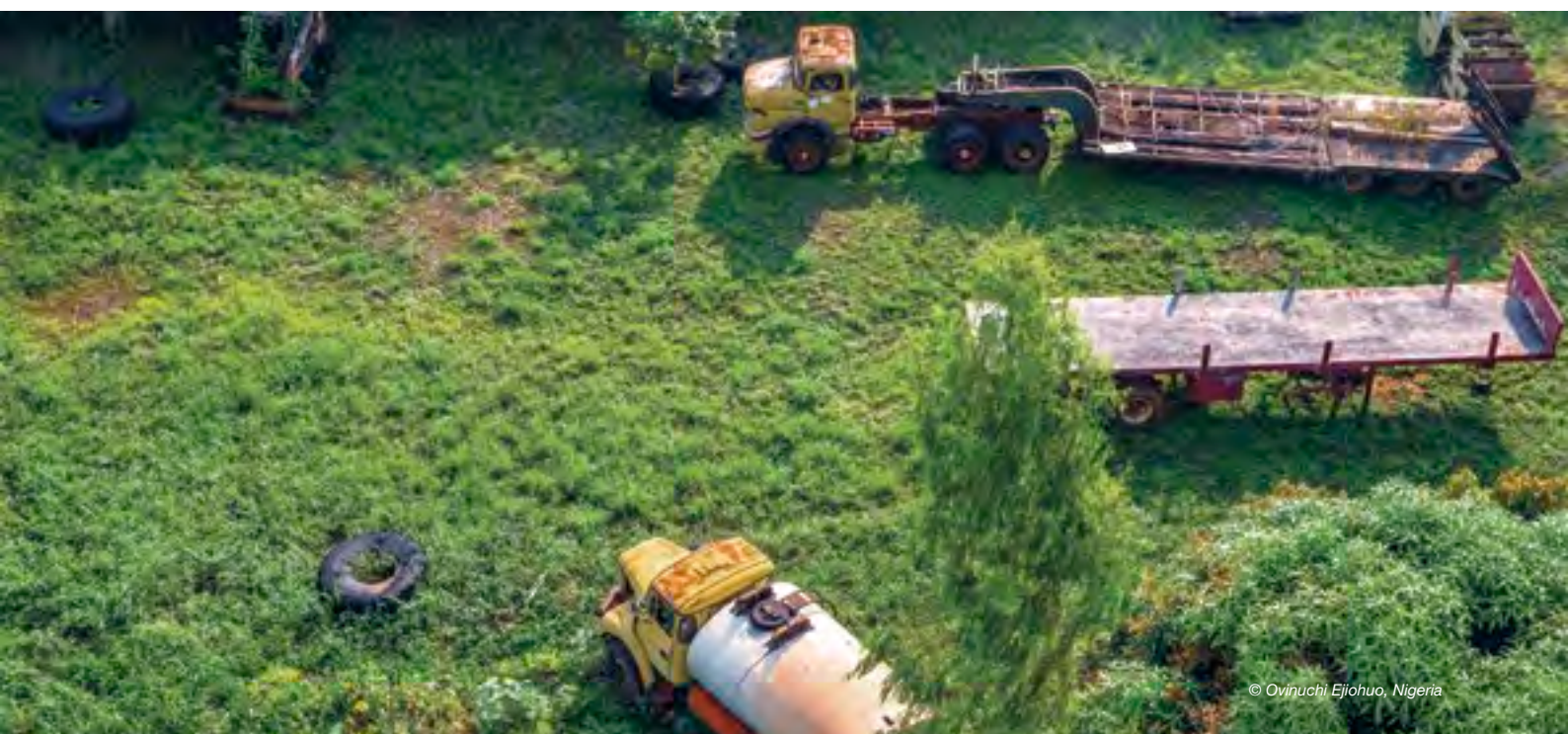
#### Case of Senegal

The analysis of infrastructure of the Lower Delta of the Senegal River shows that of the 15 identified as being able to have impacts on sites of ecological or biological interest, 12 of them are very large (the Diama dam, the Saint-Louis and surrounding sewerage network, Saint-Louis airport, the breach (relief canal), the Langue de Barbarie dyke protection project, infrastructure related to the Senegal River navigation project, agricultural developments, tourist facilities, the new Niayes road (coastal highway), human settlements, zircon exploitation, infrastructure for offshore gas exploitation). The lower delta has become an environment strongly anthropized by these infrastructures and major changes have occurred in production methods. Agribusiness is becoming increasingly important in the area to the detriment of traditional agro-sylvo-pastoral systems.

In the Lower Delta of the Senegal River, special attention will have to be paid to the infrastructures linked to the exploitation of gas and zircon, when they are ready. Indeed, their possible dysfunctions could have serious consequences on the environment, populations and socio-economic activities (pollution, displacement of villages, loss of fields, etc.).

In the Lower Delta of the Senegal River, the establishment of infrastructure is mainly motivated by hydro-agricultural development, and more recently the exploitation of gas and zircon resources.

In the case of the mangroves of the Lower Delta of the Senegal River, the infrastructures that have the most impact are: the Diama dam, the wastewater treatment plant and the emptying trucks of private operators, the breach (shedding canal), hydro-agricultural developments, road transport infrastructures.



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As regards nesting sites, feeding sites and the migration routes of sea turtles, the following infrastructures have the most significant impacts: human settlements, the Diama dam, the breach (canal shedding), infrastructures linked road transport and tourist infrastructure.

The exploitation of gas off Saint-Louis will increase boat traffic in the area and will probably lead, at the same time, to an increase in collisions with sea turtles and marine mammals.

The construction of infrastructure in the Saloum Delta is above all linked to the resolution of four major concerns: isolation, the lack of drinking water, the fight against coastal erosion and the exploitation of natural resources. Indeed, roads, bridges and pontoons and ports occupy a good place and constitute a prerequisite for a harmonious and sustainable social and economic development of the area.

Infrastructure related to the exploitation of fishery resources are abundant in the area. Their impact on the mangroves, the health of the populations and the working conditions of women processors of seafood products is considerable.

As regards mangroves of the Saloum Delta, the infrastructures that have (or will have) the most impact are those related to the exploitation of oil and gas, road transport, human settlements, hotels and camps, tourist sites, fishery product processing plants, fishery product smoking ovens and small-scale seafood product processing sites.

Indeed, the exploitation of hydrocarbons off the Saloum Delta can lead to oil leaks, ship accidents that can create oil spills and noise pollution (especially during the construction phase). The risky behaviour of fishers (high concentration of fish around oil installations

usually highly coveted by fishermen) and Senegal's lack of experience in managing the risks associated with the exploration and exploitation of hydrocarbons are factors that may increase the risk.

Road transport infrastructure, by blocking the water supply of mangrove areas and by building pontoons, culverts and culverts during road construction, contributes to the destruction of large areas of mangroves and to the disappearance of all associated fauna and flora.

As regards the Saloum Delta seagrass beds, it is above all the Sangomar Offshore Deep oil and gas infrastructure that can have negative impacts in the event of an oil spill. Fishing also contributes to the degradation of seagrass beds. In fact, bottom trawls and drift nets tear up seagrass beds. When fishing pressure is high, large areas can be affected, which is the case on the Petite-Côte and the Saloum delta.

Sea turtle nesting and feeding sites and migration routes are mainly impacted by human settlements, hotels and tourist camps.

#### **Case of Boa Vista in Cabo Verde**

In Boa Vista (Cabo Verde), the tourist and hotel facilities with land use destroy the nesting sites of sea turtles and constitute obstacles to their movement. The lighting of hotels, port infrastructures, communication routes, cars and the noise of machines constitute factors of disturbance and disorientation of sea turtles.

The increase in the circulation of motorcycles and all-terrain cars on the beaches, which is due to the lack of control, the low interest of operators in respecting environmental laws (which prohibit the



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circulation of vehicles on beaches and dunes), or simply ignoring current environmental legislation disorients sea turtles and scares them away. Noise pollution produced by boat engines affects the behaviour of sea turtles. We must also deplore the production of solid waste which contaminates both soil and water.

As regards the protected areas of the island of Boa Vista, the most significant negative impacts are due to tourist and hotel facilities and urban infrastructure.

The development of many recreational tourist activities, in particular excursions in all-terrain vehicles, has negative consequences on dunes and the nesting sites of sea turtles.

The capture of birds is the cause of the reduction in their numbers. The other impact in relation to the urban infrastructure is the frequent visits of fishers and their disturbances (noise, contamination, destruction of habitats).

As regards sea turtle nesting sites, tourist and hotel infrastructure and urban infrastructure have the most negative impact on wetlands. Among the activities developed in the wetlands, there is the “laser game”, excursion tourism in all-terrain vehicles and the observation of avifauna. These activities may have impacts in species reduction.

The dunes of Boa Vista are also affected by tourist activities, including the influx of people for the observation of avifauna, the

circulation of motorcycles and all-terrain vehicles which destroy the dune structures and the vegetation.

The illegal extraction of sand from beaches and dunes accelerates erosion and leads to the destruction of the natural habitat of the loggerhead sea turtle, which uses the dunes for egg laying. The free and extensive grazing of goat cattle causes the compaction of dunes and the destruction of vegetation. Solid waste (waste, rubble, scrap metal) contaminates the ground and water.

Small bays are also affected by tourist and hotel infrastructure and urban infrastructure through “laser game” activities, sport fishing, water sports, illegal fishing of small fish. We must also deplore the presence of fishermen on the entire coastal strip who catch protected species.

#### **Case of Kapatchez Delta in Guinea**

With regard to the Kapatchez Delta, mining is not carried out on the perimeter of the Kapatchez MPA, but its treatment and evacuation infrastructure significantly affect the populations and ecosystems of the Delta.

Since 2015, the number of operational ports, or under construction or under design has been constantly increasing in the Kapatchez Delta. The rhythm of their planning and their realization was de facto imposed by the need to allow the exploitation of the bauxite

reserves and the evacuation of the bauxite by the mining companies installed in Boké.

Thus, the Prefecture of Boké today hosts more than ten bauxite extractive industries. Two of them (CBG and GAC) are located in Kamsar, that is to say in the immediate vicinity of the Kapatchez Delta MPA. The district of Taïgbé, for example, is located less than five kilometres from certain facilities of the CBG and GAC, bauxite exporting companies, owners of evacuation ports from quays for large tonnage ships. The ore is transported in both cases by rail, in ore trains of more than 100 wagons, with also the noises and jolts that accompany them.

Port facilities of the other mining companies are installed upstream of the Rio Nunez, directly adjacent to the Kapatchez Delta, in the villages of Dapilon, Katougouma and Kabata. Other mining companies plan to do so in the near future. Towards these ports there is an incessant movement of trucks and increased air pollution. From these ports upstream of the Rio Nunez, the bauxite is transported in towed barges to large tonnage ships stationed off the Atlantic Ocean.

### 6.3.8 Weak monitoring capacities of marine protected areas

West African MPAs benefit from a remarkable diversity of environments and natural resources (Johnson et al., 2014). Like the coastal areas that host them, they face significant and growing anthropogenic pressures due to economic development (Binet et al., 2012). Home to a large part of the population, attracted by the wealth of natural resources and job opportunities (most economic activities are located in the coastal zone), the coast is subject to numerous attacks (Johnson et al., 2014; Dahou et al., 2004)<sup>4</sup>. In such a context, the marine protected areas (MPAs) of the region have been established with the objective of conserving natural resources (ichthyofauna and emblematic marine mammals, in particular) and habitats (mangroves and beaches in priority), and in order to act as a vehicle for social development at the local level (Failor et al., 2019). These MPAs act under the supervision of specialized national institutions, although some sites are managed at the community level (e.g. in Senegal and Guinea-Bissau). Overall, they struggle to achieve their conservation objectives (Failor et al., 2018; Staub et al., 2014), and more particularly in terms of monitoring.

One of the most critical aspects in the management of most MPAs in West Africa is the establishment of adequate systems for effective monitoring, in order to fight against the illegal exploitation of natural resources (fishing, exploitation of protected species, mangrove cutting, etc.) (Karibuhoye, 2008). Despite the efforts made over the last twenty years, such as the regional training program which was implemented with the technical assistance of the French Office for Hunting and Wildlife (Office français de la chasse et de la faune sauvage or ONCFS), in collaboration with the PNBA (which made it possible to train around ten MPA monitoring agents in the sub-region each year), the support of technical and financial partners and the budgets and equipment allocated by the States, the financial, material and human resources made available marine protected

### Box 6.2 Extracts from newspaper reports on field activities in MPAs

“A lot of things don’t work. We certainly receive support from the State and certain NGOs. But we are facing difficulties purchasing fuel to ensure surveillance with the canoes. The other problem with the AMP is volunteering because the people who carry out surveillance are not paid. We do patrols because we don’t have the means to do surveillance. Currently, the three boats are at the quay, whereas they should have been on the water to ensure surveillance. In all sincerity, we do not have enough means to ensure surveillance”, confides Mr. Sall<sup>1</sup>, also President of marine protected areas in West Africa .

Commander Moustapha Cisse, then curator of the Sangomar MPA in Senegal, spoke on the sidelines of an activity to clean up marine turtle nesting sites, an initiative falling within the framework of the fight against the proliferation of plastic waste by saying: “ It is clear and note that the means available to the service responsible monitoring and conservation of the area are not proportional to the surface area and configuration of the MPA.<sup>2</sup>

1 Senegal Black Rainbow, 2014. Joal marine protected area. <https://www.senegalblackrainbow.org/2014/11/06/aire-marine-protgee-de-joal/>

2 Nionko S., 2020. Monitoring the Sangomar MPA requires more resources, according to its curator. <https://www.koldanews.com/2020/10/07/la-surveillance-de-lamp-de-sangomar-demande-plus-de-moyens-conservateur-a1260594.html>

areas in West Africa are still insufficient to ensure proper preservation of ecosystems.

The comments of a marine protected area custodian and an actor from the communities confirm this situation of insufficient resources (see Box 6.2 taken from newspaper reports on field activities in MPAs).

In addition to that, it should be added that, although progress has been made, coastal management is struggling to extricate itself from a logic of lack of harmonization of legal texts, institutional compartmentalization, centralized and top-down governance (MOLOA, 2021). This highlights the need to implement participatory legal and institutional reform, to achieve Integrated Coastal Zone Management (MOLOA, 2021) also taking into account the specific needs of MPAs.

4 Dahou T., Weigel J.-Y., Ould Saleck AM, Da Silva A.-S., Mbaya M. and Noel J.-F., 2004. The governance of marine protected areas: lessons from West Africa, Vertigo, volume 5, article n° 3

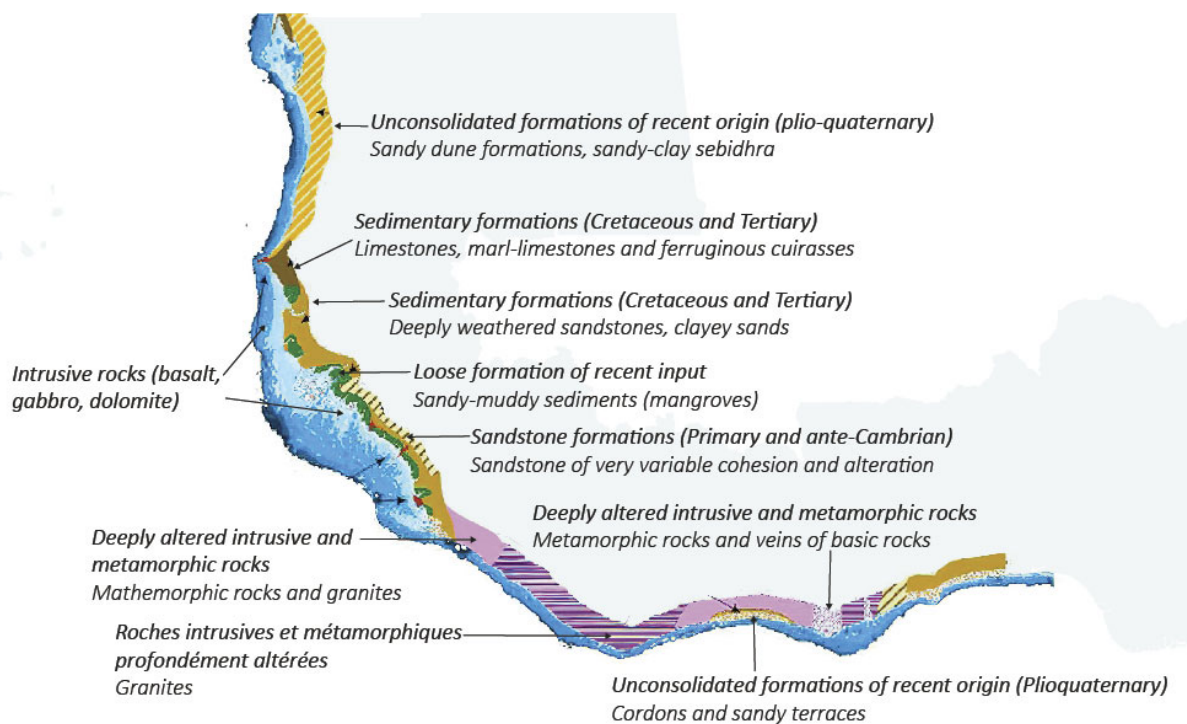


Figure 6.5 Simplified lithology of the West African coastline Source: CCLME (2021)

### 6.3.9 Coastal erosion

The coastal zone of West Africa is characterized by sandy formations subject to the direct action of the coastal drift current (Mauritania to the Cabo Verde peninsula), rocky capes and sandy coves (Cabo Verde peninsula to Lower Casamance, Liberia, central Ghana), several estuaries including the Senegal River delta and the Volta delta (Côte d'Ivoire), mangroves from Sine Saloum in Senegal to the Sherbro Islands in Sierra Leone. This feature predisposes the West African coast and the MPAs it shelters to a certain fragility in the face of marine weather hazards (CCLME, 2021). Erosion can reach 20 meters per year in certain areas (Saint-Louis MPA in the Gandiolais) and can create ecological upheavals (Case of the natural opening of the Sangomar coastal spit, Sangomar MPA).

The West Africa coastal areas, from Mauritania to Benin, extend over approximately 10,000 km of coastline (WAEMU, 2017). In this coastal line, rocky coastlines constitute less than 3% of the coastline formed by rocks often altered and fractured, sometimes not very coherent, and subject to landslides and erosion, such as the cliffs of Dakar for example (CCLME, 2021).

Coastal erosion is an important factor in the degradation of the coastline and the MPAs therein. In addition, floods are most often linked to three combined phenomena: flooding by marine submersion, flooding by rainwater runoff and river flooding, the occurrence and power of which are aggravated by the effects of climate change (CCLME, 2014).



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## 6.4 Issues and challenges of offshore extractive activities in marine protected areas in West Africa: the example of Senegal

### 6.4.1 Introduction

If the States have, through their public policies, a large share of responsibility in the transformation of natural environments, private companies are also leading protagonists (Bommier S., Renouard C., 2020). Major oil companies thus contribute to the construction and expansion of economic and social structures incriminated in planetary changes such as climate change, loss of biodiversity, eutrophication of oceans, water and air pollution, air, etc., and in doing so contribute to the degradation of marine protected areas. The question therefore arises of the responsibility of oil companies regarding the sustainability of marine protected areas, threatened by offshore extractive activities. This contribution aims to analyse the environmental and socio-economic risks oriented towards the preservation of marine protected areas (MPAs) in the face of offshore extractive activity projects located off the coast of Senegal. To this end, we will attempt to succinctly describe the issues, potential impacts and proposed solutions.

### 6.4.2 Offshore oil and gas discoveries: What are the challenges for marine protected areas?

Since 2014, Senegal has hosted new industrial projects deemed profitable offshore. A major challenge arises when it comes to the preservation and protection of marine protected areas (MPAs). In 10 years, Senegal has gone from five marine protected areas to 15 (DAMCP, 2022 edition)<sup>5</sup>. MPAs, which constitute an essential driver for the sustainability of fisheries resources, ecosystem services and the survival of coastal communities, are potentially threatened either by an explosion, an accidental spill, an operational discharge of hazardous waste or pollutants, or by a risk of oil spill related to these projects. Studies show that Senegal belongs to one of the most productive maritime areas in the world thanks to the upwelling of cold waters called upwelling (Bakun A., 1996; Faye., S. 2015). The concern to guarantee a healthy and sustainable environment as stipulated in the Constitution (Article 25.1), in the face of the exploitation of offshore hydrocarbons, must lead decision-makers to quickly guarantee a framework that makes it possible to take into account the dimension of the ecological and economic transition of oil projects, at sea, before it is too late, paying particular attention to the issue of coastal MPA management and the preservation of vulnerable ecosystems in the high seas. Experience shows that offshore oil and gas activities often lead to complex transformations on the environment, fisheries and tourism, and can cause a scarcity of fishery resources or conflicts with sea users, if they are not well managed upstream and supervised during their development.

<sup>5</sup> Information workshop on the organisation of the 2022 Scientific and Technical Advisory Committee of the Department of Community marine protected areas (held on 25 May 2022).

### 6.4.3 Senegal: Lessons learnt from the impacts of planned offshore extractive activities

The history of hydrocarbons in Africa and around the world is littered with issues identified by the Extractive Industries Assessment Report and the policy bulletin of the African Center for Economic Transformation (ACET). These reports revealed conflicts and numerous socio-economic and environmental impacts (World Bank Group, 2004, ACET, 2012). Africa is still stuck in its historical role as a subordinate provider of natural resources, including extractive ones, for the global system, even if that role does not exclude a variable degree of autonomy (Bayart, 1989). At all stages of upstream oil, zero risk does not exist. This allows us to present the Figure 6.6 to describe the different phases of the upstream oil life cycle.

Compared to the prospecting phase, the number of seismic pulses executed during the exploration of an area of 100 km<sup>2</sup> is not less than 5-8 million (Patin, 1999). In Mauritania, in an area covering 100 km<sup>2</sup>, 25,000 explosions are recorded (Woodside Energy, 2005). Studies reveal that during seismic campaigns, shoals may become dispersed and lose track of their migratory path (Patin, 1999, Maeir, 2002). It is well recognized that marine mammals are particularly sensitive to seismic surveys. They can become deaf when in contact with certain sound frequencies (Michaud and Chenelière, 2005). Several studies have shown that whales and dolphins not only stop feeding and communicating, but also change the way they dive (Mc Cauley, et al., 2003). As concerns the drilling and development process, explosion cases are not uncommon: in the United States alone, 39 cases have occurred in the past 16 years, half of which were caused by sealing problems wells (Steiner, 2010). Thus, on April 20, 2010,

in the “Mississippi Canyon 252” of the Macondo deposit carried by BP, located 80 kilometres from the coast of Louisiana, a violent explosion destroyed the Deepwater Horizon drilling platform, causing eleven deaths among the employees and enormous environmental damage. By way of illustration, we present below a few cases of accidents that occur during oil operations.

As regards the Deepwater Horizon explosion, the leak released 4.9 million barrels of crude oil into the ocean (Steiner, 2010; Géraud Magrin and Bopp Van Dessel, 2014). The well had not been sealed until 87 days later. Some 7,000 birds, turtles and dolphins had fallen victim to the oil in 3 months. Thousands of fishers, especially shrimp fishers, had found themselves technically unemployed and the tourist season compromised on more than 2,000 km of the coast. Other ecosystems have been damaged by oil activities in Africa and around the world, such as the case of the Niger Delta in Nigeria, Chad, Angola, Congo<sup>6</sup> and the Gulf of Mexico (Steiner, 2003, Magrin, 2011).



© Louisiana GOHSEP, pelican covered in oil

6 Antoine M., K., I. 2009. “Impact of oil exploitation on the health of local populations and the environment in Moanda: Case of the firm Perenco” 17 p.





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#### 6.4.4 Prospects for marine protected areas management: What solutions to suggest?

Senegal is moving towards the exploitation of gas fields of Grand Tortue Ahmeyim (GTA), Téranga and Yakaar and the oil fields of Sangomar, formerly called SNE<sup>7</sup>. Indeed, the production of gas and oil resources is planned from 2023 for phase 1 of the GTA and Sangomar deposits, while scientific knowledge of the seabed ecosystem is still considered low.

In addition, the national, regional and international regulatory frameworks intended for the protection of the marine environment and the supervision of offshore economic activities in Senegal still pose limits. In 2008, in his report titled “Protect, Respect and Remedy” and submitted to the United Nations Human Rights Council, John Ruggie asserts that a responsible company must identify, minimize and repair the negative impacts linked to its activity, throughout its value chain. In the years that followed, the United Nations, OECD, International Labor Organization, European Union and many government bodies adopted this impact perspective in their codes of conduct and public policy guidance documents.

These reforms legitimize the discourse of social movements vis-à-vis companies in terms of environmental and social accountability and modify society’s understanding of these transnational actors (Bommier 2016b).

Thus, faced with insufficient knowledge and information on the Senegalese continental slope and the risks linked to the exploration and future production of fossil fuels at sea, the State must take measures to better control the whole process of the oil and gas activities taking place at sea but above all to be able to reconcile them with maritime fishing and the conservation of marine biodiversity in order to manage all its maritime resources located in MPAs and outside MPAs on a sustainable basis .

Due to the need expressed by Senegal to diversify its economy and its energies, it is important to ensure that the exploration and exploitation of offshore hydrocarbons will not compromise the management and protection of the environment in general and MPAs in particular and that this is not done to the detriment of other resources and/or sectors, in particular fishing and tourism.



Figure 6.6 The four phases of the oil cycle

Source: Authors’ compilation from Newmont (2013) and Minerals Council of Australia (2015), adapted by Gueye (2020).

<sup>7</sup> SNE: Shelf North Edge

As such, this is all about:

- putting an end to anarchic exploitation known in African countries to promote coherent corporate responsibility, at the service of social and ecological ties;
- creating an ecological compensation fund for the protection of MPAs and sensitive areas;
- promoting scientific research of the seabed located in the bathyal zone.
- developing relevant technical tools to monitor environmental (including micro-contaminant) and social impacts;
- implementing tools that facilitate the support and supervision of people impacted or affected by the projects (PIAP) and their retraining.

#### **6.4.5 Example of success stories related to the conservation and restoration of ecosystems in West Africa's MPAs**

To control pollution of the Saint-Louis MPA beach in Senegal, managers of the latter regularly organise “Cleaning Days” as part of the waste management and recovery project at the level of the Saint-Louis MPA, funded by RAMP AO. These events are organized by MPA officers, the populations and members of the Management Committee. This activity helps to rid the beach of plastic and other waste deposited by the waves on the nesting areas of sea turtles and breeding birds, especially gulls.

During each session, dozens of people, enthusiastic, motivated and committed, take part in cleaning up the Saint-Louis beach. Hundreds of kilograms of waste are eliminated. The waste that can be enhanced is recovered and the others are disposed of or treated in the most appropriate way according to their characteristics.

We supported this initiative by organising a training workshop for stakeholders on plastic waste issue, including: sorting, packaging and disposal of plastic waste. This training took place on 28 February 2022 in Saint-Louis.

Drivers of success of this initiative include:

- the participatory and inclusive approach;
- good information and communication highlighting the positive impacts of Cleaning Days;
- quality leadership within the Saint-Louis MPA; and
- support from technical and financial partners.



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## 6.5 Conclusion and recommendations

Marine and coastal areas play a key economic and social role in West African countries, through fishing, tourism, oil and gas exploitation, concentration of industries and populations. However, they are subject to multiple pressures which, if we are not careful, risk undermining the integrity of the ecosystems they shelter and reducing their productivity.

MPAs that have been created there, if well preserved, constitute a pledge and an assurance of the sustainability of ecosystem services and goods, which they provide to an increasingly large population. This good conservation of MPAs requires considering the pollution and nuisances to which they are subject, but also several other factors that contribute to their degradation. It also involves strengthening the technical, functional, institutional, material and financial capacities of the administrations and the agents who manage them as well as the stakeholders associated with this management. It would also be wise to strengthen RAMPAO's capacities, which is a valuable tool for better management of MPAs in West Africa, taking into account sub-regional and transboundary aspects.

A particular effort will have to be made by the authorities, research centres and universities to help improve knowledge on pollution (especially) and the factors that contribute to the degradation of MPAs. Information on MPA pollution is sparse and figures are often lacking. Similarly, the absence of a reference state for several MPAs is detrimental to a good understanding of the issues and to the management of these MPAs.

Currently, the situation related to pollution and the factors that contribute to the degradation of MPAs, overall, is not yet alarming, except for solid waste for which a special effort must undoubtedly be made. MPAs far from major urban centers and industrial

concentration areas are the best preserved. This is particularly the case in the Bijagos Islands in Guinea-Bissau. However, with the short-term prospects for the development of oil and gas activities and extractive industries in general in the sub-region, it would be beneficial to develop an action plan for the conservation of MPAs in West Africa. This action plan should include a system for monitoring risks in the marine and coastal environment. Satellite images will be of significant importance in this monitoring system.

Moreover, if we want to maintain the attractiveness and socio-economic dynamism of the marine and coastal zone of West Africa, given the important role played by MPAs in maintaining the productivity of ecosystems and the maintenance of biodiversity (at the local, national, sub-regional and global levels), it is essential that the authorities representing MPAs in the area be involved in negotiations between States and oil/mining companies so that MPAs can benefit from offset credits associated with these operations. There are terrestrial examples in the sub-region as in Guinea which should usefully inspire other countries.

Finally, offshore oil and gas exploitation is at the dawn of significant development in the sub-region. The current negotiations leave a possible place for MPAs to even benefit from these industrial developments, for example by creating ecological compensation funds intended for the protection of MPAs and sensitive areas, by promoting scientific research of the seabed located in the bathyal zone. It would be extremely unfortunate if this opportunity to support conservation through development were missed.



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## Box 6.3 Oil in Nigeria

### Introduction

Nigeria has a coastline of about 853 square kilometres and a maritime space of about 170,400 square kilometres seaward of the baseline. This represents about 18.5 per cent of Nigeria's landmass of 923,768 square kilometres. It could also be rightly said that Nigeria's maritime space is about one-fifth of Nigeria's landmass (The Guardian, 2021).

The Nigerian coastal and marine environments is the main source of foreign exchange in the form of oil and gas and is also responsible for almost 70% of the fisheries resources consumed nationally. Other notable resources include the expansive mangrove vegetation (covering over 11,134 square kilometres in the Niger Delta) and other ecosystems which support the numerous fauna some of which are becoming extinct. The rich biodiversity resource of the marine environment supports some pharmaceutical companies, wood processing and ornamental plants and support a variety of research, education, and cultural values.

### Pollution issue

The onshore and offshore environment of Nigeria is dotted with several legal Oil Mining Lease (OML), Oil Prospecting License (PML) and other illegal oil exploitation activities. The negative aspects of these activities result in the decimation of the natural resources. Onshore repeated seismic survey and lines, dredging, construction of roads, exploration and drilling expands the size of destroyed mangrove ecosystem and other coastal vegetation. Other impacts include the destruction of the Niger river hydrology and the release of the toxin accumulations in most of the river system through dredging. Seismic Surveys offshore introduces noise while exploration drilling results in

mud cuttings which introduces plume in water column. It has been reported by several authors (Wali, E. et al 2019; Isebor and Awosika.1996) among others that oil exploitation offshore introduces negative impacts on reproductive health of bottom-feeding fish and changes in the cell membrane.

### Consequences of oil exploitation on coastal ecosystem

Oil spill is the direct consequence of oil exploitation. Nigeria experiences rampant oil spills which have persisted for decades because of inadequate servicing and maintenance of the oil and gas facilities such as preventer blowout, wellhead, flow lines or pipelines, sabotage, accidental and equipment failures by legal and illegal oil companies. National Oil Spill, Detection and Response Agency (NOSDRA) alerted with a recent aid through data acquisition in monitoring of oil spill from January 2013 to September 2014 reveals that there were 1,930 oil spill incidents in the core Niger Delta are primarily offshore incidence in wetlands ecosystem (Wali, E. et al 2019).

Generally, oil spills in Nigeria are not reported, as they are considered "minor" spills. Major spills recorded and reported range from 300,000 to 400,000 barrels as was the case of the Texaco Funiwa-5 blowout in 1980 of about 400,000 barrels, GOCON's Escravos spill in 1978 of about 300,000 barrels and SPDC's Forcados Terminal tank failure in 1978 of about 580,000 barrels. These spills affect the overall health of the wetland ecosystem and the fishery resources. The resulting environmental degradation and hazards are immeasurable. The impacts of these pollutants are varied and depend in particular on the chemical nature of the waste, physical and chemical characteristics of the recipient environment as well as the biological characteristics of the organisms exposed. The loss of biodiversity remains a major cause for concern.

## Box 6.4 Box on hydrocarbon risks (BRLi)

### Context

Offshore oil and gas activities present several risks to marine and coastal ecosystems, including crude oil, damage to seabeds, gas flaring and waste, as well as spills of oil and other chemicals at sea. These spills are generally accidental and unfortunately have major adverse consequences for ecosystems.

To prepare effectively for this type of incident, it is essential to predict the short- and medium-term behaviour of oil spills along the West African coast in order to determine which sensitive areas or key biodiversity zones may be at risk.

BRL ingénierie, a French engineering consultancy, conducted numerical simulations for PRCM, an association working for marine conservation in West Africa, of the propagation of oil slicks accidentally spilled at sea from offshore oil and gas exploitation sites in the North-West African zone in order to determine which marine turtle feeding and nesting sites could potentially be threatened by these activities.

### Modelling method

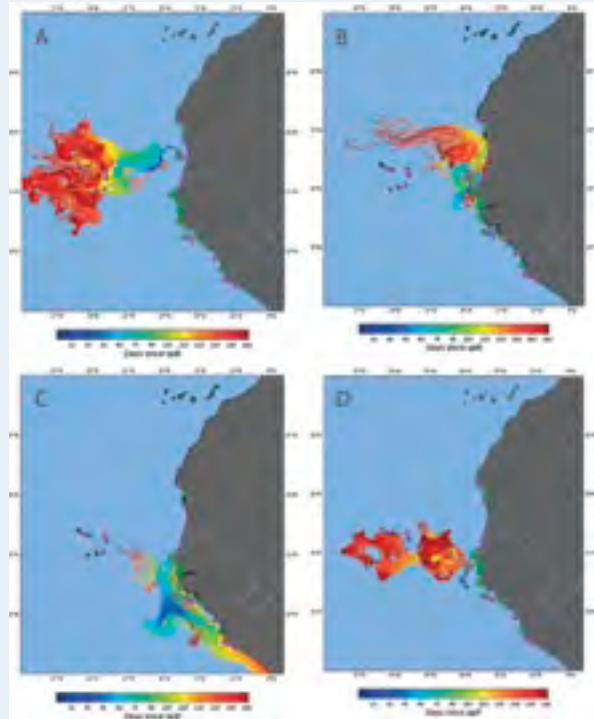
- Identify 7 potential oil spill sites
- Modelling particle dispersion from these sites
- Lagrangian drift of particles (Ocean Parcels software) in a surface current field (Mercator current data)
- Spill of 5,000 particles over 1 km<sup>2</sup>
- 5 accident start dates: January, August, November 2018 and May, August 2019 (analysis influencing weather and ocean conditions), i.e. 35 accident scenarios (7 sites x 5 dates)
- Particle monitoring for 6 months



### Some findings

Scenarios shown here:

- Accidental spill at Chinguetti on 1 August 2018
- Accidental spill at Grand-Tortue on 1 May 2019
- Accidental spill at Sinapa on 1 May 2019
- Accidental spill at Sangomar on 1 August 2019



### A few clarifications

- We display all the positions taken by the oil slick
- The colour represents the number of days since the spill.
- Blue: the positions occupied by the oil slick immediately after the spill
- Red: the positions occupied by the oil slick several months after the accident
- All the coloured dots represent the area covered by the oil slick = the area polluted by the oil slick
- Crosses indicate sensitive sites for marine turtles
- + = Main nesting sites, X = Main feeding sites

### Key points to remember

- The starting point of an accident, the date, the weather conditions (but also the nature of the oil product) lead to a great diversity in the behaviour of an oil slick.
- The entire coastline, MPAs and therefore emblematic species can be affected by oil spills.
- This threatens biodiversity, fishing and therefore livelihoods
- Need for international cooperation and oil and gas risk management plans.

*Disclaimer: The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of PRCM and BRL ingénierie concerning the legal status of any country, territory or area, or regarding the delimitation of its frontiers or boundaries.*

Source: BRLi



© Tore, Western Red Colobus monkey, Gambia



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## Chapter 7

# West African marine protected areas and climate change

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In addition to the direct anthropogenic impacts, climate change impacts, which are already being felt in MPAs, represent a serious threat, and taking these changes into account in management is a major challenge for managers. On the other hand, MPAs protecting ecosystems with a good carbon sequestration capacity (mangroves, seagrass beds, etc.) have an important role to play in mitigating impacts.

This chapter focuses on the following points:

- General information on climate change in West Africa;
- The various impacts induced on marine and coastal environments;
- Climate change and West African MPAs;
- The role and contributions of MPAs in climate change mitigation and adaptation strategies.





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## 7.1 Introduction

According to the Intergovernmental Panel on Climate Change (IPCC), climate change refers to a statistically significant variation in the mean state of the climate that may be due to natural variability or human activities (IPCC., 2001). It is unequivocally admitted that the observed changes are due to the increase in the concentration of greenhouse gases in the atmosphere conditioning feedbacks from the climate system, which induces global warming.

Climate variability and change manifest themselves in a variety of ways, exposing “the ocean and its ecosystems to conditions not seen for millennia” (IPCC, 2022): rising sea surface temperature (SST), the rise in the level of the oceans, acidification, deoxygenation and the multiplication of extreme events, constitute the main problems increasing the sensitivity and exposure of these environments as well as of the human communities that depend on them.

Although adaptation tools and strategies exist, their appropriation by the territories (scale of policy implementation) still poses some difficulties and deserves an in-depth evaluation policy in terms of effectiveness and efficiency (IPCC, 2022).

Conservation and development actors have long considered climate change as a global issue, less of a priority than the fight against poverty and the conservation of biodiversity. Aware of the threats, governments and actors are gradually beginning to consider climate change issues as priorities in their strategies. Integrating climate change into conservation then appears as a new challenge with the objective of: (i) increasing the resilience of ecosystems for the long-term maintenance of goods and services; (ii) increase the resilience of human communities to the current and future impacts of climate change.

The establishment of marine protected areas (MPAs) that can promote the protection of these marine and coastal ecosystems as well as the species they shelter, is a major challenge. While enhanced greenhouse gas (GHG) reduction targets are essential to protect the oceans and avoid further irreversible impacts, MPAs are increasingly recognized as a key tool for maintaining and restoring ecosystem resilience, offering positive results for biodiversity (see Box 7.1). Marine protected areas can:

- Protect blue carbon ecosystems, including salt marshes, seagrass beds, mangroves and seabeds, which provide long-term storage of atmospheric carbon and play a critical role in mitigating climate change;
- Preserve biodiversity;
- Provide many ocean and coastal ecosystem services: protection against storms and erosion, food production, as well as income security for coastal populations, recreation and tourism;

Increase species survival by allowing them to move around and escape certain pressures, provided that MPAs are well integrated and connected.

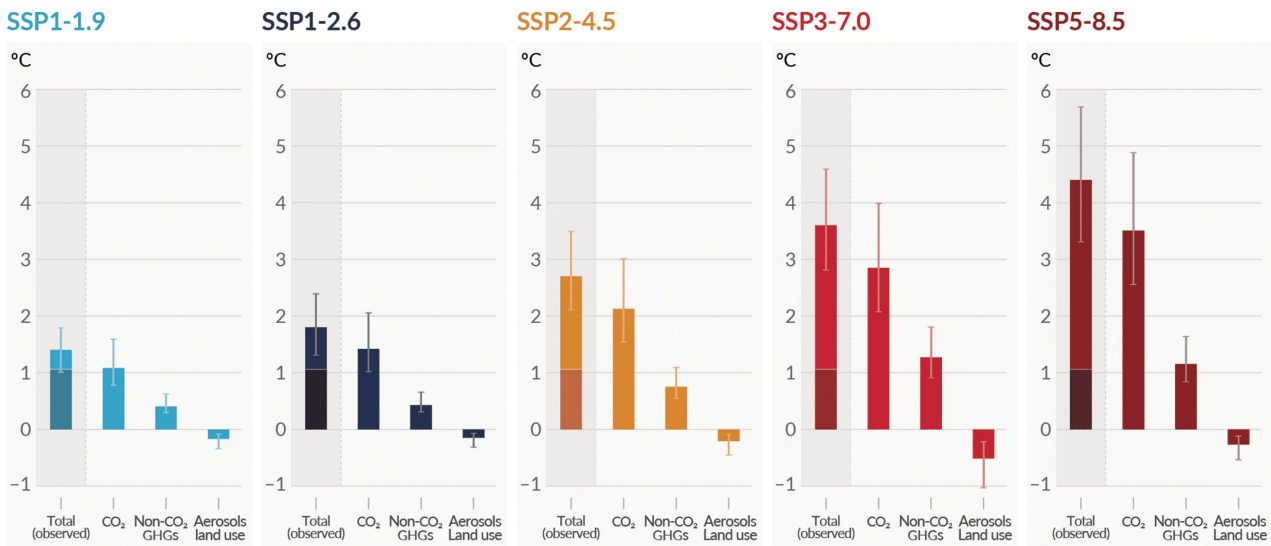


Figure 7.1 Evolution of CO<sub>2</sub>, non-CO<sub>2</sub> GHGs and aerosol levels according to the different temperature rise scenarios

Source: IPCC, 2021

## 7.2 Climate change in West Africa

Global surface temperature over the period 2001–2020 was 0.99°C higher than 1850–1900. (IPCC, 2021), with larger increases over land (+1.59°C) than over the ocean (+0.88°C). This increase in temperature results from the increasing concentration of GHGs in the atmosphere which has become a certainty. Different global climate models agree on the very high probability that warming will be greater in Africa than in the rest of the world with a potential increase of 3°C in Senegal and Guinea-Bissau and 4°C for the continental Sahel. (Blain, 2013).

Sea level rose by 20 cm between 1901 and 2018. From a rate of 1.3 mm/year between 1901 and 1971, the rise accelerated to +3.7 mm/year in the period 2006–2018 (IPCC, 2021). As a result, the sea level has risen faster since 1900 than in any century in the last 3000 years.

Rainfall variability, defined as deviation from the mean (Figure 7.2), is significant and often reaches 40 to 80% (African Studies Centre, 1999). Combined with other factors, the recurrent drought in West African countries has repercussions on people's livelihoods. "Changing precipitation patterns, for example, decrease overall rainfall volume in West Africa, causing reduction in the flow of rivers in the region, and leading to a decrease in sedimentation deposits that fosters erosion (WACA)".

On the other hand, against this backdrop of increasing climate change and climate extremes, the trend in rainfall over the last few decades shows a timid improvement in annual accumulations (Sarr et al. 2013).

The consequences linked to the rapid increase in average temperatures as well as the drop in long-term rainfall, constitute challenges that the populations of West Africa are facing. Climate change scenarios in West Africa show that extreme weather events will increase.

### Box 7.1 MPAs: A useful tool for climate change mitigation and adaptation of socio-ecological systems

Marine protected areas (MPAs) are increasingly being promoted as an ocean-based climate solution. In order to verify this statement, a recent study (Jacquemont et al, 2022) on a systematic literature review of 22,403 publications covering 241 MPAs, analysed 16 ecological and social parameters making it possible to assess whether MPAs can contribute to the climate change mitigation and adaptation. This meta-analysis demonstrates "that marine conservation can significantly improve carbon sequestration, coastal protection, biodiversity and the reproductive capacity of marine organisms, as well as the catches and incomes of fishers." Most of these benefits are only achieved if they are fully or highly protected areas and increase with the age of the MPA. Although MPAs cannot solely compensate for the full impact of climate change, they are a valuable tool for the mitigation and adaptation of socio-ecological systems.

Major climate changes are predicted for the future climate of West Africa, with warming average between +2°C and +6°C by 2100, and changes in rainfall patterns that could lead to a shift in the timing of the rainy season. These climate changes are likely to have significant adverse effects in several areas of life such as hydraulics, the economy, health, the environment, etc. (Hegerl et al, 2007; Bodian, 2011) but also on animal and plant resources (Hartley et al., 2007; Belle et al., 2016). They will thus undoubtedly have impacts on protected areas globally and particularly on marine protected areas. These various constraints are therefore an obstacle to the provision of ecosystem services and the preservation of species (Ndiaye A. and Ndiaye P., 2013).

## 7.3 Impacts on marine and coastal environments

IPCC's work show that, even if there are a multitude of factors of climate variation intervening in the degradation of marine and coastal ecosystems, the main factors are the rise in water temperature, the intensification of acidification water and deoxygenation. Added to this is the rise in sea level which promotes coastal erosion, a major problem on the Western Africa coasts.

### 7.3.1 Rise in surface water temperature

JUN SHE, (2011) detects a warming of the oceans surface which can reach +2°C against an increase estimated between 1 and 3°C (IPCC., 2007) by the end of the 21st century. It should be noted that in Africa, water bodies (seas, rivers and lakes) are endowed with abundant flora and fauna and marine ecosystems including various fish, other forms of aquatic life and coral reefs. They are essential for the livelihoods, freshwater resources, food, power generation and transport activities of many Africans, as well as

for the development of the continent's blue economy. However, rising ocean temperatures and ocean acidification are exacerbating the loss of fisheries resources. Climate variability and change, and the exposure and vulnerability of millions of people in Africa, drive migration, displacement and related protection needs.

#### Box 7.2 Climate change in selected West African countries

Generally speaking, climate change constitutes a threat and a challenge for the future of West African countries (Jalloh et al. 2010), but there are some nuances between countries depending on the climatic hazards they face and their location. For example, sea level rise only affects coastal countries.

Thus, in **The Gambia**, the national climate change adaptation action plan (The Gambia, 2007) reports a drastic drop in rainfall since the 1940s. The proportion of the country which receives less than 800mm of rain per year has risen from 36% to 93% since 1965. Temperatures have increased by an average of 0.4°C over the same period. The main climate hazards identified at national level, including in areas where there are protected areas include: torrential rains, storms, droughts, cold snaps, intra-seasonal droughts, heatwaves, unseasonal rainfall and rising sea levels. The risks associated with these climate hazards include the limited capacity to predict when they will occur and their potential impact.

In **Togo**, climate change models predict an increase in average monthly temperatures along the south-north gradient of 1.00°C to 1.25°C. As regards rainfall, forecasts indicate a drop of between 0% and 0.80% according to the isohyets extending from the north-west to the south-east. The most affected areas will be the southern half of the country (Maritime region and Plateaux). The major climate hazards identified are drought,

flooding, uneven rainfall distribution, late rainy seasons, violent winds and coastal erosion for the ecosystem of the coastal zone.

In **Sierra Leone**, studies on climate change have shown that rainfall and temperature are both changing. According to simulations using global models, the average temperature for the period from 1961 to 1990 should increase by around 7% to 9% by 2100. These models also predict a reduction in rainfall of around 3% and 10% for monthly and annual averages respectively. Thus Sierra Leone faces a variety of climate hazards which include drought, strong winds, landslides, heatwaves, flooding, heavy rainfall and a reduction in rainfall. (Conteh, 2014).

In **Senegal**, we note a spatial variability of temperature with historical data (1950-2014), and projections (2015-2080) for the scenarios ssp12.6, ssp24.5, ssp58.5 of the ensemble average of CMIP6 models. A regular trend which is reflected in the increase in temperatures since the start of the projection period (2015). We have observed the same upward trend in temperatures since the historical period, which is worsening in the projections. Most climate models project a "drying" in Senegal even if there is a lot of uncertainty regarding interannual and decadal variability.

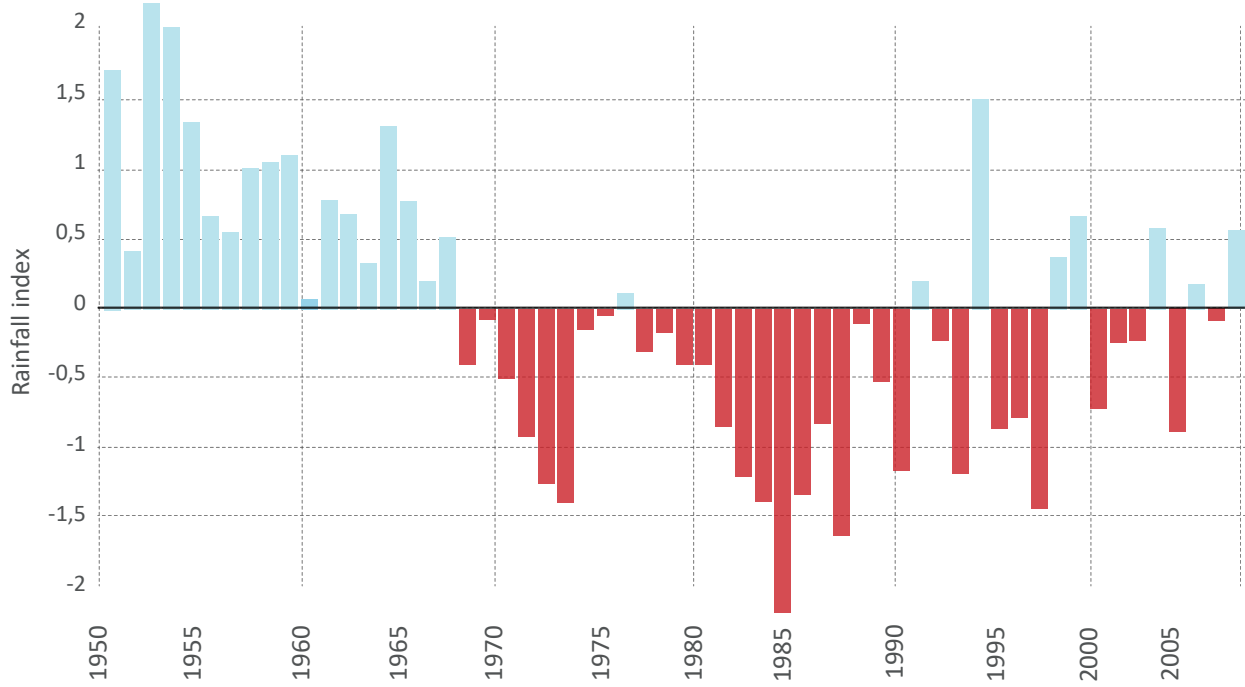


Figure 7.2 Evolution of the rainfall index in the Sahel from 1950 to 2005 (Com. AGRHYMET) Source: Com. AGRHYMET

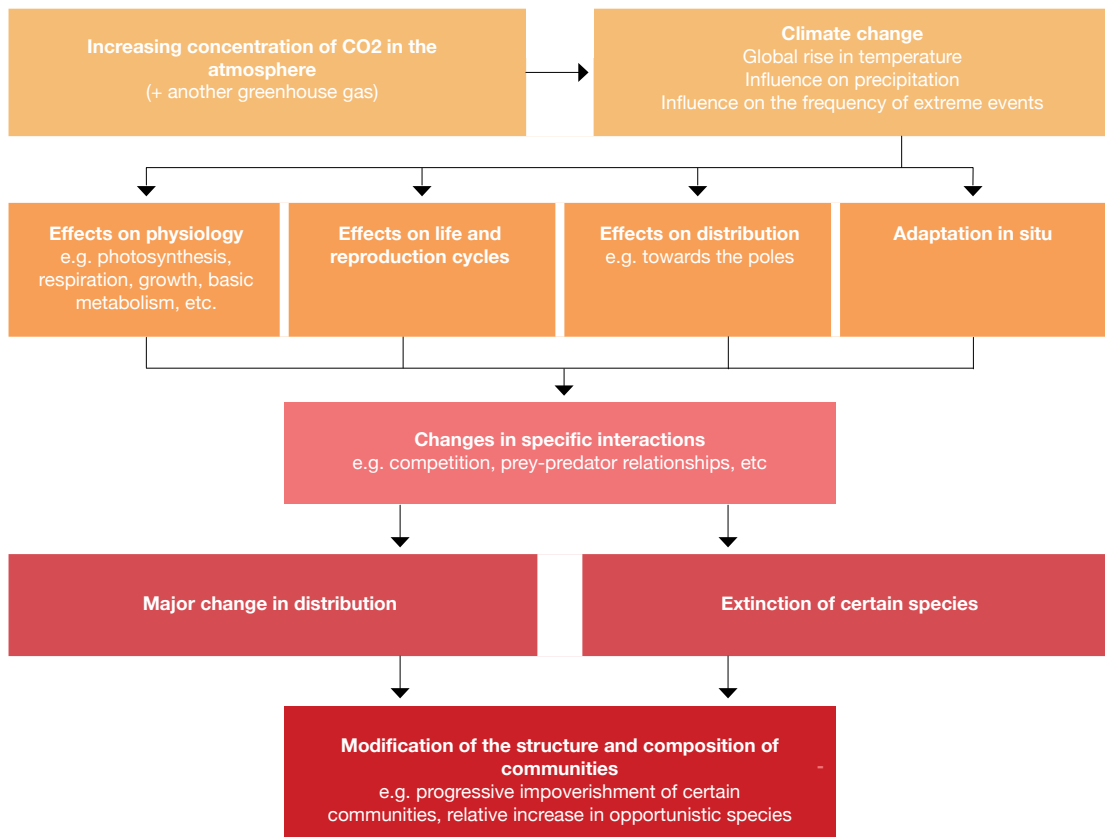
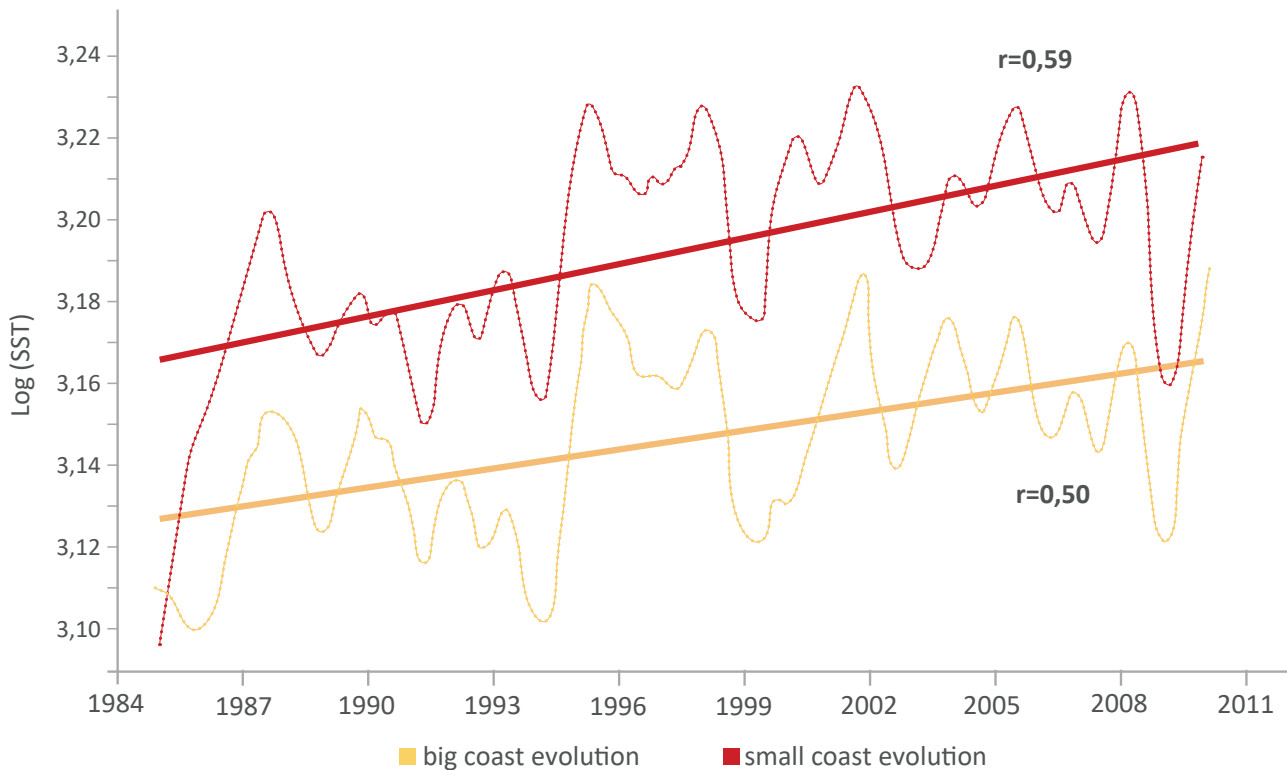


Figure 7.3 Diagram on the impacts of climate change on marine and coastal biodiversity Source: Hughes, 2000



**Figure 7.4** Trend of surface temperature (SST) over the 1985-2009 period

Note: The yellow and red curves correspond to the evolution of this component in the Large Coast and the Small Coast respectively. Source: IPCC, 2021

### Box 7.3 Climate change and the marine environment in Senegal and Mauritania<sup>1</sup>

In the Senegalese maritime area, climate change is manifested by an increase in surface temperature, sea level and a reduction in phytoplankton productivity. Over the 25-year period (1985-2009), an increase of 1.04°C and 1.05°C is observed in the north and south of Dakar respectively, i.e. approximately an increase of 0.04°C/year in each zone. Sea level, over the interval 1985-2011, shows an estimated rise of 3 cm at the Grande Côte and 4.6 cm in the Petite Côte. Which is equivalent to an increase of 0.12 cm/year and 0.18 cm/year respectively in the two zones. Regarding phytoplankton biomass, a reduction of 0.14 mg/m<sup>3</sup>/year occurred in the Grande Côte, while in the Petite Côte there was a slightly greater drop of around 0.16 mg./m<sup>3</sup>/year. These changes recorded along the Senegalese coastline can have an impact on marine biodiversity.

Decrease in carbon sequestration capacity. At the level of estuaries, climate change induces a reduction in the capacity for carbon sequestration and the supply of goods and services

(CDN, 2016). These elements are the consequence of the simultaneous action of the drop in rainfall and the increase in ocean temperature which lead to an accentuation of the phenomenon of evaporation and hyper-salinity (INTAC, 2011).

In Mauritania, the National Institute of Fisheries and Oceanography reports an increase in sea surface temperature of 0.34°C in 20 years (22.69°C in 1989-1998 to 23.03°C in 2009 - 2018) and a decrease in trends in the strength of deep water upwelling from 1980 to 2018).

<sup>1</sup> Nationally Determined Contributions Report, Senegal 2016

### 7.3.2 Ocean acidification

The ocean contains about 16 times more carbon than the terrestrial biosphere and about 60 times more than the pre-industrial atmosphere. When CO<sub>2</sub> is absorbed by seawater, a series of chemical reactions occur resulting in the increased concentration of hydrogen ions or a rise in acidity levels. These changes are known as “ocean acidification”.

### 7.3.3 The global ocean acidification crisis

The increase in atmospheric carbon dioxide (CO<sub>2</sub>) the world is experiencing is unprecedented in recent history. In the mid-1700s, the concentration of atmospheric CO<sub>2</sub> was around 280 parts per million (ppm); today it is 411 ppm, an increase of 47%. With increasing atmospheric CO<sub>2</sub>, oceans around the world are becoming more acidic. They absorbed up to one percent of the carbon dioxide (CO<sub>2</sub>) generated by human activity. As dissolved CO<sub>2</sub> increases, the oceans become more acidic (pH decreases). The average pH of the ocean has declined rapidly since the industrial revolution: estimated at 8.2 pH units in the mid-1970s, it is now 8.1 pH units, a 30% increase in hydrogen ion concentration.

When carbon dioxide dissolves in the ocean, it reacts with water to form carbonic acid. Carbonic acid dissociates into bicarbonate ions and hydrogen ion. Hydrogen ions react with carbonate ions to form bicarbonate, which reduces the availability of carbonate ions to

calcifying organisms.  $\Omega_{ar}$  represents the saturation state of aragonite. When  $\Omega_{ar}$  drops below 1.5, the shells are unable to develop properly. When  $\Omega_{ar}$  drops below 1, the shells actively dissolve. The more carbon dioxide is dissolved in the ocean, the more carbonate ions are converted into bicarbonate, and the more difficult it is to form shells. This process is not uniform and is strongly dependent on temperature and salinity.

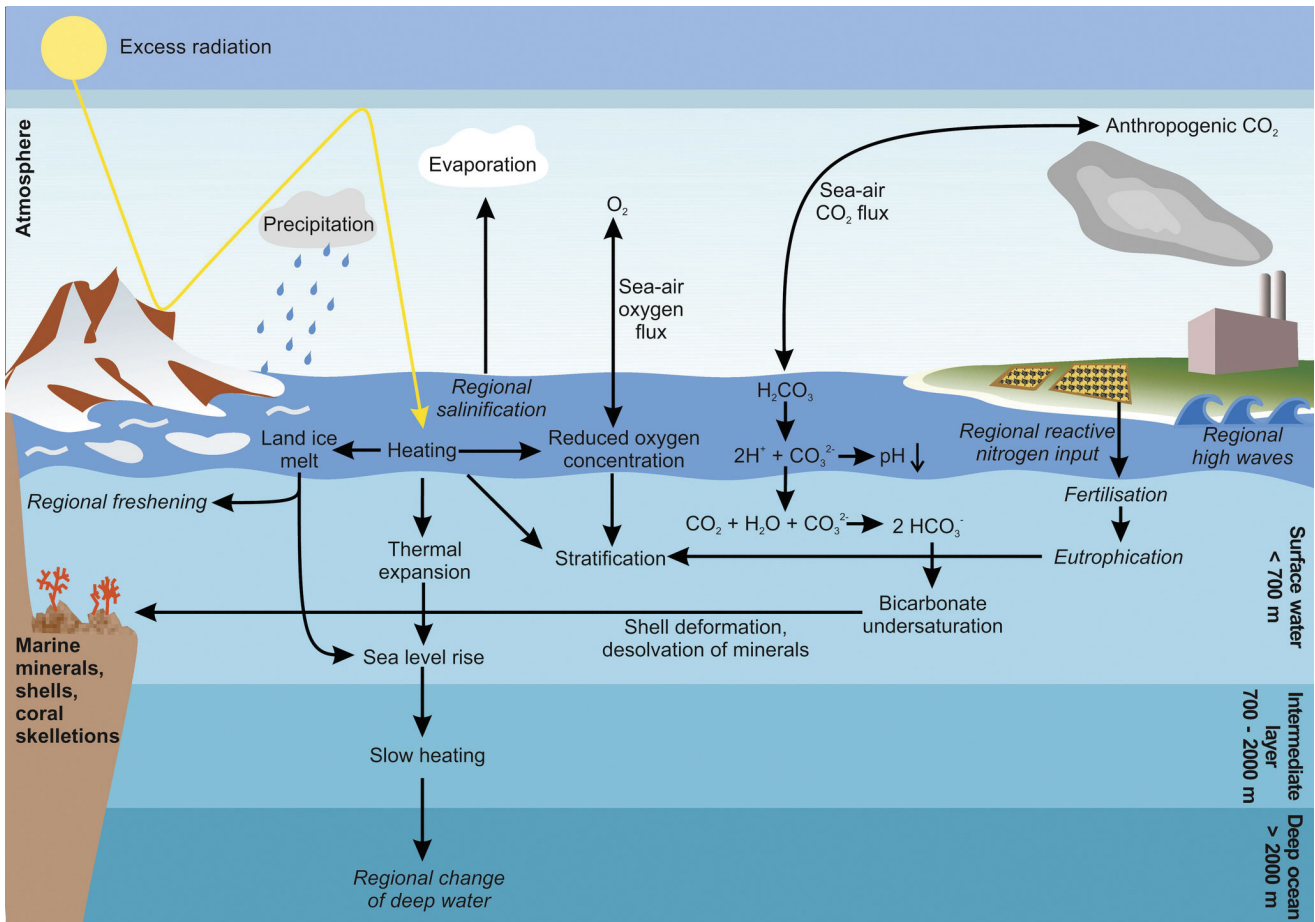
Calcifying organisms such as mussels, corals, and various plankton species need exactly carbonate ions to build their shells and skeletons. The less carbonate ions are available, the more costly calcification becomes. Also other marine organisms that do not have calcium carbonate shells or skeletons must spend more energy to regulate their bodily functions in acidifying waters. Conditions for growth, reproduction, or resistance to other environmental stresses will no longer be available. At the same time, some species, such as seagrass and blue-green algae, may benefit from the additional CO<sub>2</sub> dissolved in seawater: there are winners and losers in the food net.

#### Knowledge about ocean acidification

Research on ocean acidification in Africa is still in its early stages, with monitoring and experimental research lagging far behind other ocean regions. Most countries do not have chemical and biological monitoring equipment or data, up-to-date marine experimental facilities, or scientists engaged in ocean acidification research. Overall, observations of pCO<sub>2</sub> by the Surface Ocean CO<sub>2</sub> Atlas



© Diego Delso CC BY-SA delso.photo, Padina Pavonica coral



**Figure 7.5 CO<sub>2</sub> absorption by the ocean causing acidification** Source: commons.wikimedia.org © Laura Käse and Jana K. Geuer

(SOCAT) and pH reported by the Global Ocean Acidification Observing Network (GOA-ON) show huge discrepancies from coverage in African coastal waters. These gaps in data collection may lead to a severe underestimation and high variability of the contribution of ocean areas (e.g. Indian Ocean) to the global anthropogenic CO<sub>2</sub> sink (i.e. 21 ±10%; Gruber et al. 2019). Better data will help identify ocean acidification hotspots where more infrastructure and research could be directed.

A literature review of research in Africa on ocean acidification (2010-2019) found only 51 scientific papers out of almost 5,000 published that could be linked to research institutions within 12 African countries. Such a statistic under represents the contributions of African researchers to the field of ocean acidification, as many of them may not list African institutions as their primary address. However, it indicates a lack of regionally conducted research and limited direct involvement of African institutions.

Ambitious regional and local projects are already documenting the impacts of ocean acidification, and the capacity of researchers working on ocean acidification is growing. Ten projects focusing on ocean acidification in African coastal waters are known, and more are being developed. The main ocean regions studied include the northeast Atlantic, from the Canary Islands to Gibraltar, the Gulf of Guinea, the Benguela current system and the southwest Indian Ocean. Government research programmes are mandated to study the marine effects of climate change in their territorial waters (EEZ),

including observation of carbonate chemistry parameters to study CO<sub>2</sub> sinks and sources and the impacts of ocean acidification.

Government institutions and research organisations have also carried out local short-term monitoring and partnered with international organisations such as the Ocean Acidification International Coordination Centre (OA-ICC) and the IAEA's TOF (International Atomic Energy Agency) to build capacity for national research projects. International research cooperation has supported the local development of research on acidification, such as that of the Nansen programme on the ecosystem approach to fisheries (EAF) and the European Mediterranean Sea Acidification in a changing climate (MedSeA) initiative.

Cross-regional scientific associations such as Ocean Acidification Africa (OA-Africa) are pushing for research to grow on the continent to provide excellent knowledge and resources to policy-makers and resource managers for the benefit of informed policy and adaptation strategies in African coastal waters. In other cases, African researchers have independently conducted biological response and monitoring studies during postgraduate research.

## What can we do?

With the United Nations Decade of Ocean Science for Sustainable Development, countries have an excellent opportunity to address SDG target 14.3 (“Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels), which reflects global concern about ocean acidification. However, addressing this concern requires having the tools, knowledge and infrastructure to accurately assess and report ocean acidification. It is therefore essential to use emerging technologies and make commitments to maintain and strengthen existing observation systems.

International agreements such as the United Nations Convention on the Law of the Sea (UNCLOS), the Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC) provide a framework for nations to African countries to take ocean acidification into account as part of their broader mandate to protect their coastal waters, conserve biodiversity, sustainably manage fisheries and combat climate change. Collectively, these conventions require States to take necessary measures to reduce and control pollution, manage fish stocks and develop strategies for the conservation and sustainable use of biological diversity. Although not usually explicit, ocean acidification may be considered under these

agreements due to its anthropogenic causes and expected harm to marine life.

While international agreements justify research into ocean acidification, they also depend on local and regional support. Countries must therefore develop national strategies and plans that take into account their particular vulnerabilities to ocean acidification.

The Barcelona, Nairobi and Abidjan Conventions are one way to achieve this. Together with international organisations, these instruments may represent the best way forward for multilateral cooperation to establish national research programmes on ocean acidification in Africa. Countries can also benefit from such collaboration by sharing resources and information. Other essential solutions are other management tools such as marine protected areas and integrated coastal zone management (ICZM) initiatives.



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### 7.3.4 Ocean deoxygenation

The oceans deoxygenation, induced by climate change, added to the phenomenon of marine eutrophy, caused by nitrogen pollution, results in the frequency of dead zones characterized by the absence of biodiversity (Bonnin, 2015). In recent decades, ocean and coastal waters deoxygenation around the world has worsened. The two main causes are significantly higher nutrient concentrations (eutrophication) due to increased human activities affecting coastal areas. Warmer water holds less oxygen and leads to increased stratification, which reduces ventilation, that is, the replenishment of oxygen from the interior of the ocean and estuaries. The increase in carbon dioxide (CO<sub>2</sub>) in the atmosphere is the main cause of deoxygenation, warming and acidification of the oceans in the high seas, which put pressure on marine ecosystems in various ways, including the effects socioeconomic factors are only beginning to be known.

### 7.3.5 Sea level rise and erosion

By 2100, West Africa is expected to have sea level rise of up to 1.06 m, higher incidences of extreme rainfall, a temperature increase of 2°C, and 5,500 km<sup>2</sup> of coast flooded. Mauritania and Senegal are expected to see an increase of 0.6 meters by 2050, followed by Benin, Côte d'Ivoire and Togo with 0.3 meters (WACA).

The dynamics of the oceans with the rise in sea level affects habitats as well as resources through the intensification of coastal erosion which is manifested by an overall retreat of the coastline. Since MPAs are all located along coasts, in insular environments and in estuaries, erosion of the coastline or banks is a systematic threat. Its effect is accelerated by the multiplicity of aggravating causes also resulting from climate change and operating in cascade: decrease in precipitation and rainfall deficit (Descroix et al., 2015; Failler et al., 2019), responsible in turn, with the developments coastal areas, of the sediment deficit which weakens the coastline (Faye, 2010) and favours the intrusion of sea water inland.

The Regional Coastal Erosion Control Program was adopted in 2007 by the UEMOA Council of Ministers and aims to mitigate the economic, environmental, social and cultural consequences of coastal erosion in the coastal Member States of UEMOA.

## 7.4 Climate change and West African marine protected areas

### 7.4.1 Marine protected areas vulnerability

The concept was defined in the third IPCC Report as “the degree to which a system is susceptible to, or unable to cope with adverse effects of global warming, including climate variability and extremes”. The vulnerability of coastal and marine ecosystems to climate change is obvious. This pushes the various players in marine protected areas to think about alternative MPAs that are much more resilient than the current model to the effects of climate variation (David et al., 2019). Vulnerability to the effects of climate change is defined by several factors such as exposure, sensitivity, potential impact and adaptive capacity to hazards (Otero, M et al., 2013; Figure 7.6).

### Box 7.4 Erosion in Senegal

Thus, in Senegal, the coastline decreased by around 37 m over the period 1946–2001 (Dabo, 2006). Other specific work revealed a decrease between 0.06 and 5.1 m/year on the Petite Côte Sénégalaise between 1954 and 2012 (Sambou et al., 2012) against a decrease varying from 28 m to 51.3 m in 35 years or 0.80 to 1.5 m/year on the Grande Côte (Sy et Sy.,2010). Submersion phenomena are observed at the bird island of the Saloum Delta National Park (PNDS) where around 2000 royal tern nests and 300 Caspian tern nests were engulfed by water in April 2015 (CDN, 2016). In Ansoukala (PNDS), between 6 and 16 June 2015, the high tide took away between 13,000 and 14,000 chicks and the products of 16,844 pairs (eggs or chicks) at the southern tip and in Ansoukala (FIBA, 2015). In addition, the effects of changes in tidal amplitude are felt on coastal habitats and mangroves which are subject to the abrasive power of marine currents. The recurrence of weather extremes will cause an accentuation of the erosion process in the future.

The difficulties in assessing vulnerability are linked to the fact that MPAs are places where the actions of climatic and non-climatic factors combine. Vulnerability is specific to a given habitat, species or community and depends on their ecological and socio-economic characteristics. At the level of MPAs, the success of the vulnerability analysis first implies the availability, within the framework of the monitoring and surveillance of habitats and species, of variables such as the area, coverage, quality and size of the populations (Otero, M et al., 2013). There are not many works that analyse the potential impacts of climatic hazards on MPAs in the world, especially in West Africa. The work of UNEP-MAP-RAC/SPA, (2009), on the Mediterranean region is a reference document that could be used to study the future impacts of climate change on MPAs in West Africa.

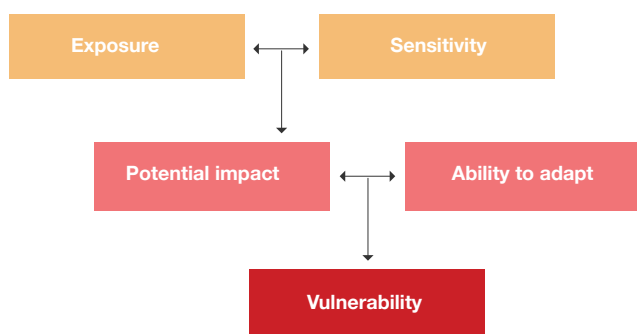
### 7.4.2 A threat perceived by managers

It emerges at the end of almost all of the evaluation studies on the MPAs effectiveness in West Africa that climate change, through its various variations, represents the main natural threat which influences the management of protected marine and coastal ecosystems (Table 7.1) and climate change is, along with fishing, the natural threat most widely mentioned by MPAs managers (Figure 7.7, Failler et al., 2019).

**Table 7.1 Main threats identified in the assessment of MPAs management in West Africa**

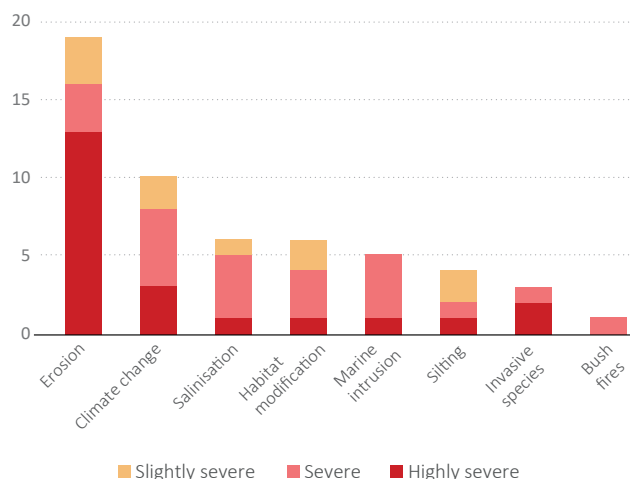
RAPPAM (RAMPAAO, 2010)	RAPPAM (Kane et al., 2011)	RAPPAM (UNDP/Go-Wamer and WWF, 2014)	RAPPAM/Rose des vents/IMET (UNDP/Go-Wamer, 2017)	Perception survey (Failler et al., 2018)
<b>Threats</b> <ul style="list-style-type: none"> <li>• Uncontrolled fishing</li> <li>• Timber cutting</li> <li>• Habitat modification</li> <li>• Erosion</li> </ul> <b>Pressures</b> <ul style="list-style-type: none"> <li>• Pollution</li> </ul>	<b>Pressures &amp; Threats</b> <ul style="list-style-type: none"> <li>• Fishing</li> <li>• Erosion</li> <li>• Logging</li> <li>• Pollution</li> </ul>	<b>Threats</b> <ul style="list-style-type: none"> <li>• Fishing</li> <li>• Erosion</li> <li>• Pollution</li> <li>• Industry</li> </ul> <b>Pressures</b> <ul style="list-style-type: none"> <li>• Fishing</li> <li>• Overexploitation of natural resources (mainly wood)</li> </ul>	<b>Pressures</b> <ul style="list-style-type: none"> <li>• Fishing</li> </ul>	<b>Anthropogenic threats</b> <ul style="list-style-type: none"> <li>• Uncontrolled fishing</li> <li>• Overexploitation of resources (mainly wood)</li> <li>• Pollution</li> </ul> <b>Natural threats</b> <ul style="list-style-type: none"> <li>• Erosion</li> <li>• Climate change</li> </ul>

Source: Failler et al., 2019



**Figure 7.6 Conceptual model of vulnerability**

Source: Otero M. et al., 2013



**Figure 7.7 Frequency and intensity of natural threats identified by MPAs managers in West Africa**

Source: Failler et al., 2019



© Gregory «Slobirdr» Smith, sperm whale (*Physeter macrocephalus*)

### 7.4.3 Impacts of climate change in West African MPAs: some examples

#### The Saint-Louis MPA (Senegal)

The direct impacts of climate change on the marine environment in Saint-Louis are visible through a number of measurable indicators. Such as the increase in water temperature or the rise in sea level which strongly threatens the habitats and populations of the L'Anse de la Barbarie, due to coastal erosion accentuated by repetitive swells and storms. In addition, certain parameters such as the rise in water salinity, salinization, acidification and the drop in oxygen levels in the oceans, the increase in marine flooding and the degradation of mangroves are quite noticeable at the Saint-Louis MPA and its immediate surroundings. The resource is now scarce due to the consequences of these climate changes. This is felt in the socio-economic activities of the populations.

Measures are taken to mitigate the effects of climate change on the MPA by implementing soft solutions to combat coastal risks. Awareness and environmental education sessions for stakeholders (pupils, populations living near the MPA of Saint-Louis, market gardeners, fishers among others, etc.) are organised. In addition, reforestation of casuarina trees and mangroves is carried out with the help of technical and financial partners to deal with these issues linked to the climate change impacts.



© Régis L'Hostis, white mangrove (*Laguncularia racemosa*), Saloum Delta National Park, Senegal

## Soft solutions for coastal protection in the Saint-Louis MPA

### Context and protection mechanism

The Langue de Barbarie (Figure 7.8) separates the Senegal River from the sea and constitutes a long fragile and unstable coastal barrier stretches over a length of more than 50 km between the Boytet backwater (Mauritania) to Taré (Louga, Senegal). In its current form, the width of the strip of sand is between 100 and 500 m with a maximum altitude of 7 m.

As part of the WACA FFEM project “Monitoring coastal risks and soft solutions in Benin, Senegal and Togo”, developments such as windbreaks (typhavelles, using *Typha australis*, an invasive local species) and reforestation (plantations of *Casuarina equisetifolia*) are carried out to fix the sand and promote dune reconstitution, thus reducing exposure to coastal risks. Implementation is ensured by the Saint-Louis Marine Protected Area with technical assistance from the French Littoral Conservatory. Two rows of typhavelle 2 m long by 1 m high, fixed on 1.8 m posts are arranged over a distance of 1.5 km following a NW direction (photo 4). The installations were carried out in several stages between April 2019 and May 2020.

At the same time, casuarina reforestation operations are being carried out to further secure the reconstituted coastal barrier. Between 2014 and 2020, 149 hectares of casuarina trees were planted.

The results obtained after more than a year of experimentation are satisfactory.

### Dune reconstitution monitoring mechanism and results

The dune reconstitution mechanism is monitored monthly to measure the reconstitution of the dunes after the installation of the typhavelles. Eight profiles located along the typhavelles are measured:

Tyhavellas begin to trap sand in the first months after their installation. The rear part of the typhavelle traps more sand on all the profiles observed. The dunes began to form from March 2020, i.e. 9 months later on profiles 1 and 2, when they were non-existent. Depending on the month, they reach widths of between 60 and 120 cm. The last two profiles were installed on pre-existing dune ridges which were leveled between October-November 2019 and February 2020 and were reconstituted from March 2020. The levelling of the dunes is done by a significant supply of sediment around the dune. The existing beach is therefore no longer visible.



Figure 7.8 Location MPA Langue de Barbarie

Source: Centre de Suivi Ecologique

### The Joal-Fadiouth MPA (Senegal)

The Joal-Fadiouth Marine Protected Area is an important area of biodiversity. There are seagrasses but also a mangrove forest. These two entities, which form the Joal-Fadiouth marine-coastal ecosystem, play an important role in mitigating climate change:

- Sand fixation and coastal stabilization;
- CO<sub>2</sub> storage by mangroves and seagrasses: carbon sink role.

Like all coastlines, the Joal-Fadiouth MPA is impacted by climate change effects:

- **On the seagrasses, which is a feeding area for sea turtles and manatees, but also a spawning ground for many species.**
  - **Negative impacts** observed are mainly: coastal erosion and silting phenomena. The intensification of the erosion process causes a substantial supply of sand in the seagrass zone. This silting leads to a reduction in the area of development of seagrasses with harmful consequences for biodiversity: shrinkage of the feeding area of sea turtles, manatees and all the other species that reproduce in this ecosystem. The formation of sandbanks and their dynamics represent a constraint for the reproduction and feeding of small pelagics.
  - **Positive impacts:** the significant influx of sand at the entrance to the bolong results in the creation of sandbanks that serve as resting points for birds. They are also bird feeding areas due to the presence of molluscs. With the in depths reduction, the avifauna finds an environment with favourable conditions for fishing.

- **Adaptation solutions and actions taken:** the reduction in the space of the meadows and their expansion zone is a threat to the biodiversity of the ecosystem. Reforestation campaigns are carried out to fix the sediments. This makes it possible to reduce the local sedimentary dynamics to fight against the silting process. All actions that may cause a hydro-morpho-sedimentary imbalance are prohibited, particularly the removal of sand. The means used are surveillance and sensitization through broadcasts on community radios.
- **On the mangrove:** Mangrove cover in Joal-Fadiouth experienced a decrease from 1970 to 1990. This drop is partly due to the drought of the 1970-1980 decade. However, efforts undertaken for the conservation of biodiversity have made it possible to be part of a dynamic process of restoration of the mangrove. However, with the rise in sea level and the reduction of continental inputs, there are difficulties in the growth of reforested species due to oversalinization of waters. A tannification process is also observed, particularly in the supratidal zones.
  - **Adaptation solutions and actions taken:** The difficulties observed in the reforestation of mangroves are mainly due to oversalinization of waters and the nature of the substrate. To remedy this situation, ecological engineering is favoured, with the method of assisted natural regeneration (ANN). This involves the development of hydraulic axes (tidal channels) to facilitate water run-off towards reforestation sites. These facilities provide essential functions in the restoration of the mangrove: permanent water supply, renewal of water and reduction of salinity. Monitoring and raising awareness through community radio broadcasts are the main means used for mangrove conservation.



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### The Abéné MPA (Senegal)

The Abéné MPA was created in 2004 to promote the preservation of the ecosystem and the conservation of its biodiversity. Like coastal areas, the Abéné MPA is subject to the impacts of climate change:

**Loss of sedimentary resources:** coastal erosion and sea's advance represent the greatest threats on the Abéné MPA. The most affected sectors are the following:

- **Abéné Site:** Loss of tourist facilities related to sea's advance; Abandonment of the Abéné rice fields in Niafrang due to salinization.
- **Kafountine Site:** Environmental degradation of the fishing wharf with real threats at gas stations, fishery product processing sites, sites of worship, etc.; Loss of beaches.
- **Niafrang Site:** Very advanced destruction of the dune cord which protects the village of Niafrang and its rice fields; Salinization soils with abandonment of certain rice fields; Important silting of the Niafrang Bolong Estuary, the consequence being an impossibility of tidal navigation.
- **Impact on biological resources:**
  - **Mangrove:** Before the 2000s, periods of mangrove regression cover had been observed in the area due to the drought of the 1970s-1990s, characterized by sharp reduction in fresh water supplies and nutrients from water-catchment areas. The use of mangrove wood has also contributed to the degradation of the mangrove.
  - **Marine turtles:** Coastal erosion has greatly reduced the sea turtles' nesting space.

### The Tristão MPA (Guinea)

The MPA participates in mitigating climate change by storing CO<sub>2</sub> in mangrove forests, which thus constitute an important carbon sink. Climate change is affecting the Tristão MPA. Among the impacts observed, we can cite:

- **Loss of sedimentary resources and coastal areas:** The Great Beach which extends from Katcket to Kaboth over approximately 20 km is the MPA area most affected and threatened by coastal erosion and the advance of the sea. The rise in sea level also leads to marine flooding in rice-growing areas. Currently, the recommended solution is to raise or set back the dykes upstream to limit marine flooding and saltwater intrusion. On the contrary, in the area of Katfoura and Kasmack, a very strong hydro-morpho-sedimentary dynamic is observed. This development results in the development of sandbanks in the river mouth areas and in the enlargement and/or clogging of tidal channels.
- **Biological resources:** The degradation of the mangrove seems to be mainly linked to the exploitation of mangrove wood. However, actions are undertaken for the restoration of the ecosystem and the conservation of mangrove. They are done through reforestation campaigns. Assisted natural regeneration (ANR) is also facilitated: destruction of dykes that prevent water run-off in the restoration perimeters. The introduction of improved ovens and hearths for cooking and smoking fish has also reduced the use of mangrove wood. Surveillance and awareness campaigns are regularly carried out by the MPA conservator and agents.

### Adaptation means and tools

The Tristão Islands mangrove conservation and ecosystem restoration project comes in the form of:

- Mangrove reforestation campaigns since 2012: 185 ha of mangrove reforested;
- Support to natural regeneration (NR) by opening water drainage channels to irrigate mangrove development areas (350 ha of NR concerned);

Monitoring, awareness and environmental education campaigns for stakeholders: on-site meetings, community radios, etc.

## 7.5 Climate change impacts on biodiversity and fisheries

### 7.5.1 Impacts on biodiversity

For marine and coastal species, the unusual warming and the frequency of hot extremes will result in significant physiological changes by exceeding the thermo-tolerance capacity due to the rapidity of the changes (Somero, 2012). The consequences will result in mortality that can lead to the extinction of less resilient species, migration to other areas and significant physiological transformations to adapt to new conditions of the living environment. Climate change therefore affects the growth and viability of certain species (corals, bivalves, crustaceans and plankton).

Researchers have explained that the warming and the deoxygenation which accompanies it, disturb the reproduction of the fish and their growth, by causing a reduction in their adult size and sometimes their premature mortality. Indeed, these animals must use most of their energy trying to survive. They estimate that these alterations in growth and reproduction lead to a 5% loss in global fish productivity per degree of warming. This loss is estimated at up to 20% by 2100, despite a significant reduction in greenhouse gas emissions. At the same time, there are significant changes in the geographical distribution of fish populations, the magnitude and speed of which vary, however, depending on the species and the areas. In this regard, researchers use the term “tropicalization”: warm water species appear and proliferate in our latitudes, while those in temperate or cold waters tend to disappear there to migrate further north or towards the depths.

Acidification is particularly damaging to a large number of marine organisms. It gradually alters and causes both the death of

corals, which are the foundations of essential ecosystems, and plankton. It also poses a serious threat to other living creatures such as crustaceans and shellfish whose bodies are protected by a calcareous envelope that these new living conditions make more difficult to develop, and which they further weaken.

Through their study of 1,066 species of fish and marine invertebrates, Cheung et al (2009) showed that by 2050, Senegal's maritime space will be one of the areas most affected by the consequences of climate change (NDC, 2016).

Thermal modifications impact the incubation of sea turtles and the sex ratio through the warming of the temperature of the sand of the nests (Limpus et al., 1985; Hays et al., 2003; Petit, 2009) which results in the birth of more females than males (Godley et al., 2002). On the Senegalese coasts, the increase in temperatures which are around 34°C generates the phenomenon of embryonic mortality (Limpus et al., 1985; Matsuwaza et al., 2002) in sea turtles, which has been observed at the level of the park of the Barbarie Langue and the MPA of Joal-Fadiouth (NDC, 2016). In addition, coastal erosion will promote the loss of nesting beaches for sea turtles along the entire Senegalese coast. Indeed, out of the 10 nesting sites monitored along the Senegalese coast, 7 are often flooded during the nesting period, due to the advancing sea (Langue de Barbarie National Park, Marine Protected Area of Joal-Fadiouth, Community Nature Reserve of Palmarin, Saloum Delta National Park, Nature Reserve of Popenguine, Marine Protected Area of Abéné, Ornithological Reserve of Kalissaye). This leads to the deterioration of eggs and consequently a problem of renewal of turtle populations.

With regard to birds, according to the African-Eurasian Migratory Waterbird Agreement (AEWA) report (2008, in NDC, 2016) climate change effects will have an impact on migratory waterbirds; the early



© Awitazi, West African manatee (*Trichechus senegalensis*) highly endangered specie



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or late arrival of birds at their wintering sites can pose a problem of food availability. In addition, the rise in sea level is leading to a gradual submersion of island breeding sites (Birds Island of the PNDS, Ansoukala Island and Sangomar Island, Langue de Barbarie, Ornithological Reserve of Kalissaye, Saloum Delta, etc.).

The new conditions also favour the development of new invasive species that cause profound changes in the ecosystem of MPAs and other marine and coastal areas (Otero M. et al., 2013). This is the example of the community nature reserve of Tocc Tocc (RNCTT) where the plant cover has undergone major changes marked by the presence of the species *Typha australis* ("Barakh") and whose density interferes with agricultural, fisheries, pastoral and domestic activities. All of these elements will disrupt the functioning of marine ecosystems (Doney et al., 2012).

### 7.5.2 Consequences on fishing and coastal populations

The increase in water temperature, combined with the deterioration of the quality of the oceans by the phenomenon of acidification, will in the long run lead to a decline in the benefits of MPAs and in income from fishing in all these forms (Bonnin M., 2015).

The increase in the average acidity of the world's oceans (Denman et al., 2011) can affect the physiological functioning of marine organisms, their quality and their population (Bonnin M., 2015) with the modification of the trophic chain navy (Barange et al., 2011). Ocean acidification is already affecting marine life, with consequences for fisheries, aquaculture, tourism and biodiversity which are all affected, and huge financial losses are expected by the end of the century. These potential losses are particularly alarming

for the African continent, where many countries rely heavily on the sea for their economic, social and nutritional services. Currently, fisheries and aquaculture directly contribute US\$ 24 billion to the African economy. The sector provides employment to over 12 million people in the continent. The fisheries sector is essential for Africa's rural coastal populations, who are among the poorest and most vulnerable, in terms of food security and employment provision. For African consumers, fish and other fish products represent about 18% of all animal protein intake (WorldBank, 2019). Due to the growing population and per capita income, demand for fish is expected to increase 30% by 2030. Combined with other climatic factors, ocean acidification could make it difficult to meet this demand.

Recent analysis of fisheries data for 235 fish stocks worldwide, over the 1930-2018 period, shows that the maximum catch potential has decreased by 4.1%. Other studies predict an overall decline in catches of 5% by 2040, with significant qualitative variations of fish species caught. At the same time, global fish consumption is on the rise. According to the FAO, it has doubled since 1995 to reach 132 million tonnes, or nearly 17 kg/year on average per person. Coastal communities that make their living from small-scale fishing or export high value-added fish will therefore face significant difficulties from an economic point of view, but also to ensure their own subsistence. In this regard, IPCC indicates that "globally, climate change impacting the abundance, distribution and potential catches of fish stocks is likely to reduce the maximum potential income from fisheries around the world. These impacts on fisheries will increase the risk to the incomes and livelihoods of people working in these economic sectors by 2050. This risk is greater under high greenhouse gas emission scenarios".



## 7.6 Role and contribution of MPAs in mitigating climate change effects and adaptation strategy

The climate system brings together a plurality of entities that help maintain natural balances and therefore the well-being of all living beings. The ocean, which plays an important role in mitigating climate change effects, absorbs more than 80% of the heat emitted, and is now experiencing strong warming (Bindoff et al., 2007).

The direct impact of MPAs in combating climate change lies in the capacity for carbon sequestration. Marine and coastal ecosystems located in marine protected areas, mainly mangroves, seagrass and salt marshes, act strongly in this phenomenon through the process of blue carbon sequestration. The contribution of marine and coastal ecosystems to carbon sequestration has been estimated at around 15% of the global carbon stock (Dudley et al., 2010). It should be noted that West Africa covers around 16,000 km<sup>2</sup> of mangroves (FAO, 2009) and that each hectare of mangrove can sequester up to 1,000 tonnes of carbon. Thus, these ecosystems contribute to mitigating the impacts of climate change on biodiversity and people (De Wasseige et al., 2015; Eba'a Atyi et al., 2015).

Despite their importance, the oceans are subject to different forms of threats that affect the different services they provide and marine biodiversity. To date, only 3.5% of the oceans are protected for 2% which enjoy high protection, which is far from the objective of 10% of protected areas in 2020 and 30% in 2030 (Rand M., 2020). It is clear that MPAs have limits in this fight because they constitute static responses to spatially dynamic phenomena and resources. The various existing works on the impacts of changes show that the intensity of these changes on marine and coastal biodiversity will not fade in the future (Otero M. et al., 2013).

The protection of marine ecosystems can, to some extent, mitigate the effects of climate change, the ocean is therefore part of the nature-based solutions to combat these changes. Healthy marine habitats also allow marine species to better adapt to climate change.

If climate change has a certain impact on biological diversity, the reverse is also valid. Changes in biological diversity at the ecosystem and landscape scales are in turn expected to influence local and global climate by altering greenhouse gas uptake and emission, evapotranspiration, and albedo which plays on the temperature (CNRS/Sagascience, 2008). This is what justifies the importance of taking immediate adaptation measures to anticipate the harmful effects of climate change, so that the species and habitats identified as vulnerable can be protected and that the services rendered to the populations by these ecosystems are sustainable. In this context, adaptation based on ecosystems can constitute a relevant approach for the development and implementation of a global adaptation strategy. This approach, as advocated by the IUCN, calls for the sustainable management, conservation and restoration of ecosystems to provide services enabling populations to adapt to the negative effects of climate change. It aims to maintain and increase resilience, while reducing the vulnerability of ecosystems and human communities to the negative effects of climate change.

### Box 7.5 Case of Senegal

Pelagic resources (75% of landings in Senegal), very dependent on upwellings, will be marked by a decrease (REPAO, 2010). Assessments of stocks and fishing efforts since 1983 in Senegal have shown that the abundance of five demersal species (*Pagellus belloti*, *Epinephelus aeneus*, *Pagrus caeruleostictus*, *Pseudupeneus prayensis* and *Galeoides decadactylus*) has decreased by 75% over the last twenty years. This reduction will be accentuated by climate change. The migratory cycle of the thiof (*Epinephelus aenus*), very dependent on the seasonal evolution of upwelling water, will also be disrupted, while zooplankton filter feeders (*Sardinella*, *Trachurus*) will be favoured. On the other hand, with the warming of surface waters, the stay period of tuna in Senegal could lengthen due to the presence of warm waters. The decline in pelagic fish populations will certainly have an impact on the availability of this resource on which many species of fish-eating birds depend.

Thus, protected areas in general, and marine protected areas in particular, constitute a response to the impacts of climate variability and the pressure of human activities. Maxwell et al. (2020) estimates protected areas at 15.3% of the world's surface and marine protected areas at 7.6% in 2020 (UNEP-WCMC, 2020) which is very insufficient compared to Aichi target 11.

Stolton et al., (2015) qualify MPAs as spaces hosting a significant floristic and faunal diversity and fulfilling different functions. In fact, they constitute an alternative to traditional resource management methods in areas that are often complex and marked by the plurality of threats to resources. They appear as new levels of management of marine and coastal territories (Chaboud et al., 2008; Jentoft et al., 2007; Chakour and Dahou, 2009).

Their implementation therefore underlies a multitude of ecosystem, economic, socio-cultural, legal and legitimate considerations (Sarr, 2006). The role of marine protected areas has been grouped into three main functions: safeguarding biodiversity, maintaining natural balances and strengthening resilience to climate change.

These protected marine ecosystems play a critical role in mitigating climate change globally and especially in Africa (Bonnin et al., 2015). They are, in addition to the role of safeguarding marine and coastal biodiversity, spaces of resilience to climatic hazards (Dudley et al., 2010). Thorpe et al. (2011) consider them as areas of guarantees against the multitude of impacts generated by climate variability. Thus, the protection of marine and coastal ecosystems within MPAs against various forms of degradation would contribute to reducing CO<sub>2</sub> emissions. These benefits from the phenomenon of carbon sequestration by MPAs go beyond their circumscription. "In West Africa, seagrasses and, to a lesser extent, mangroves play the role of carbon pump, all the more so when these ecosystems are preserved and therefore in a better state of health. Thus, within MPAs, the sequestration capacity is approximately 25% greater than it may be outside". (Bonnin et al., 2015).



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Regarding coastal erosion, MPAs constitute a significant protective barrier for coastal areas. MPA resources, such as mangroves and seagrass beds, provide a 70 to 90% reduction in wave power (Wells et al., 2006) with mangroves providing around 25% of these services compared to other ecosystems (Bonnin et al., 2015). This service offered by the marine and coastal ecosystems of MPAs favours the reduction of impacts linked to climate change on coastal areas. Faced with the intensification of climatic extremes, these areas could play a decisive role in maintaining natural balances.

In addition, MPAs across the various ecosystems improve the quality of water and nutrients, as observed by Cormier-Salem (1999) in the complex of rivers in North-West Africa. It is therefore clear that MPAs play an essential role in mitigating the impacts of climate change. The various advantages related to their implementation go beyond the local framework to respond to global concerns.

In addition, the role of networks of marine protected areas have is to ensure biological and ecological connectivity that strengthens the resilience of marine ecosystems. For this, they must be representative and distributed in a coherent way in their role of contributing to the resistance to climate change. The response to climate change by MPAs networks will be enhanced if the cumulative effects of stress factors are reduced. Networks of marine protected areas will also respond better to climate change and other stressors if managed effectively. Management needs to be adaptive but reinforced from a regulatory point of view. Managers must also have the logistical and technical capacity to carry out their mission, which includes the scientific monitoring of climate impacts.

## 7.7 Conclusions and recommendations

Climate variability and change are manifesting themselves in a variety of ways, exposing “the ocean and its ecosystems to conditions not seen for millennia” (IPCC, 2022): rising sea surface temperature (SST), the rise in the level of the oceans, acidification, deoxygenation and the multiplication of extreme events, constitute the main issues increasing the sensitivity and exposure of these environments as well as of the human communities that depend on them. Climate change leads to the degradation of marine and coastal ecosystems. They are a serious threat to habitats and the local populations.

MPAs will be impacted and regional networks will have to be designed to maximize resilience, strengthen connectivity. MPAs, provided they are well managed, therefore have an important role to play and they are among the nature-based solutions for maintaining and restoring the resilience of ecosystems in a changing climate. The creation of MPAs and MPAs networks and their proper management can thus:

- contribute to the resilience of marine environments;
- minimize other stress factors in ecosystems to improve the ecosystem’s capacity to respond and adapt to climate change;
- facilitate the implementation of adaptation strategies based on ecosystem approaches;
- help maintain biological and ecological connectivity between marine environments;
- facilitate adaptation to climate change;
- protect marine habitats that absorb large amounts of carbon dioxide, such as mangroves, seagrasses and salt marshes, which

can store up to 71% of the total amount of carbon found in marine sediments.

“Blue carbon” MPAs (MPAs protecting mangroves, seagrasses, etc.) must therefore be multiplied and widely extended.

Increasing resilience and adapting to the effects of climate change is one of the challenges that MPAs managers are facing rapidly. They must be prepared and trained.

Knowledge of the impacts must also be reinforced. Thus, understanding the ecological and socio-economic consequences of ocean acidification in African coastal waters is still minimal, and many countries are not yet in a position to engage in ocean acidification research. This is a growing field that requires support from national governments, international organisations and global scientific collaborations. Scientific networks and capacity building efforts continue to be developed through cooperative programmes and regional convention bodies. This approach helps African nations combine their strengths and knowledge centres with the establishment of collaborative and ambitious programmes that meet the goals of the SDGs and protect the livelihoods of coastal communities. Ocean acidification strongly contributes to the erosion of marine biodiversity, and therefore to the productive capital of coastal communities.

The marine and coastal ecosystems of West Africa, some of which are established as MPAs, could be affected by the consequences of the acidification of the Atlantic Ocean.

Thus, combating the impacts of climate change, ocean acidification and its mitigation will require a radical reduction in global CO<sub>2</sub> emissions. It is nevertheless possible to develop local adaptive solutions to increase the resilience of ecosystems by responding to the specific societal priorities of coastal communities. To do so, it is essential to have strategic data on ocean acidification to develop and implement such solutions that meet the needs of coastal communities and their sustainable development, including identifying hotspots of acidification.

Here is a summary of some suggested actions, more specifically related to acidification issues:

- Pan-African cooperation, through the creation of a national coordination unit to collaborate between national authorities and stakeholders affected by ocean acidification. This should include the creation of a pan-African funding strategy for ocean acidification research;
- Regional and inter-regional technical cooperation projects were established between African coastal nations and the international community to support and expand ocean acidification observation and research networks;
- Environmental monitoring programmes aimed at making long-term observations on ocean acidification should be created strategically to take advantage of local strengths, pool resources and collaborate using existing water quality measurements in the private and public sectors;

- Develop local infrastructure for field (e.g. boats) and experimental (e.g. marine stations) marine research, including species facilities for ocean acidification research;
- Strengthen the growing community of African researchers specialising in ocean acidification by creating training and research programmes through collaboration between national and international stakeholders;
- Improve awareness-raising and communication on ocean acidification and its threat to stakeholders, through an educational programme designed to inform and prepare. Particular attention should be given to training and capacity building of policy-makers, national administrations and NGOs using the UN guidance note on ocean acidification;
- Identify local priorities based on services most likely to be affected by ocean acidification (e.g. fisheries, aquaculture) and gaps in developing and implementing solutions;
- Address socio-ecological risks (and not only ecological risks which, to a large extent, are beyond the control of African coastal states). Socio-ecological risks can be mitigated by various management measures;
- Focus research on socio-economic targets such as commercially relevant marine species and ecosystem engineers essential to maintaining food webs. The socio-economic effects on the regional ocean economy constitute a hidden risk to the sustainable development of African coasts, which will only worsen over time;
- Develop regional bioeconomic modelling tools that predict expected effects on marine life and resulting consequences for at-risk stakeholders. This will allow governments to consider expected economic losses and strategies to reduce those losses;
- Develop natural-social studies on adaptation, including co-management and sustainable development;
- Update policies, regulations and standards to recognize the role of human activity in ocean acidification locally and globally. Measures to reduce eutrophication, acid rain, mitigate CO<sub>2</sub> emissions and habitat loss would be valuable steps to help coastal ecosystems adapt to increasing ocean acidity.



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**Part 4 - Sustainable  
economic development in  
support to conservation**

## Chapter 8

### Ecosystem services provided by West African marine protected areas and the economic impact – Blue Economy

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The following chapter outlines the ecosystem services that MPAs are likely to provide:

- The conceptual framework and calculation methods specific to the evaluation of these services;
- Studies conducted in West African MPAs;
- The main limitations of these studies;
- Main recommendations;

## 8.1 Introduction

The West African coastline, which is over several thousand kilometres long, is subject to many pressures (UNEP-WCMC, 2016b), while marine resources are increasingly exploited (Defaux, Failler and Rey-Valette, 2017; PRCM, 2019). Its natural habitats are damaged due to direct anthropogenic actions (resource extraction, environmental modification, pollution) and indirect actions such as climate change (UNEP-WCMC, 2016b; CBD, 2018). In addition, many fish species stocks are overexploited (FAO, 2019; Failler 2014). Thus, the surface area of natural coastal habitats such as mangroves, coral reefs, and seagrass beds has globally decreased in recent decades (with an annual loss of mangrove surface area of 2%, on the scale of the African continent for example) (IPBES, 2018). At the same time, the ecological condition of these habitats has deteriorated, leading to a significant loss of their functionality (Trégarot, Tournon-Gardic, et al., 2020) and compromising their essential functions to maintain a framework of adequate life for the people.

To address this phenomenon, national and international institutions have mobilised to organise and harmonize public policies in favour of the coastal environment in Africa (Abidjan Convention, Nairobi Convention, Jeddha Convention, Convention on Biological Diversity, etc.). While public policies formerly focussed their actions on maintaining natural spaces and related biodiversity, they are now increasingly included in the process of reclaiming and enhancing degraded natural areas (Yetunde, 2017; David Dan-Woniowe, 2020). In the current framework of the Intended Nationally Determined Contribution (INDCs) for the implementation of the Paris Agreement with particular consideration for blue carbon (UNECA, 2016; 61 CMAE et al., 2019), or more conventionally in the achievement of Aichi Targets (Tittensor et al., 2014; 62 Failler et al., 2019) and the implementation of Global Environment Facility (GEF)-funded programs (63 related to LMEs (Sherman, 2019), the enhancement of coastal habitats has a leading role.

In this regard, monetary valuation is a relevant tool for integrating the environment into the economic, political and social spheres (Binet et al., 2012; UNEP and GRID-Arendal, 2016). Quantifying ecosystem



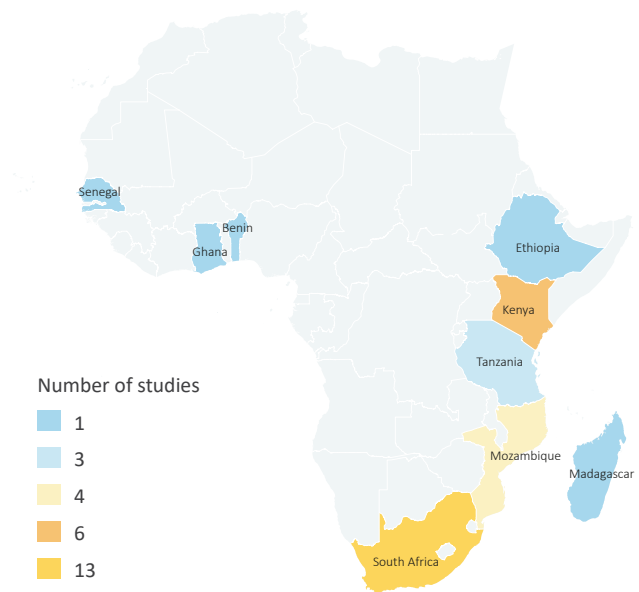
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services in monetary terms allows us to compare different types of habitats and compare them with income-generating economic activities (Bacon et al., 2019; Bonnin et al., 2015). It also makes it possible to estimate the costs of political inaction (Trégarot et al., 2017), following the degradation of natural habitats. While the natural capital is often overlooked due to a lack of data compared to the human, social and economic capital (Failler et al., 2015; Pascal et al., 2018), this approach offers the advantage of emphasizing ecosystems in the planning of public policies. For example, a study carried out in Nigeria on the evolution of land cover estimated that natural environments had lost almost 5% of their monetary value in 10 years, representing US\$ 2.53 billion (Olusha Arowolo et al., 2018). On the one hand, choices in terms of investment for protection or conservation would be better informed if, for example, undervalued and previously overlooked habitats, such as seagrass beds, are taken into account. On the other hand, monetary valuation of ecosystems further allows for greater balance in decision-making regarding the use of spaces: economic activities to the detriment of ecosystems versus risk-averse management of these ecosystems due to their high economic value.

Due to the recurrent lack of data and studies related to African coastal and marine ecosystem services (Wangai, Burkhard and Müller, 2016; Willcock et al., 2016), it seems fundamental to advocate for the development of this area of research. By analysing the titles of thousands of scientific articles, it was highlighted by Jamouli & Allali (2020) that the natural habitats located in most West African countries had not been the subject of assessment of ecosystem services (see Figure 8.1).

It should be noted, however, that a significant proportion of these studies are published in the form of reports. As a result, this “grey literature” is not referenced in the documentary databases of scientific articles. Among these reports, a few monetary assessments have already been carried out at the regional level of LMEs (Large Marine Ecosystems) (Chukwuone et al., 2009; Interwies, 2011; Interwies and Gorlitz, 2013), or geared towards the assessment of fisheries resources (Sumaila, 2016). West African marine protected areas have also sporadically benefited from such studies (Binet et al., 2012; E. Trégarot et al., 2018, Touron-Gardic et al., forthcoming), as has the carbon sequestration service (Bryan et al., 2020). Finally, Trégarot et al. (2020a) made a first assessment of the value of key coastal habitats at the continental scale. The assessment of the monetary value of ecosystem services can then be reused for similar work at regional, national and local scales, particularly within the framework of the implementation of the African strategy related to the Blue Economy, in which the enhancement of coastal ecosystems is a main concern.

Environments with protected status are expected to be healthier than non-protected environments (Laë et al., 2015), and are therefore likely to provide services at a higher level. In short, MPAs now play a role in maintaining the services provided by ecosystems (Leenhardt et al., 2015). To this end, monetary valuations can be served as tools that highlight the high value of habitats located within MPAs. In this regard, these assessments can facilitate the integration of MPAs into public policies for spatial planning and environmental management or can simply be used as an eloquent advocacy tool.



**Figure 8.1 Inventory of studies to assess the value of ecosystem services in African countries**

Source: Jamouli and Allali, 2020

The purpose of this chapter is to outline monetary valuation of ecosystem services in the context of West African MPAs. The first section presents the conceptual framework needed to conduct these assessments, as well as the main calculation methods to estimate the monetary value of ecosystem services. A second section reviews the main assessments already carried out in West African MPAs and discusses their main findings. Thereafter, a third section quickly addresses the limits of these studies, particularly in connection with the calculation methods. Finally, the last section lists some recommendations to improve the quality of these studies, to draw useful information from them and so that they lead to concrete actions for the conservation of natural environments and the services they provide.

## 8.2 Conceptual framework and calculation method

The most widely used unit for measuring the value of ecosystem services is the total economic value (TEV) explained in this section. The selection of services to be analysed is taken from the work of Trégarot et al. (2018a).

The monetary value of a service provided is often defined as a person’s willingness to pay for that good or service, minus its cost of production. In the case of ecosystems, they often provide goods and services for free. In this case, only peoples’ willingness to pay is taken into account to translate the value of the service provided (Noël, 2006) in (Failler, Pètre and Maréchal, 2010). In other words, the economic value of the ecosystems studied can be evaluated on the one hand by estimating their contribution to market activities (which include costs and benefits) and on the other hand to non-market activities for which an additional estimation method needs to be developed.



The concept of total economic value (TEV) offers a conceptual framework capable of taking into account all the values previously described, and which can be attributed to the ecosystems under consideration (Figure 8.2). It is this framework that will be developed in this chapter, since it is widely used in contemporary assessments. The advantage of such a framework is first of all that it allows a monetary valuation of the majority of services provided by ecosystems. On the other hand, because it is widely used since the end of the 1980s, it is lending itself largely to comparisons, which is one of the objectives of these monetary valuations. For example, the various reviews of assessments of the goods and services provided by seagrass ecosystems ((Blanquet, 2008) in (Failler, Pètre and Maréchal, 2010); (Failler et al., 2015) have highlighted their high value, hence the interest in adopting the TEV framework. This does not mean, however, that this method accounts the monetary value of all the possible uses, among others, indicated in the Figure 8.2: it will focus on a certain number of them, because they best represent the services provided by the analysed ecosystems.

In the case of MPAs assessments, the work covers several types of coastal and marine habitats. It is therefore essential to classify the goods and services provided by each according to the same nomenclature. All of the services provided by the ecosystems contained in the MPAs can thus be distributed in one of the four main categories of services selected, including supporting services, regulating services, provisioning services and cultural services. The nomenclature of the Millennium Ecosystem Assessment (2003) related to the types of services, as well as the Common International Classification of Ecosystem Services (CICES) classification are recurrent for the selection of services to be assessed in studies related to protected areas (see Table 8.1 for an example of a list of services to be assessed in MPAs). It should be noted that goods are assimilated to supply services in the classification of the millennium assessment.

Supporting services are acting as a foundation for the other three types of services (provisioning, regulating, and cultural). Therefore, estimating the value of support services could introduce a risk of double-counting with the three subsequent types of services (IPBES, 2018a). Furthermore, estimating the value of supporting services is complex due to their highly diffuse nature.

The services provided by coastal and marine habitats (estuaries and channels, seagrass beds, mangroves, tidal mudflats, beaches, rocky bottoms, coral reefs, tidal flats, coastal forests, etc.) are not the same, so a distinction is made between them in terms of the services provided.

Once the services have been identified, they need to be translated into monetary terms. Broadly speaking, there are several methods to express these services in monetary terms:

- Estimation of the value of services can be done based on the direct added value generated by commercial activities (fishing, wood collection, etc.), and in particular for provisioning services (also called here the “turnover” approach). In the case of non-market activities (provisioning services intended for self-consumption), the use of direct value added proxies makes it possible to obtain estimates of the added value (Failler et al., 2015; Trégarot, Failler and Maréchal, 2017).
- The use of reference values can also be used. For example, for services related to climate change, reference monetary values from national documents related to the Paris Agreement (Nationally Determined Contributions or NDCs) can be used to determine the price of a tonne of carbon. Therefore, by multiplying this unit price by the total quantity of carbon sequestered by such and such habitat, it is possible to determine a monetary value. When such reference values do not exist, transfer values can be used, that is to say reference values used during similar estimations in different contexts. For example, the price of a ton of nitrogen treated by natural habitats can be based on the operating costs of wastewater treatment plants.

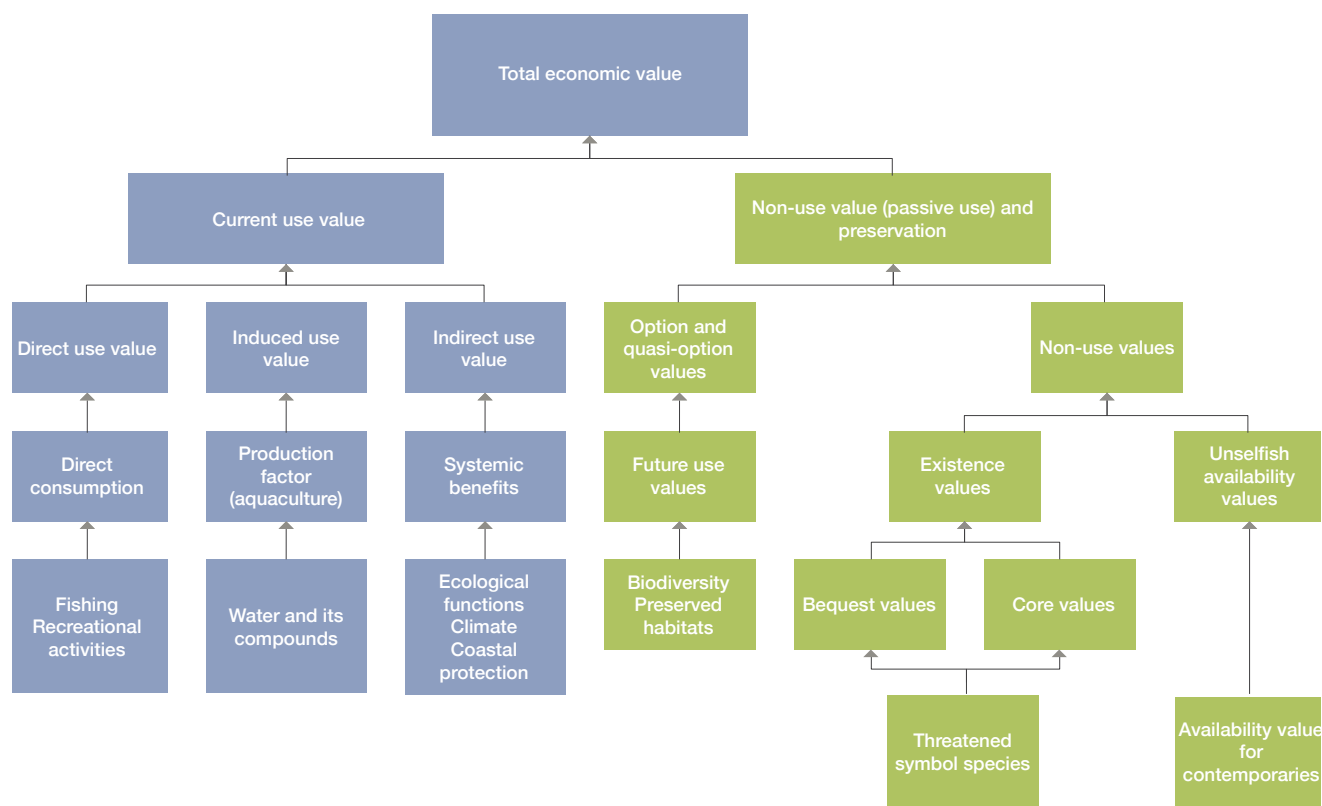
It should be noted that in these two cases, it is necessary to quantify beforehand the production function of ecosystem services, i.e. the quantity of services provided by natural habitats to humans. For example, in the case of carbon sequestration, it will be important to estimate the amount of carbon sequestered. Or in the case of biomass production, it will be necessary to estimate the total number or weight of fish generated within the MPA. This production function is estimated in different ways, based on cartographic data, area yields and data specific to the local context (fishing landing data, etc.).

In other situations, and in particular when the “turnover” and “reference values” approaches cannot be applied, the “Willingness-To-Pay” (WTP) approach is widely used. This method applies to cultural services which are difficult to quantify using a production function. In this case, users of a place are asked to determine the price they would be willing to pay to continue to enjoy this or that use. This may concern the price that users are willing to pay to benefit from a guaranteed supply of drinking water (Troni et al., 2014) , i.e. the provisioning service of fresh water. In another example, Coffman et al. (2009) estimated the value that the users of a wave were ready to spend, within the framework of their sporting practice (surfing, bodyboarding, etc.). In this case, the cultural service of the wave as a support for the practice of a sport has been estimated.

**Table 8.1 Classification of services provided by coastal and marine ecosystems**

Services provided by ecosystems	
<p><b>Supporting services (it is advisable not to rate them)</b></p> <ul style="list-style-type: none"> <li>• Services necessary for the production of all other ecosystem services</li> <li>• Soil formation and marine substrate</li> <li>• Nutrient cycling</li> <li>• Primary production</li> </ul>	<p><b>Provisioning services</b></p> <ul style="list-style-type: none"> <li>• Products obtained from ecosystems</li> <li>• Fish, shellfish</li> <li>• Water</li> <li>• Wood (mangrove)</li> <li>• Fibers</li> <li>• Biochemical compounds</li> <li>• Genetic resources</li> </ul>
	<p><b>Regulating services</b></p> <ul style="list-style-type: none"> <li>• Benefits obtained from the regulation of ecosystem processes</li> <li>• Climate regulation</li> <li>• Regulation of certain diseases</li> <li>• Regulation of the water cycle</li> <li>• Water purification</li> </ul>
	<p><b>Cultural services</b></p> <ul style="list-style-type: none"> <li>• Non-material benefits obtained from ecosystems</li> <li>• Spiritual and religious</li> <li>• Recreation and ecotourism</li> <li>• Aesthetic</li> <li>• of Inspiration</li> <li>• of Education</li> <li>• Cultural heritage</li> </ul>

Source: Failler et al., 2009



**Figure 8.2 The Total Economic Value Concept** Source: according to Point (1998) and adapted by Failler & Pan (2007)

### Box 8.1 Evaluation of ecosystem services provided by the Banc d'Arguin National Park (Mauritania): a comprehensive analysis

Conducted in 2018 by a consortium of scientists from CEE-M, IRD (France), the University of Portsmouth (UK), IMROP (Mauritania) and several private companies, this vast study is currently the most comprehensive monetary assessment of ecosystem services in a given West African MPA. It involved months of work, including extensive fieldwork.

To carry out this study, the production functions of several main ecosystem services were estimated: water treatment, carbon sequestration, protection against waves, etc. In addition, all services relating to fishing (refuges for many species, importance of fishing for the lives of the Park's inhabitants, contribution of the Park to national fishing activity, etc.) have been recorded. To quantify these services, a careful mapping analysis was part of the evaluation protocol. Interviews with Park stakeholders (residents, users, administration, Park management team, etc.) were also carried out in collaboration with Mauritanian scientists, as well as in-depth analyses of national data relating to fishing, coastal protection, wastewater treatment, etc. At the same time, a perception survey was carried out among residents, as part of a thesis also aimed at completing this study (Abdel Hamid, 2018).

It is worth noting that studies of this magnitude are optional to assess the monetary value of ecosystem services in MPAs! Smaller studies can be implemented, without presenting poor quality results. Furthermore, cartographic data and data relating to fishing activities in some MPAs in the region are already available.

The strengths of this study are multiple: firstly, the careful mapping of natural habitats can be used for subsequent analyses, including studies that have no links with ecosystem services. Furthermore, it gave pride of place to the role of the Park as a "carbon sink". Finally, the integration of the social aspect – particularly regarding fishing – gave a voice to site users.

It emerged that the annual value of main services provided by the marine ecosystems of the Park was equivalent to an annual 6.5 billion Mauritanian Ouguiyas (MRU), or 160.5 million euros or 105.3 billion FCFA (Trégarot et al. 2018b). Compared to the Park's marine area, this represents almost 30,000 euros per km<sup>2</sup> per year (or 19 million FCFA). The main services were carbon sequestration (thanks, among other things, to large seagrass bed areas) and the Park's contribution to fishing. Furthermore, these services are useful beyond Mauritania's borders: several fishing companies from many countries are active in Mauritania, while carbon sequestration remains a global issue.

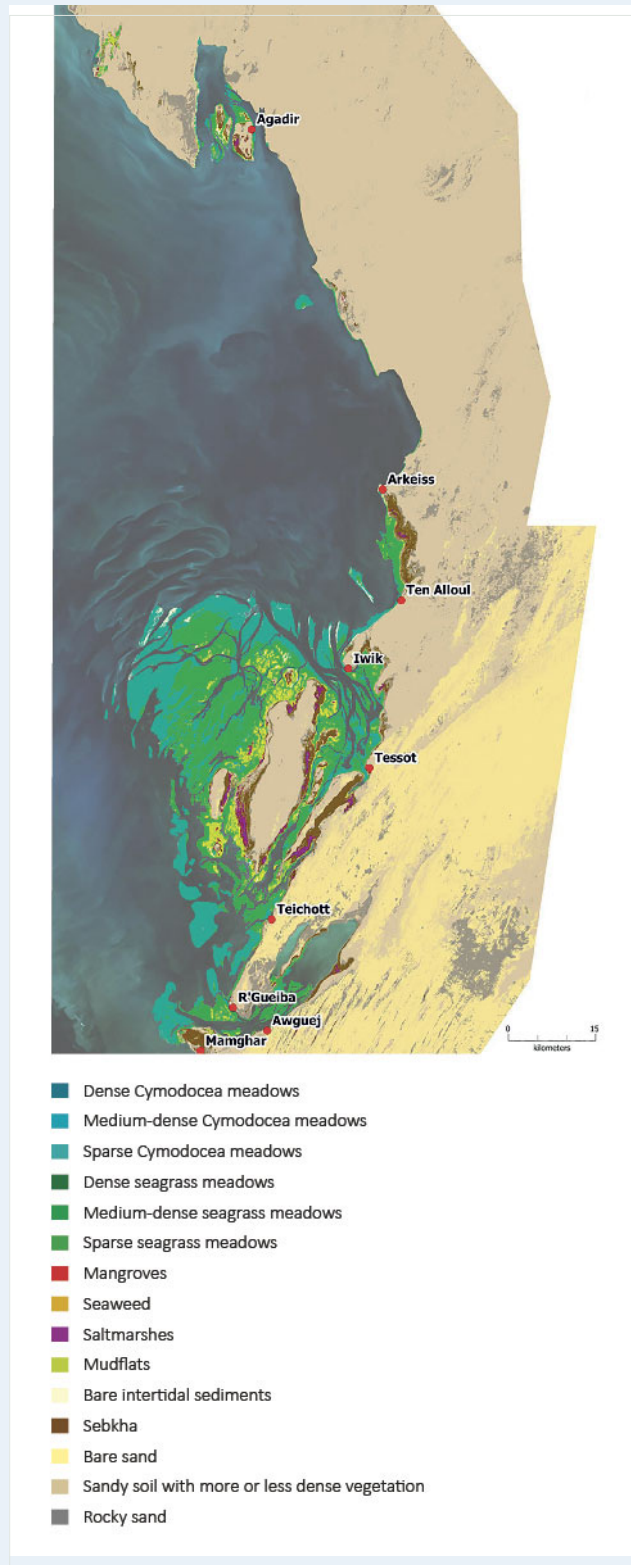


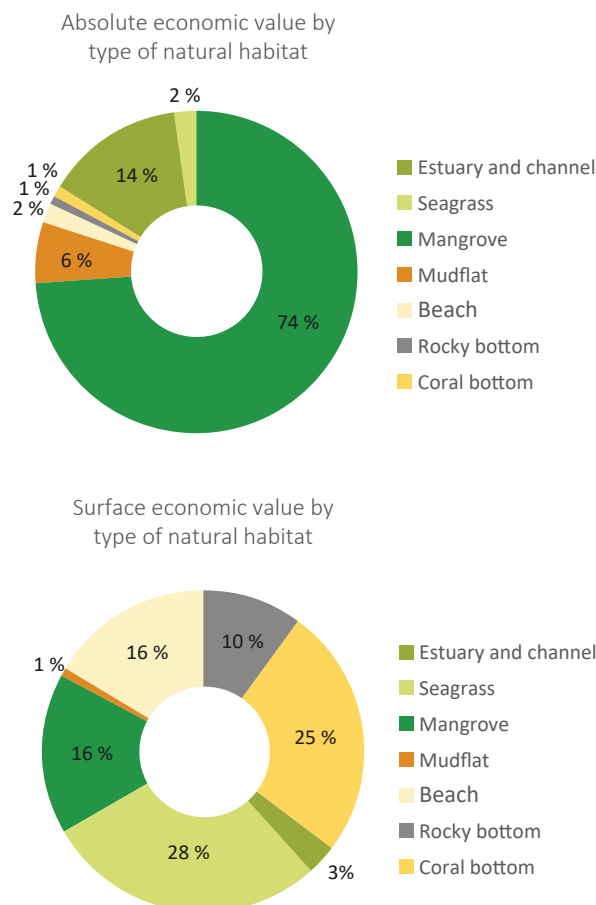
Figure 8.3 Mapping of natural marine habitats located in the PNBA in Mauritania Source: Extract from Trégarot et al. (2018b)

### 8.3 Studies conducted in West African marine protected areas

Monetary estimates carried out in West African MPAs are not legion: the first were probably carried out in Mauritania, such as an IUCN study at the Diawling National Park in 2009 (Ly and Ould Moulaye Zein, 2009). The monetary estimate presented in this study is also the lowest of all those made in the region since then: the value of the park was estimated at US\$ 15 per square kilometre on average (or FCFA 8,600). Other studies were to follow in the country's MPAs, including a new study in Diawling National Park in 2011 (Aleph Conseil, 2011), carried out by a consultancy firm specialised in economics, which was reflected in its approach: the concept of the aquifer had thus been retained for the first and last time. This service logically provided most of the monetary value of the site.

However, such studies did not extend to other MPAs in the region until 2012 and the publication of the EVA report. This report, which was the result of the project bearing the same name, aimed to establish a baseline of information on ecosystem services in the region. The real added value of this project is that it was the first time in West Africa that a study on ecosystem services in the region's MPAs was carried out at "network" level: six MPAs from four countries were analysed<sup>1</sup>, and as many comparison areas (Binet et al., 2012). The estimation method was mixed, with provisioning services being assessed using a "turnover" approach, while regulating services and cultural services were based on transfer values and "willingness-to-pay" to users. Natural habitats were also mapped and the results showed that the MPAs had a slightly higher economic value than the comparison areas (the cumulative annual direct use value of the MPA ecosystems, equivalent to 7.5 million euros, was 2.5 million euros lower than those of the same ecosystems in the comparison areas, while the indirect use values, equivalent to 28 million euros, were 2.9 million euros higher than in the comparison areas). The small relative difference could be explained by the low rate of use of the ecosystems in the comparison areas. The average surface value in the 5 MPAs was thus €26,000 (or FCFA 17 million), and the main contributing natural habitat was the mangroves (see Figure 8.4, upper chart). On the other hand, in terms of surface yields, seagrass beds were considered to be the most "valuable" environment (see Figure 8.4, chart below). It should be noted that the following studies regularly obtained similar surface values.

Secondly, economic evaluations were not widespread, except for a few studies initiated by the Senegalese MPAs Directorate (DAMCP), notably at the Saint-Louis MPA (Fall, 2018), Gandoul the MPA and the Palmarin reserve (Sall Ndiaye, 2017). In all three cases, the results are very high: €85,585/km<sup>2</sup> in Saint-Louis, i.e. FCFA 56 million (Fall, 2018), €73,419 (FCFA 48 million) in Gandoul and €211,061 (FCFA 138.4 million) in Palmarin (Sall Ndiaye, 2017). The main reason for these high results is that the methodology is different. In fact, the process sought to account in addition for the option and heritage values using the technique of peoples' willingness to pay, as well



**Figure 8.4 Distribution of the economic value provided by ecosystem services: Breakdown by habitat type during the EVA project** Source: Extract from Binet et al., 2012.

as the existence values based on investments in MPAs by public authorities and external organisations (international cooperation) and on the "attachment that the populations have for" these MPAs. In addition, the upstream and downstream economic activities required to conduct fishing (intermediate consumption)<sup>2</sup> were taken into account. Finally, carbon sequestration rates were estimated to be much higher than in most other studies (more than 10,000 tonnes per km<sup>2</sup> in the case of Palmarin, for example, against less than 500 t/km<sup>2</sup> in most other studies).

This was followed by the most comprehensive case study in a given site, i.e. the one carried out by Trégarot et al. (2018b) at the PNBA, to which is added a thesis published the same year on the same site (Abdel Hamid, 2018) – see Box 8.1.

The latest study is that of the "Small pelagics in RAMPPO MPAs – PPAMP" project, in which an international team carried out a "Network" analysis in six MPAs in four countries<sup>3</sup> located in the region, in order to estimate the monetary value ecosystem services of the latter with particular emphasis on the "fishing" aspect. For this study, a cartographic analysis as well as field surveys were

<sup>1</sup> Langue de Barbarie National Park in Senegal, Rio Cacheu National Park and MPA Urok in Guinea-Bissau, MPA Tristão and Alcatraz in Guinea and MPA Santa Luzia in Cabo Verde.

<sup>2</sup> Fuel – food – maintenance and repairs

<sup>3</sup> These are the Diawling National Park (Mauritania), the MPAs of Joal, Sangomar and Abéné (Senegal), the Niimi National Park (The Gambia) and the PNM João Vieira e Poilão (Guinea-Bissau). It should be noted that the contribution of these MPAs to the life cycle of small pelagics was required by the proxy.

**Table 8.2 Selection of ecosystem services to be quantified in order to determine their monetary value**

	Provisioning services				Regulating services					Cultural services
MPA	1. Fisheries economic services (small pelagics)	2. Fisheries economic services (excluding small pelagics: other marine species, shellfish)	3. Wood supply + pharmacopoeia	4. Agriculture (livestock + market gardening)	5. Spawning /Nursery/ Biomass production (small pelagics)	6. Migration corridor	7. Coastal protection	8. Bioremediation	9. Carbon Sequestration	10. Tourism
Diawling	X	X	X	X	X			X	X	X
Joal-Fadiouthl	X	X	X		X	X	X	X	X	X
Sangomar	X	X	X		X	X	X	X	X	X
Niumi	X	X	X		X	X		X	X	X
Abéné	X	X	X		X	X	X	X	X	X
João Vieira e Poilão	X	X	X		X	X		X	X	X

*Note: In this example, only the main services have been considered, in relation to the local context. However, the “cultural” aspect has not been addressed to any great extent. Source: Extract from Touron-Gardic et al. (forthcoming).*

necessary. The mixed “turnover” approach based on the use of transfer values was used. Ten main services were identified (see Table 8.2), and these were then estimated in the six MPAs of the study.

In this study, the average economic value was estimated at FCFA 44.712 billion each year (representing €68.159 million) for a surface value of FCFA 16.029 million (or €24,435) per km<sup>2</sup>. The results are of obviously disparate between MPAs studied, nevertheless the “fishing”, “biomass production outside MPAs” and “carbon sequestration” services proved to be the most important. It should also be noted that these different services are varied, ranging from tourism to the supply of wood and pharmacopoeia.

It should also be noted that ecosystem services are a function of the MPAs morphology. In the case of West Africa, MPAs are essentially located at the interface between terrestrial and marine areas; there are no offshore MPAs (Failler et al., 2020). This is why services such as tourism, wood supply or carbon sequestration are relatively present.

Finally, MPAs of several regional countries have not been studied (Guinea, Sierra Leone, Liberia, Ghana, Nigeria)<sup>4</sup>. However, it would be relevant to extend monetary assessments to MPAs in these countries since they also represent major environmental and societal issues. By way of illustration, populations residing along the coasts of Ghana depend for at least 50% on the services provided by coastal habitats (Hagedoorn et al., 2021). Fishing is the most important source of income, and households receive 53.2 million Ghanaian cedis annually thanks to the services provided by the ecosystems, representing €1,250 or FCFA 820,000/year/household (Ibid). As regards the mangrove ecosystems of the Niger River Delta, a recent

study estimated that mangrove habitats provide an indirect use value of US\$ 1,962/ha/year (Akanni et al., 2018), representing €162,000/km<sup>2</sup>/year or FCFA 128 million. However, it remains to be investigated in MPAs.

### 8.3.1 Limitations of these studies

The monetary valuation of ecosystem services remains highly subjective, since it attempts to quantify diffuse phenomena (Salles and Figuières, 2013). Therefore, the different methods used will strongly influence the final results. There are many sources of discrepancies between these studies, as shown by the various results between the studies conducted in the region’s MPAs: the surface economic value thus varied from US\$ 15 per km<sup>2</sup>, representing FCFA 8,600 (Ly and Ould Moulaye Zein, 2009) to more than €200,000/km<sup>2</sup> representing FCFA 138 million (Sall Ndiaye, 2017).

First of all, the selection of services is challenging. Some studies will be limited to the main services, namely a few provisioning and regulating services, while others will broaden the spectrum of analysis. Furthermore, it is difficult to know where to stop quantifying provisioning services, since they generate complex sectors, with their upstream and downstream jobs. For example, when analysing the fishing service, some studies will be limited to quantifying the turnover at landing, while other studies will include fuel supply, repairs, fish distribution chain, etc.

Secondly, the method used to calculate the production functions depends on the quality of the data available, and in particular the mapping tools and current scientific knowledge available at the time. For example, the carbon sequestration service is often calculated

<sup>4</sup> The Niumi National Park in The Gambia is currently the subject of a monetary evaluation within the framework of the BIOPAMA program, in addition to being included in the study by Touron-Gardic et al. (to be published).



© ScubaDiver - stock.adobe.com, yellow helmeted hornbill, a rare species of bird that lives in Guinea-Bissau

based on the surface area of mangroves present, multiplied by a surface sequestration rate found in the scientific literature. However, these surfaces depend on the spatial analysis tool: high-definition satellite images, low-definition satellite images, field analyses, aerial images taken using drones, etc. In addition, the surface area rates present in the scientific literature can change as new scientific findings are made. For example, it is now possible to determine the surface sequestration rate of mangroves by analysing primary production using satellite imagery, which was not possible in the past (see Trégarot et al. (2020b) for an example of such a process).

When the production functions of services are estimated, it is their translation into monetary terms that is sometimes risky. The choice, in particular, of transfer values when a product is not marketable leads to significant differences and discrepancies between the various studies. Taking carbon sequestration as an example, the price per tonne of carbon can be determined according to the documents resulting from the Paris Agreement or based on the REDD+. Depending on which of these references is selected, the price per tonne of carbon can vary considerably. Finally, the “willingness-to-pay” approach also brings its uncertainties. This approach is conditioned by users’ perception of their environment and perception is by nature subjective.

Finally, just like many other scientific productions, these studies are greatly remained limited to the scientific level. Disseminating this information to decision-makers and the general public still poses problems, partly because of the complexity of the methodology used. However, the main goal of these studies is to bring the environmental dimension more easily into public policy, using a “standard” monetary value. In that sense, findings so far have been unsatisfactory. Both the scientific and conservation communities therefore need to think about how decision-makers and the general public could take ownership of such studies. In other words, it is all about finding the tools to improve the way in which scientific results are taken into account in formulating public policies. There have been some encouraging signs in Mauritania, where a relative “ownership” of the report by Trégarot et al. (2018b) by the government has been observed.

### 8.3.2 Main recommendations

Although their ownership by public policies is unsatisfactory, the various ecosystem services assessments have nevertheless included the most accessible recommendations. Some of the most recurring recommendations are summarized hereafter:

- **Indirect use values predominate in most studies.** Among the most “valuable” services are, for example, fisheries biomass production and carbon sequestration. Therefore, as noted by Binet et al. (2012), “to be effective, the MPAs management must be geared towards preserving these supporting and regulating services. Management measures aimed at preserving these services would have the immediate effect of improving the net benefits of MPAs”. In addition, to maintain their services, MPAs must guarantee the general good state of health of ecosystems, by limiting human uses.
- **Protect the most “valuable” natural habitats.** In many of these studies, seagrass beds and mangrove habitats were highly valuable, as they were involved in many services (carbon sequestration, spawning grounds/shelter/nurseries areas for marine resources, waves, water treatment, etc.). While the role of mangroves is already well known in the region, this is not the case for seagrass beds. Monetary valuations therefore highlight these highly valuable habitats.
- **State the cost of inaction.** As far as possible, monetary valuations should include the notion of the cost of inaction, i.e. the difference between the economic value of ecosystems functioning at full capacity and their current functioning. It may be useful to conduct scenarios on the evolution of natural habitats, in order to highlight the potential monetary losses. It should also be highlighted that these monetary losses are not just “environmental losses”: they will regularly have to be compensated for by costly human actions (erosion control facilities, imports of fish, etc.).
- **Increase basic information and disseminate data.** This is constant in these studies: they are mainly based on spatial data sets and on counting resource harvesting (fish, shellfish, wood, etc.). However, the availability of data is lacking at all levels in the sub-region: there is no accounting of timber harvesting (this activity is officially banned, but informal activity is very developed), no estimates of fish catches within MPAs (although data in main sites are relatively substantial in some countries), land use that is not mapped or taken from old maps (lack of data on seabed), etc. Finally, very little is known about the “spillover” effect of fisheries resources from inside to outside MPAs. A few MPAs have hosted pilot projects (Brochier et al., 2013; Mbaye et al., 2015), but this research has not led to the implementation of protocols that can be replicated systematically across all the MPAs in the region. It is imperative to strengthen the basic information data in order to develop effective natural habitat conservation strategies.
- **Integrate monetary valuations into a broader process of sustainable financing of MPAs.** Monetary valuations highlight the importance of MPAs in guaranteeing many economic activities. Moreover, “willingness-to-pay” evaluations provide an idea of the price to access to certain services. Thus, financing mechanisms (taxes, access fees) can be implemented, as part of a “cost-benefit” approach to protect habitats in MPAs. Mauritania, for example, has introduced a “payment for ecosystem services” system as part of its fisheries agreement with the European Union, under which part of the EU’s financial contribution is allocated to the PNBA (Binet et al., 2013).
- **Develop the eco-tourism potential.** The region’s MPAs have strong tourism potential, due to the beauty of their landscapes and the presence of emblematic animals (birds, marine mammals, etc.). However, tourism is not very well developed in these sites, despite some promising attempts (the Bamboung MPA and Somone MPA in Senegal, the Diawling National Park in Mauritania, etc.). The introduction of sustainable tourism would also generate economic income that would compensate for the loss of income resulting from reduced pressure on resources (Chloé, Gale and Cobb, 2010; Kane, 2014).
- **Integrate MPAs and ecosystem service accounting into the Blue Economy strategies of West African countries (including multi-national strategies).** The concept of blue economy is developing worldwide. As a continent, Africa already has its own strategy, as do certain states and groups of states. This general framework includes and organises all activities related to maritime space. The monetary value of ecosystem services should therefore be integrated from the earliest stages of designing these strategies (which is the case in many of these documents). In West Africa, such strategic tools should soon be created. These documents are a prime opportunity to integrate ecosystem services into public development policies.

## Box 8.2 Testimony from a conservation expert

*Achille Assogbadjo*

“Marine protected areas (MPAs) are marine and coastal ecological systems characterized by remarkable biodiversity of flora and fauna. They are environments where primary production remains important and where all the functions of the food chain take place. In West African countries including Benin, these MPAs are increasingly being created to ensure the sustainable management of the resources that make them up, in a context of climate change and fast growing populations along the coasts. In Benin, there have been few qualitative and quantitative scientific studies of the areas likely to become MPAs in the near future.. Apart from mangrove areas which are relatively well studied, other marine ecosystems are little or not studied at all. Quantitative data for assessing biodiversity are rare, which limits the scope of actions to restore degraded or overexploited areas. Anthropogenic pressures on resources remain uncontrolled and the interactions maintained by local communities and resource users are poorly understood and unquantified.

Very few initiatives were taken to exploit the resources of potential future MPAs, particularly with regard to certain key aspects linked to ecosystem services: improving fishing yields, settling conflicts of interest between users, assessing the value of biodiversity and ecosystem services, improving the small pelagic fish processing chain in southern Benin to make the population more resilient to the effects of climate change, developing new products based on small pelagic fish to improve the nutrition of women of childbearing age and schoolchildren, etc.

Benin’s membership in RAMPAO therefore becomes a niche of opportunities for the country to develop, in partnership with the network’s stakeholders, initiatives that could involve local communities, resource users, university research, non-governmental organisations, policies, the private sector and development partners. This must lead to sustainable development strategies for MPAs involving the country, for better resilience of natural landscapes and human capital.”



© Padonou Dotou, Wikimedia Commons, baby turtle from hatcheries, Bouche du Roy, Benin





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## Chapter 9

# Marine protected areas and fisheries in West Africa

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*Contributors: Didier KABOU, Pierre CAMPREDON*

*Reviewer: François HENRY*

Fishing, which is a major economic sector in West Africa, plays a central role in MPAs. Fishers are the first to be affected by restrictions on their activity and uncontrolled fishing is recognized by managers as the threat that affects the greatest number of MPAs. On the other hand, MPAs can contribute to fisheries management, as long as they are part of a more global system of fisheries management and regulation. This chapter discusses the following considerations:

- General information on fisheries in West Africa: resources, exploitation, management, development.
- Threats posed by fishing to MPAs.
- The role of MPAs for fishing and the socio-economic development of resident populations.
- Fisheries management and co-management methods in MPAs.
- The performance limits of MPAs.
- Fishers migrations and their consequences in the sub-region.



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## 9.1 Introduction

In most West African countries located in the coastal zone, the fisheries sector is one of the pillars of the national economy, in terms of budget revenues, food security and employment.

The regional marine waters are among the richest in fisheries resources on the planet. This great richness results from the particular oceanographic conditions of the region, with the presence of upwellings of cold water which favour a strong biological production, and important terrigenous contributions, drained by the large rivers and the rivers of the south, that enrich the environment. In addition to its richness, the fisheries sector of this region is characterized (i) by the presence of straddling stocks of marine resources, shared between the countries of the region, with a continuum of migration and spawning grounds, sharing of the same ecosystems, (ii) by the great mobility of fishers, (iii) by a strong overexploitation of resources, linked in particular to oversized means of capture and a lack of regulation of access to resources (Garcia et al., 2013).

“The full exploitation of fish stocks and the scarcity of resources having considerably restricted the prospects for development of the sector, the States of the region are showing a desire for sustainable management of fisheries, reconciling the objectives of exploitation with the imperatives of conservation of fisheries resources and environments. To do this, MPAs are increasingly presented, alongside more traditional tools, as one of the tools for fisheries management.” (Oceanic development, SRFC project).

The different management approaches in the countries concerned have evolved but the basic questions formulated by fishing stakeholders are still relevant and include the following:

- What is the added value of MPAs compared to conventional fisheries management instruments when it comes to promoting the particular protection of certain stocks, certain areas, habitats, species, allocation of resources, community participation in decision - making?
- What do we really know about the effects of MPAs on fishing, and what do we know about the tools and methods used to measure these effects?
- Are there any lessons to be learned from international experience in terms of governance of MPAs linked to fisheries and allowing improvements in management?
- Can we continue to create MPAs, especially in the high seas, what impact on fishing and how to ensure their management?

Whether marine protected areas are dedicated to the conservation of biodiversity or the preservation of fishery resources, fishing has almost always played a central role. But on the other hand, among the anthropogenic pressures facing MPAs, MPAs managers prioritize uncontrolled fishing (Failler et al., 2020).

This gives an indication on the major challenge that fisheries management constitutes within the framework of MPA management.

## 9.2 General information on fisheries in West Africa

### 9.2.1 Coastal fishery resources in West Africa

The West African coasts are mainly swept by three major marine currents, namely the Great Canary Current in the north (from Western Sahara to the south of the Bissagos Islands via Senegal), the Gulf of Guinea Current (from Nigeria to the south of the Bissagos), and the Benguela Current (from Angola to southern Nigeria). During the dry season, trade winds from the north largely dominate the Saharan species and water gets cold, especially surface waters while during the rainy season or winter, there is a rise in the intertropical front (ITF), monsoon winds with Guinean species and water gets warm.

Two-thirds of the main fishery resources are made up of small pelagics (sardines, sardinella, horse mackerel, mackerel, bonga, anchovies, etc.), which accounts for almost three-quarters of production. Small coastal pelagics (sardines, sardinellas, bonga, anchovies) are the main target of artisanal fishing, while small offshore pelagics (horse mackerel, mackerel, etc.) are targeted by industrial fishing. The remaining ¼ is made up of demersal species (sparids, serranids, sciaenids, etc.). Other species include selachians, sharks and rays, crustaceans (coastal prawns, crabs, lobsters, etc.), and molluscs (oysters, gastropods, etc.).

These resources are highly coveted by industrial deep-sea fishing fleets using mainly trawls. They are also targeted by artisanal fisheries, where fishers use various fishing gears (gillnets, driftnets, lines, purse seines, beach seines and longlines), from boats propelled by sail, or increasingly by outboard motors, and which sometimes migrate to areas with more fish outside their country of origin.

### 9.2.2 Resource exploitation and production

Average annual production in the region is around 2.5 million tonnes, with significant variations between countries (see Table 9.1).

Over the past fifty years, fishing effort has been steadily increasing in all countries, as has the number of target species. Coastal demersal resources are globally overexploited, and biomass of these species has drastically decreased by 50% to 90% depending on the species (Hub rural, M. Thiaw, 2021). The effects of this overexploitation can be seen in the drop in yields of fishing plants, the closure of several fish processing plants and several conflicts between stakeholders, as well as the fact that many fishers have given up fishing to emigrate to Europe.

Faced with this situation, West African countries are increasingly establishing multi-annual fisheries management plans. For example, Senegal and Mauritania have thus drawn up management plans for certain species such as deep-sea shrimp, octopus and mullets.

Table 9.1 Average annual production of the different countries of the West African region

	Production in tonnes (marine resources)	Year	Share of fishing in GDP (%)
<b>Mauritania</b>	967 706	2018	6
<b>Senegal</b>	395 400	2015	3,2
<b>Cabo Verde</b>	26 580	2018	3,7
<b>Gambia</b>	55 686	2016	1,8
<b>Guinea-Bissau</b>	6 550	2016	3,3
<b>Guinea</b>	309 000	2020	4,5
<b>Sierra Leone</b>	200 000	2017	9,1
<b>Liberia</b>	126 000	2017	
<b>Côte d'Ivoire</b>	75 000	2017	1,5
<b>Ghana</b>	202 000	2014	1,1
<b>Togo</b>	20 000		5,3
<b>Benin</b>	16 200	2013	2
<b>Nigeria</b>	369 720	2015	0,5

Source: FAO - Profils des pêches et de l'aquaculture par pays (2020) / Bulletin statistique 2021 Centre National des Sciences Halieutiques de Boussouira / Rapport annuel 2021 Banque Centrale de la République de Guinée

### 9.2.3 Fisheries management

The ecosystem approach to fisheries (EAF) is positioned as an approach whose purpose is: *“to plan, develop and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystem”* (statement of the Reykjavik Summit in 2002). This is a management principle based on preservation of the services provided by the ecosystem, fishing being considered as a service of harvesting a living resource.

Sustainable fishing also means profitable fishing that diversifies its catches and marketing channels, maximises the value of products at first sale, has little debts and is dependent on operating subsidies.

At the social level, sustainable fishing creates local jobs, ensures high incomes as well as social justice, labour law and safety on board. It is linked to the territory and contributes to its balance and dynamism. Fisheries sustainability can be achieved if management decision-making processes are transparent, through scientific advice and on participatory approach.

Another important criterion is the precautionary approach to decision-making and action, which is necessary given the incomplete nature of our knowledge on ecosystems and unpredictable changes in the state of resources (climate and non-climate changes).

MPAs are particularly suitable laboratories for this approach. The application of the FAO's EAF (2003) to the management of MPAs promotes a sustainable management of these areas. To be effective,

management measures will also need to be compatible from one MPA to another in the case of a network of MPAs (e.g. strict control of fishing activities, regulation of access and activities, marking of MPAs).

In West Africa, fisheries management before the 1990s was carried out with a “top down” approach, consisting of centralized management by the Ministries in charge of fisheries, relying on fisheries directorates or agencies, often depending on political orientations.

Under the Sub-Regional Fisheries Commission (SRFC), the countries of the region have come together to harmonise their fisheries policies and pool their efforts through this regional advisory body, which provides recommendations and advice on fisheries management to its members.

### 9.2.4 Fisheries as a driver of development in West Africa

Maritime fishing is undoubtedly a development tool, as it generates thousands of direct jobs (artisanal fishers, fishmongers, processors, etc.) and related trades including engines and fishing gear repair, salt sales, carpenters and painters.

It plays a key role in society and the national economy, as indicated by the usual indicators such as the contribution to GDP (from 0.5 to 9% depending on the country — see Table 9.1), the contribution to the trade balance, food security and job creation.

In West Africa, the fisheries and aquaculture sector employs about 12.3 million people of which half of the people are fishers, the other 42.4%<sup>1</sup>, and 7.5% are processors and fish farm workers, respectively.

### The five key principles addressed by the Ecosystem Approach to Fisheries (EAF) are as follows:

1. ecological relationships between species should be maintained;
2. governance should ensure both human and ecosystem well-being and equity;
3. fisheries should be managed to limit their impact on the ecosystem to an acceptable level;
4. management measures should be compatible across the entire the distribution of the resource;
5. precaution in decision-making and action is needed because the knowledge on ecosystems is incomplete.

Inland fisheries employ more than half (55%) of fishers while most fish processors (42%) are employed in small-scale marine fisheries, followed by marine artisanal and marine industrial fisheries, which employ about 30% and 28% respectively. Women constitute more than 25% of the people working in the fisheries sector in Africa, and the majority (91.5%) of those women are involved in post-harvest activities.

About 5% of the world’s fish trade, worth a total of US\$ 56 billion, comes from African countries. According to the Food and Agriculture Organization of the United Nations (FAO), in 11 African countries, fishery products account for more than 10% of the total value of national exports.

### Findings of the Transboundary Diagnostic Analysis (TDA) of the Canary Current Large Marine Ecosystems Project (CCLME)

#### Main transboundary issues:

- Decline and vulnerability of small pelagic resources (sardines, sardinella, horse mackerel, anchovies, ethmaloses);
- Decline in marine resources (fish, cephalopods and crustaceans);
- Threats to vulnerable species (sharks and rays, marine mammals, sea turtles);
- Vulnerability of tuna resources.

#### This is mainly caused by:

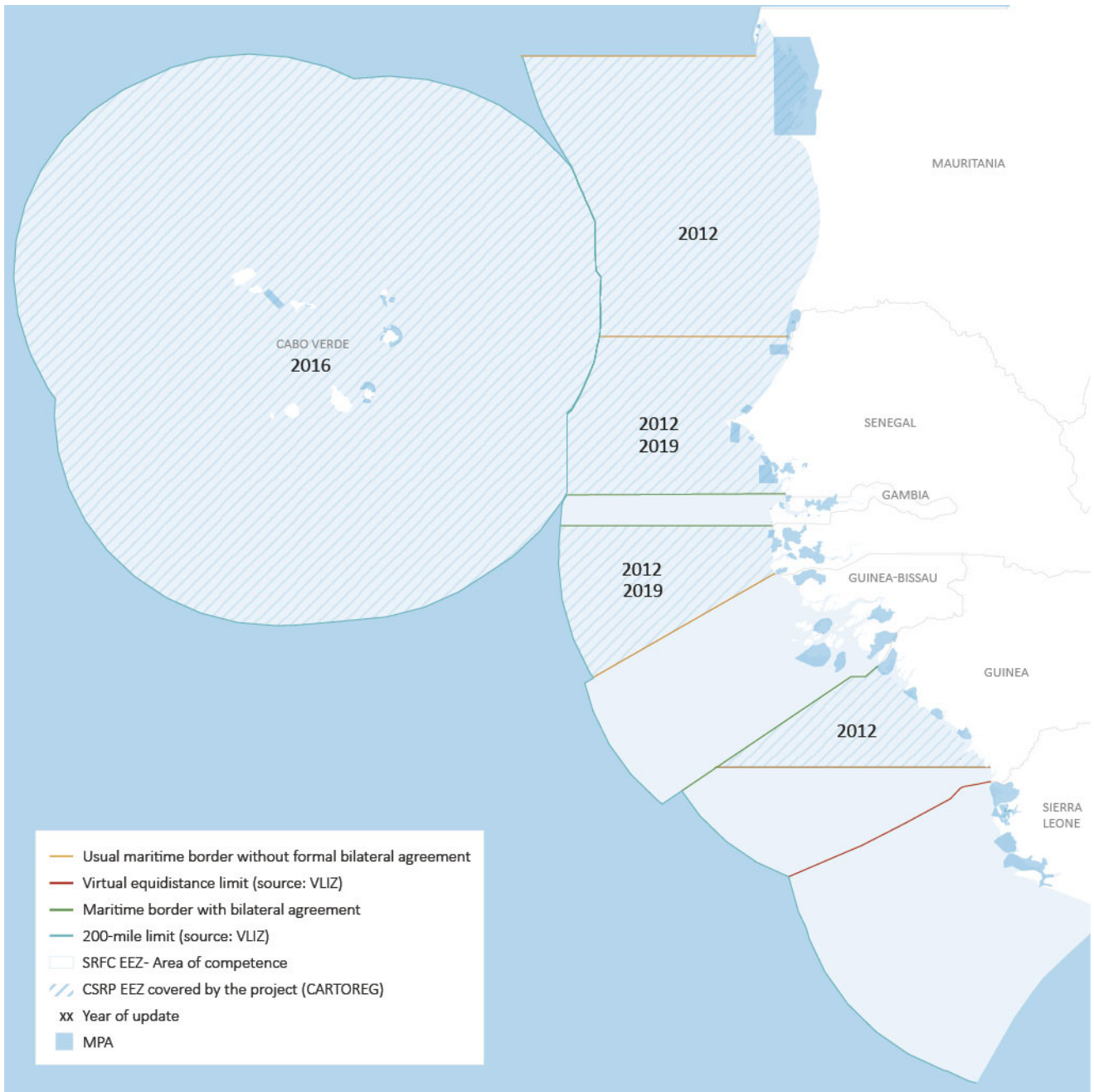
- overfishing and overcapacity of both artisanal, coastal and industrial fleets;
- excessive fishing in breeding areas and critical habitats;
- the use of poorly selective and destructive fishing methods and gear;

- illegal, Unreported and Unregulated (IUU) fishing;
- change in environmental factors.

#### For the following reasons:

- lack of regulation of access to resources or open access to resources;
- poor monitoring, control and surveillance;
- lack of (co)management and regional collaboration;
- insufficient scientific knowledge;
- strong demand for seafood products and emerging markets;
- great variability in upwelling and changes in water temperature;
- disturbances due to offshore oil exploitation;
- inappropriate management of large river basins.

<sup>1</sup> Source: FAO



**Figure 9.1 Mapping of marine environmental law in West Africa**

Source: IRD/SRFC: *Marine and coastal environmental law in Senegal*

The processing of fishery products is an important segment of the sector, thanks to the added value it creates, the jobs it generates, its contribution to the food at domestic level, as well as its important role in terms of exports. Fishing has always fulfilled an important social function, as it is almost exclusively carried out by women. It is practiced as a small-scale activity, notably in and around MPAs, and as industrial activity, mainly for exports.

However, the role of women in artisanal processing is becoming increasingly fragile for various reasons, including competition with other operators (fishmeal industries on small-scale fishing sites, foreign exporters of fresh and processed products) to get access to raw materials, weaknesses in organising actors in the sector and lack of appropriate funding for artisanal processing activities.



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### 9.2.5 Threat posed by fishing on MPAs

The work of Failler et al. (2019, 2020) shows that in West Africa, where 70% of the population lives close to the coast, meeting nutritional needs in terms of animal protein depends largely on unmanaged fishing which “constitutes the threat that affects the greatest number of MPA” (see Table 9.2): 86% of the managers consider that their MPA is affected by fishing practices that are illegal. Incursions of migrant fishing units into MPAs, or even industrial fishing vessels and nets in “bolongs” (mangrove inlets) and (Binet et al., 2012, in Failler et al, 2020) other channels, seem to be the most common forms of illegal fishing.

Thus, severe-level threats identified by the managers are, in order of importance, unmanaged fishing, overexploitation of land and marine resources, pollution of various kinds, mainly marine and atmospheric, extractive industries and infrastructure.

The main reason for the recurrence of unmanaged fishing among the main threats identified, is the lack of substantial measures taken against illegal fishers. The coastline is subject to the massive influx of fishers some of whom come from very far away (Ghana, Côte d’Ivoire) (Binet et al., 2010, in Failler et al.). Indeed, as fishing is an open-access activity, the massive arrival of national and foreign fishers in the sector has greatly increased the fishing effort and led to the overexploitation of the main demersal and pelagic fishery resources. This can also be seen in the key MPAs habitats in the West African region.

Fishing pressure is exerted by vessel incursions into non-fishing areas of MPAs, using trawls that degrade the seabed and other

Mr. Claude Martin, Director-General of the World Wildlife Fund International, notes that a decline in fish output could seriously affect local food security. “A collapse of fish stocks in West Africa,” he said, “can have more serious human consequences than in Europe or North America,” the destinations for most of the region’s fish exports.

non-selective fishing gear that causes biodiversity erosion. This type of fishing (IUU fishing) also affects juveniles and spawners.

Leurs G. et al (2021) showed that although no industrial fishing was observed within both MPAs, 72 and 78% of the buffer zones surrounding the MPAs were fished for the Banc d’Arguin in Mauritania and Bijagós in Guinea-Bissau, respectively, with potentially significant repercussions on the functioning of the ecosystem due to the elimination of predatory (migratory) species.

It is therefore necessary to identify, characterize and map critical sites (Thiao et al., 2018) within MPAs<sup>2</sup>, especially core areas, and prohibit all fishing activities there, either permanently or seasonally. Within the framework of the MAVA Foundation (Sustainable management of stocks and critical coastal sites for small pelagics), the SRFC and RAMPAO have supported research and conservation institutions in Mauritania, Senegal, Gambia and Guinea-Bissau to carry out studies to identify, characterise and map critical sites within MPAs and outside MPAs (sites that could become MPAs). These results were used to produce a regional atlas of critical sites for small pelagics in collaboration with the SSC (Anonymous, 2021).

<sup>2</sup> “A site of biological or ecological importance (...) of strong socio-economic or cultural interest exposed to threats likely to disrupt its environment and compromise its ecosystem goods and services”.

Table 9.2 Occurrence and degree of severity of anthropogenic threats identified by the managers

MPA	Uncontrolled fishing	Overexploitation of land resources	Pollution	Industry	Agriculture	Hunting	Habitat loss	Infrastructures	Demography	Tourism	Transports
Diawling	Severe	Severe		Mild				Very severe			
Banc d'Arguin	Severe		Mild	Severe				Mild			Mild
Bamboung		Mild			Mild			Mild			
Saint-Louis	Severe		Severe	Severe	Severe						
Sangomar	Severe			Severe			Severe				
Cayar	Severe			Severe							
Kawawana											
Joal-Fadiouth				Severe							Mild
Langue de Barbarie											
Palmarin	Severe		Severe		Severe						
Popenguine		Mild		Mild	Mild						
Îles de la Madeleine	Very severe		Very severe								
Abéné	Severe			Very severe				Severe			
Gandoul		Mild									
Somone								Mild			
Santa Luzia	Severe		Mild								Mild
Boa Vista	Severe		Severe		Severe					Severe	
Bao Bolong	Severe	Severe	Very severe								
Nuimi	Very severe	Mild					Severe				
Tanbi	Severe	Severe	Very severe								
Tanji	Severe	Severe	Very severe								
Rio Cacheu		Mild									
Cantanhez	Severe			Severe	Mild		Severe		Severe		
João Vieira e Poilão	Severe	Severe		Severe		Mild				Severe	
Urok		Mild			Mild						
Tristão	Severe	Severe	Severe	Severe							
Alcatraz	Severe	Severe	Severe	Severe							
Loos	Severe	Severe	Severe	Severe							

Non-existent threats
  Mild threats
  Severe threats
  Very severe threats

Source: Failler et al (2019, 2020). Authors' elaboration.

### 9.3 The role of marine protected areas for fishing

Considered as public policy instruments for sustainable development (Cazalet, 2004), MPAs play an important role in maintaining ecosystems and preserving the world's natural capital, which is under serious threat from human-induced pressure. Initially, the main objective of MPAs was conservation, but over time this has been assigned a socio-economic development objective of the resident populations, in particular fishers, who are often the first to be affected by restrictions on their activities within the MPAs. This conservation-development dilemma continues to fuel debates in the

political sphere and even among scientists, particularly in developing countries. Indeed, MPAs in southern countries are often criticized for not sufficiently integrating, into their management systems, the socio-economic development aspects of the protected areas and the improvement of the living conditions of the populations.

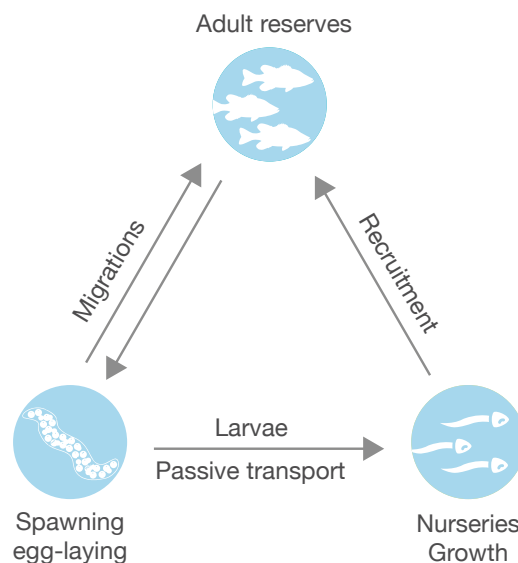
This lack of adaptation is currently giving rise to a kind of resistance and questioning of the appropriateness, or even the usefulness of the protection operation (Weigel et al 2007) and is therefore jeopardizing the legitimacy of this tool and its acceptance by stakeholders, in a context of ever-increasing demand on natural resources to finance the development of the countries concerned. Recent studies (Abdel Hamid, 2018) have highlighted a significant



gap in the perception of MPAs roles at the local level where, in some cases, they are considered by resident communities as a threat more than an opportunity to maintain the sustainability of resources and areas. An example of this problem is illustrated by the increase in human pressure around these MPAs (fishing, urban development, deforestation, oil and mining). If the role of MPAs on the eco-biological level seems to be the subject of a consensus, their role in socio-economic development remains subject to many controversies.

In the general context of depleted fisheries resources depletion, MPAs are considered a promising tool for fisheries management, and many scientists, politicians or NGO activists are calling for the protection of 20-30% of the oceans' surface.

Indeed, although there are disparities between species, most fishery resources have a life cycle marked by distinct phases during which life stages take advantage of different habitats (HARDEN-JONES, 1968: these resources are born on spawning grounds; eggs and larvae are then transported within bodies of water to nursery areas where the juvenile phase of strong growth takes place. When they reach maturity, the adults migrate, usually seasonally, to their spawning grounds to lay their eggs. Although this general pattern is not systematic, particularly for sedentary species, it does apply to a large proportion of the marine resources exploited.



**Figure 9.2 Life cycle of living marine resources**  
 Source: Marie BONNIN, Raymond LAË and Mohamed BEHNASSI, 2015



© katielt2 - stock.adobe.com, humpback dolphin



© Hellio & Van Ingen, Bijagós, Guinée-Bissau

## 9.4 Effects of MPAs on fisheries resources in some West African marine protected areas

### 9.4.1 Case study of the Banc d'Arguin National Park (PNBA, Mauritania)

Bonnin et al, 2015 carried out a study of the biological effectiveness of MPAs for fisheries in West Africa, through analyses of Catch Per Unit Effort (CPUE) within the PNBA and outside the MPA. They demonstrated that the specific diversity in the PNBA zone is significantly higher (92 species) than that of the adjacent zones (10 km zone: 68 species, 20 km zone: 50 species, 30 km and more: 44 species). Regarding the settlement level, the average value of abundance in the reserve area (PNBA) is much higher than the values recorded outside in the sectors exploited by artisanal and industrial fisheries, values which decrease over time as one moves away from the PNBA. The difference in these values is significant between this PNBA zone and the outer zones (DTK test: Dunnett-Tukey-Kramer Pairwise Multiple Comparison Test). This is also the case for the average biomass value, with the exception however of the 20 km zone, for which the average biomass appears to be higher than that of the 10 km zone. The biomass average test shows that there is no significant difference between the PNBA zone, the 10 km zone and the 20 km zone, but the difference is significant with the 30 km and 40-50 km zones.

As far as commercial fisheries are concerned, catches inside the PNBA are always higher than those outside and all the tests are statistically significant. On the other hand, even though the averages often decrease when one moves away from the boundaries of the

MPA, there is no significant difference between the outer zones, except for the 10 km and 30 km zones.

In addition, Guenette, Meissa and Guacual, 2014 demonstrated through food web modelling (Ecopath and Ecosim) that the Banc d'Arguin contributes about 9-13% to the total consumption of Mauritanian fishery resources, supports about 23% of total production and 18% of total catches of the Mauritanian plateau ecosystem, and up to 50% for coastal fish. Of the 29 groups operated, 15 depend on the PNBA for more than 30% of their direct or indirect consumption. This study also reports that between 1991 and 2006, fishing pressure increased, leading to a decrease in biomass and catches of high trophic levels. The study showed that the addition of a new fleet in the Banc d'Arguin would have significant impacts on species with a high dependence on PNBA for their food, thus leading to a 23% decrease in current catches outside of the MPA, particularly artisanal and coastal fishing.

In this same context, a recent study (Trégarot et al, 2020) shows that most of the 32 groups depend on the Banc d'Arguin for their consumption, and consequently for their production. In particular, 15 groups depend on this MPA for more than 30% of their total production (and more than 45% for eight groups), thus highlighting the role of the PNBA for many exploited species. We observed the highest levels of dependency for seabirds (73%), bonga shads (72%) and mullets (70%). In general, reliance on the PNBA is mainly due to the direct consumption of invertebrates living in the Banc d'Arguin, particularly in the case of coastal groups, including juveniles. The study also reports that on average, 16% of the total consumption of marine species comes directly or indirectly from the Banc. The PNBA's original consumption is the basis for 21% of the total production, including the primary producers (this high value



© Julien Tack, Mauritania

being due to the vast extent of algae and seagrass beds from the Banc d'Arguin). For groups of coastal fish (including mullet and meagre), the overall consumption and production of the PNBA is higher than 40%.

#### 9.4.2 Case study of the Tristão Islands (Guinea)

Scientific research related to the effect of creating MPAs is weak, due to a lack of means to conduct such studies. However, riverside populations of the bolongs surrounding the ¾ of the Islands' perimeter, where all kinds of commercial artisanal fishing nets are prohibited, are beginning to report greater abundances and sizes of fish, but this must be confirmed by scientific and independent observations. (Dombouya et al., 2014).

#### 9.4.3 Case study of the Bolong de Bamboung (Senegal)

The results of 10 years of monitoring in the Bolong de Bamboung (Ecoutin ed., 2013) show that the reference settlement of the bolong has evolved rapidly, from two to three years, from a typical stand of bolong to a more "marine" population, made up of:

1. Species with a stronger marine affinity (the contribution of estuarine marine species becomes dominant);
2. Predatory species with a high trophic level, generalist predators or piscivores;

3. Large individuals, while maintaining a very strong presence of small individuals, most often juveniles.

Prohibition therefore leads to a transformation of the settlement structure. The MPA becomes a place of predation for species with marine affinity, which concerns small and medium-sized individuals with, as a consequence, the reduction in the importance of certain classes (mainly 15-25 cm). This has led to the virtual disappearance of certain species present mainly in this size range (Case of Mugilidae).

The work shows that the MPA has therefore had an unexpected impact: *"an estuary, particularly a tropical one, is recognized as an important nursery area for coastal stocks; it is home to many species at larval or juvenile stages, whether obligatory or optional. The creation of the MPA has complicated this situation by opening up the MPA to adults, who are usually less frequent users of estuaries"*.

This work also confirms the "spill over" effect: the MPA is said to export around 10-15% of its biomass and the "spill over" effect in terms of the export of marketable fish likely to be caught is 16 tonnes per year (F. Henry pers. com.). The future of this export is not well identified: enrichment of proximal areas or migration to more distant locations. The confirmed increase in species richness (40 additional species in 8 years) is largely the result of the increased sampling effort over the period.

In short, studies<sup>3,4</sup> on the impact of MPAs on fishing activities show that these external impacts are variable:

- Species richness is not correlated to the distance from the MPA boundary;
- Abundance is correlated with this distance: it is greater near the MPA in the hot dry season (June) and greater far from the MPA in the cold dry season (April);
- The biomass tends to decrease and the average and maximum sizes to decrease according to the distance from the MPA boundary.

The findings support the fact that “*the MPA not only plays a protective and nurturing role, but also attracts certain species and supplies the surrounding areas with large individuals with a ‘spillover’ effect over a distance of 4 km. So closing the Bolong de Bamboung would have a positive impact on small-scale fishing activities, etc.*”. But no socio-economic study has yet been carried out to corroborate this conclusion.

Given the concentration of fishing activities near the boundary of the MPA, the recommendations concern the implementation of a management around the MPA and the closure of other bolongs in the Sine-Saloum as recommended by some artisanal fishers. However, the opinion of artisanal fishers on the closure of the Bolong de Bamboung is mixed. Surveys show that while the benefits are understood by many, the closure is nevertheless perceived negatively by a majority of them (with a greater sensitivity to the closure of the bolong than to its potential benefits). During the final evaluation of the Narou Heuleuk project, “*5% of fishers surveyed in the area were against the MPA, despite the fact that 52% recognised that catches in the vicinity of the MPA were better*”. Today, resource monitoring campaigns are carried out by the DAMCP<sup>5</sup>, but the results still need to be better shared with stakeholders and applied in practical terms in terms of management measures.

In Senegal, again, the Department of Community marine protected areas has reported at **Kayar**: a biological increase in certain species such as sea bream (*Spondylisoma cantharus*), red mullet (*Pseudupeneus prayensis*), and thiof (*Epinephelus aeneus*).

Case study of **Urok (Guinea-Bissau)**, perception surveys show an increase in the biomass and specific richness of the fish community, with a perception of better fishing catches, an increase in the number and/or size of certain strategic resources (such as large predators) and the growing presence of certain species that fishers already considered to be extinct or very rare, notably manatees (the population of manatees in Guinea-Bissau is said to be one of the largest in West Africa), sharks, turtles, guitarfishes, sawfish, dolphins and birds. These conclusions are based on user perception; there are no scientific studies that confirm or invalidate them.

**Impacts on molluscs:** Monitoring conducted as part of the BioCos<sup>6</sup> Project were not long enough to obtain reliable data on impacts. However, for the Bamboung MPA, preliminary data indicate a significant effect on the abundance of Cymbium and less for Senilia. The impact is also positive for oysters, with relatively similar densities inside and outside the MPA, but with larger species on average in the MPA. Closing the MPA to exploitation would therefore have positive effects on the abundance of gastropods and on the sizes of Senilia and oysters. In Urok, women underlined an increase in the abundance of molluscs, while the knifefish, which had become scarce, seemed to be abundant again.

## 9.5 The role of MPAs for the socio-economic development of resident populations

Today, MPAs are no longer a simple ecological issue: they are considered as coherent territorial spheres likely to participate to varying degrees in the development of populations living inside the protected area, nearby and beyond. Improving the living conditions of residents and maintaining their activities is inseparable from guaranteeing sustainable marine and coastal resources.

Indeed, over time, with the experience of practice, thanks to the involvement of new actors, particularly from the civil society, and under the impetus of the Rio Summit in 1992 and its recommendations on sustainable development, the objectives of MPAs have been broadened to increasingly take development issues into account. As a result, they should consider the resident populations as integral parts of the ecosystem, and seek a balance between the imperatives of conservation, maintaining and improving lifestyles, and the legitimate aspirations of the populations for harmonious human development.

In West Africa, development is almost generally perceived by MPAs managers as complementary, rather than equal, to the protection and management of resources, as the initiative to create an MPA is always based on a conservation goal. The only exception in West Africa concerns the Urok Islands in Guinea-Bissau, where development actions preceded conservation interventions, because the process there was, above all, a community development process which, little by little, took into account conservation issues and therefore the idea of creating an MPA, which undoubtedly reinforced the legitimacy of the process and made it possible to establish it on solid foundations.

If, after more than four decades, MPAs in West Africa have succeeded, in most cases, in preserving the integrity of natural capital, despite the strong pressures they are subject to both inside and outside the reserves, their contributions in terms of socio-economic development seem mixed. Indeed, development actions have most often been initiated and directed by international organizations and NGOs,

3 Hamet Diaw DIADHIOU, Jean Marc ECOUTIN, Younoussé SENE, Impacts of the Bamboung Marine Protected Area on artisanal fishing activities. CEPIA project results reporting workshop

4 Younoussé Ibn Boubacar SENE, 2013 Impact of the Bamboung marine protected area on artisanal fishing activities, Master II-degree thesis in Animal Biology, University of Dakar

5 Directory of Community marine protected areas.

6 BioCos Project: “Management of West African marine and coastal biodiversity by strengthening conservation and monitoring initiatives in MPAs” (see RAMPAO website).

with little populations participation and even of the national public authorities, which has limited their effectiveness. Admittedly, the various projects interventions have enabled an improvement in revenue from fishing in the MPAs, but the absence of management mechanisms capable of ensuring the domiciliation of the wealth created for the benefit of the resident populations means that the rent extracted is mainly captured by actors outside the MPA and therefore the impacts of these interventions on poverty reduction have remained insignificant. Similarly, the experience of developing ecotourism has not been conclusive in most MPAs. Furthermore, the lack of coherence of development projects and their poor integration into national economic policies have resulted in a certain marginalization of these territories, which have most often remained disconnected from development processes and programmes at the national level. As evidenced by the low human development indicators of MPAs compared to other areas of the country (basic socio-economic infrastructure, poverty rate, decent housing, schooling rate, health coverage rate, etc.) and as illustrated by the case of the PNBA (Box 9.1).

Experience shows that it is very difficult for MPAs to converge, and if necessary reconcile conservation, development and sustainable use objectives if this convergence is not achieved from the creation process, and through it, but this is not the case for most MPAs in West Africa.

Moreover, some MPAs in the sub-region are based on misunderstandings that weaken and threaten them. In fact, too often, the concerns of development and sustainable use of resources are only secondary, insofar as they are only mentioned to convince the populations and other actors of the usefulness of the MPA,

### **Box 9.1 Significant efforts need to be made in the area of improving the living conditions of resident populations in MPAs: case of PNBA-Mauritania**

According to Abdel Hamid (2018), the level of local development of the PNBA remained among the lowest in the country. The dwellings used in the park are mainly wooden tikits (huts) (55%). The number of rooms per household is between 2 and 3, which is very low considering the large size of families (6 people on average per household). Only 91 households out of 231 have toilets, an average of 15 people per toilet (Abdel Hamid, 2018). In terms of education, the CERTIF survey (2010) reports the lowest enrollment rate nationally (81.64%). The other infrastructures present in the park are limited to a few administrative buildings belonging mainly to the PNBA administration. Road infrastructure is almost non-existent, which makes access to the villages inside the park very difficult and requires the use of a 4x4 car and a driver who knows the road perfectly.

Access to drinking water is a permanent concern for residents of Imraguen villages in the absence of supply networks in almost all villages. In addition to the problem of access to drinking water, there is also the difficulty of access to electricity and health. Of the 8 villages in the park, only Mamghar has a power plant inaugurated in 2014 at the same time as an ice factory, the only one existing in the entire park. Regarding health, most villages do not have health coverage and people seek treatment in hospitals in Nouakchott and Nouadhibou.



or to help reduce tensions and resolve conflicts (Yves Renard and Oussouby Touré 2012). However, this dichotomy between conservation and development seems to be increasingly diminishing, for the well-being of all. But this dynamics of convergence is recent and it is not yet fully taken into account by MPAs managers, largely because several organisations that take the initiative to launch such processes are conservation organisations with skills in the field of natural resource management, but little expertise and experience in development actions.

The convergence between conservation and use concerns is of course mainly found at the fisheries level. One of the strengths and originalities of MPAs in West Africa is linked to an increasingly clearly affirmed political will to take into account the role of these protected areas in the management of fishery resources. This makes it possible to place MPAs at the heart of poverty reduction concerns. Moreover, this convergence makes it possible to mobilize the State, because the fishing sector presents major social challenges, and it is also, for some countries, a source of public revenue through fishing agreements.

## 9.6 Fisheries management and co-management arrangements in MPAs

Traditional fisheries management systems failing to limit the effects of overfishing, two new approaches seemed to be promising and complementary: the ecosystem approach and co-management. The latter is based on the principle of governance based on the sharing of responsibilities between public actors, the private sector and user communities. This principle aims to improve the quality of information and its exchange, to better assess the various development options and to facilitate decision-making.

### 9.6.1 Fisheries co-management of MPAs in West Africa

The idea of measures to ensure the conservation of marine resources goes back a long way, but the first concrete rules date from the establishment of a minimum mesh size to “manage” fish fisheries. Most regulations proceed from the principle that the marine resource is a collective good. As a result, its management is the responsibility of a central government acting for the common good of the citizens, supposed to define the objectives assigned to the fishing activity. Faced with the increasing degradation of many exploited stocks, this notion of common property is the subject of debate: fishery resources, like forestry and mining resources, are part of the public heritage, it is up to the State to manage them as well as possible for the public good, by ensuring a relevant allocation of access rights to fisheries resources, from territorial rights (TURF: Territorial Use Rights in Fisheries) to quotas by fishery on the basis of an overall TAC (Total Allowable Catch) by species (F. Henry com . people).

The principles of fisheries co-management have sometimes existed for a very long time before the creation of MPAs (example of French Mediterranean fishing known as “prud’homies” which have existed for centuries — F. Henry, pers. com.).<sup>7</sup>

Today, there are many definitions of the term “co-management of natural resources”. The notion first expressed ways of managing resources that differ according to political and socio-cultural contexts. It aims at various and varied objectives, ranging from the sharing of interests and responsibilities to the privatization of natural resources, through a more equitable distribution of the benefits resulting from the exploitation of resources or even greater collaboration between administration, professionals and scientists. In short, co-management is “the coordinated management of a common resource between the different users with a negotiated definition of the objectives and means of management between the central bodies, the local bodies and the actors”<sup>8</sup>. It thus implies the intervention of several players with often divergent, if not contradictory, interests with a view to optimizing the exploitation of the resource. Perception clarification initiatives began in the 1990s.

Co-management should include, in principle, all those who hold a formal (fishing, aquaculture) or implicit (coastal tourism, commercial and recreational navigation, etc.) user right and the decision-making bodies (governmental or supra-governmental bodies, etc.) to whom is devolved, to varying degrees, responsibility for the use of maritime space (conservation of fish stocks, management and allocation of quotas, monitoring, control and surveillance of fisheries, environment, navigable waterways, rescue, national defence, etc.). This stems from the will for concerted management that includes professionals in the decision-making process with the objective of achieving a viable economic balance and the fairest possible distribution of the benefits resulting from the exploitation of resources. In other words, it is in the search for economic and social gains that a co-management system must be seen.

It is the beginning of a recourse to the establishment of marine protected areas (MPAs) with community management as a privileged instrument with political decision-makers, civil society and environmental NGOs, which means the ability to integrate the exploitation of the local resource within a broader conservation framework involving collaboration between co-managed sectors, such as the Banc d’Arguin in Mauritania, Kawawana in Senegal, Urok in Guinea-Bissau and the Tristão Islands in Guinea. National legislation thus requires that access to fishery resources be granted only to persons who will in return assume a greater share of the responsibilities and costs in terms of fisheries management, even if in places the transfer of part of the management powers between the government and certain groups of people or certain economic sectors, such as the mining sector in Guinea, still raises debate.

7 Elisabeth Tempier: "Collective management of usage rights by the Mediterranean Prud'homies of fishing bosses, a model for the future" 2018.

8 Co-management: What future for our fisheries? Proceedings of the study days in socio-economics of fisheries, University of Quebec at Rimouski - McGill University, Montreal, 1996, Edited by Pierre Failler and Adeline Borot de Battisti, 289pp

## Case study of the fishing reserves and protected fishing areas in Senegal

The measures envisaged by the populations relate to the establishment in the territorial waters of each village of Protected Fishing Zones (PFZ). These encompass the entire shoreline of each village over a width of 2 to 3 km for reasons of surveillance capabilities. The delimitations are not often materialized by beacons but are recognized by all and transmitted in the collective memory. These areas materialize the space that the population manages in partnership with the fisheries administration. The development plan divides the PFZ into restricted exploitation zones (REZ), prohibited fishing zones (PFZ) and artificial reef immersion zones (ARIZ).

The objective of a PFZ is to improve governance to reconcile conservation and exploitation (fishing) while improving the living conditions of communities. A PFZ is an area where fishing is prohibited or where access is limited or regulated, adopted by village communities in accordance with the Code of Maritime Fisheries within the framework of a co-management system, and subject to co-management agreements with the competent State services.

**Legal status of PFZs and ARIZs:** PFZs and ARIZs do not have the legal status of MPAs, within the meaning of national legislation, and are not under the administrative supervision of the DAMCP. However, they have similar functions to MPAs, in terms of the goals of protecting marine natural resources and the participatory establishment of systems for the protection and sustainable management of marine and coastal resources.

**Management rules:** Management committees such as the Local Artisanal Fisheries Councils (CLPA) are set up in each area to propose protective measures for the development and management of artisanal fisheries, exploited resources and their habitats: closure, limitation of net meshes, fishing quotas, etc.

**Surveillance:** In the case of Senegal, participatory surveillance operates in the context of co-management of fishing activities, particularly in MPAs and other protected areas. Local committees have been established which involve all community stakeholders. Fishing canoes are made available to work in cooperation with coastal surveillance.

**Effectiveness:** PFZs constitute an effective management tool for the restoration of fishery resources and habitats, which must consider both socio-cultural and bio-ecological aspects.

### Artificial reefs to restore fisheries resources: case study of the St Louis MPA

As part of the social investment plan of the KOSMOS Energy oil company, in line with the objective of the creation of the MPA Saint-Louis which is to “restore marine and coastal habitats” and the strong demand from the communities of fishers, 410 artificial reefs were submerged in the Marine Protected Area of Saint-Louis in December 2017 by the NGO LEPARTENARIAT in collaboration with the MPA. The goal of this immersion was to contribute to the restoration of the ecosystem and to increase the productivity of the environment.

## The co-management approach in the MPA Tristão Islands

Co-management of a space or resource is a slow process that requires the support of all stakeholders. Co-management in an MPA is therefore not decreed at a certain moment of its creation. It is conceived from the beginning, from the moment when sites are established as MPAs, sites in which communities who lived have often been able to conserve these key habitats and make them biodiversity conservation areas. This is why from its creation, the MPA Tristão Islands was designed as a Managed Community Nature Reserve. This means that the resident communities were involved in all phases of the process, from studies to improve knowledge of the site to the identification of management units and the zoning of the MPA finally defined in the MPA Development and Management Plan. Community participation in the governance of MPAs must begin from the definition of management and development rules to the application of area control and surveillance measures.

The management and decision-making bodies were established from the lowest level (sector or village) to the highest (Management Committee) resulting from the General Assembly. All the stakeholders representing the different socio-professional activities are represented there, in order to always reach a consensus in negotiations to share benefits and responsibilities. This is one of the criteria used to involve resident communities to all proposals for sustainable development initiatives, associated with the co-management process, in order to guarantee the sustainability of the process, commitment, but also the level of understanding of issues related to the sustainability of the MPA.

## A fishing Task Force to support managers

In order to support managers in the management of fisheries within their MPA, an MPA-Fisheries task force was set up as part of the CSR/CEPIA project. This task force, which is made up of a pool of multi-disciplinary experts in the fisheries sector, responds to requests from MPA members of RAMP AO to support MPA managers and fisheries stakeholders on practical issues such as monitoring fisheries resources, fisheries monitoring, improving inter-sectoral dialogue, governance and management systems between MPAs and fisheries. This support, which has been provided in several MPAs (Bamboung, Urok, Tristão Islands, etc.), was highly appreciated and the task force has just been relaunched by RAMP AO.

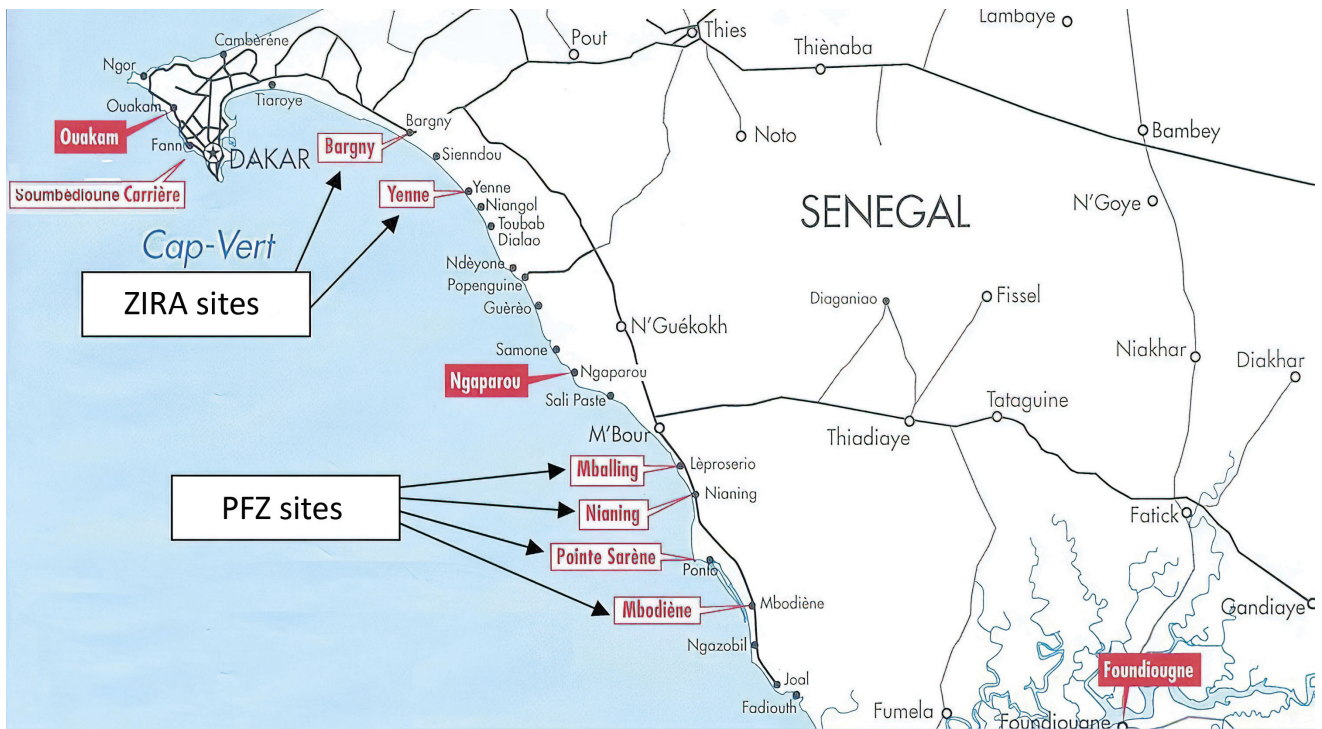


Figure 9.3 PFZ location Source: État des lieux de la gestion des Pêches au Sénégal, JICA 2016

The reefs were built in the form of Canaries<sup>9</sup> with openings on the sides. This activity was also carried out in the MPAs of Joal-Fadiouth and Abéné).

To measure the impact of these artificial reefs located at sea, the dynamics of marine species has been monitored since 2015 thanks to the implementation of a participatory protocol with local actors, the UGB (University Gaston Berger of Saint-Louis) and the Fisheries Department. After four years of monitoring through experimental fishing campaigns, 117 fish species represented by 88 fishes, 9 crustaceans and 20 molluscs have been identified there. The overall analysis of the results of bioecological monitoring in Senegal’s MPA network showed that the Saint-Louis MPA ensures the conservation of 11.18% of the fish species identified in Senegalese waters.

The specific composition of the MPA’s fishery resources has evolved positively and the number of identified species has increased from 83 in 2015 to 117 species in 2019. This situation can be partly explained by the immersion programmes of artificial reefs (shipwrecks, 200 kg stone blocks, canaries, etc.) initiated at the end of the 2000s. These settlements are essentially dominated by the small captain (*Galeoides decadactylus*, “Sikket mbao”) and the beltfish (*Trichiurus lepturus*, “Talar”), the captain (*Pentanemis quinquarius*, “Ndiao ndiao”), the African catfish (*Arius heudiloti* “kong”). The MPA is also a conservation site for rare and threatened species on the IUCN Red List (Table 9.3).

Table 9.3 IUCN Red List of Species

Nom	Status
<b>Pseudotolithus senegallus</b>	« feut », Vulnerable
<b>Fontitrygon margarita</b>	« Ragntian », Endangered
<b>Pseudupenaeus prayensis</b>	« Ngor sikkim », Vulnerable
<b>Pseudolithus senegalensis</b>	Endangered

Source: Sidibé, A (2010)

9 The Canary is a large vase or container like those used in Africa to store drinking water. But in the context of this project, it was used as an artificial reef, with openings at the sides to allow fish to enter and exit without problems. After observing that the underwater habitats of the fish are degraded or do not exist, the immersion of objects (wrecks of boats, 200 kg stone blocks, canaries, etc.) which allow the fish to stay in the area, to reproduce in peace, before leaving to continue their migration.





© Cyril Laffargue, royal tern, Tristão, Guinea

### **Case study of the MPA (MCNR<sup>10</sup>) of the Tristão Islands in the Republic of Guinea, and the exploitation of fishery products as a vector of conservation**

The MPA Tristão Islands is located in the northern zone of the Guinean EEZ, on the border with Guinea-Bissau. It is also the area with the most fish in the maritime waters, where several artisanal fishing ports are located, the largest of which is the Katcheck fishing Camp, inside the MPA (249 fishing boats in 2018; 13,432 tonnes of total catches including 6,044 tonnes of small pelagics and 7,388 tonnes of demersals in 2020). The even larger fishing port of Kamsar is located in the immediate periphery of the MPA Tristão Islands (319 fishing boats in 2018: 17,208 tonnes of total catches including 7,744 tonnes of small pelagics and 9,464 tonnes of demersals in 2020).

The Katcheck camp is representative of what is found in other MPAs in West Africa: significant migratory processes, an anarchic occupation of the territory despite a social organization in structuring, conflicts of resources use between migrants, but also and above all between migrants and residents, counterbalanced by a contribution of the camp to the economic and social dynamics of the Tristão Islands (fundamental role in trade with neighbouring countries: Guinea-Bissau, Senegal, Sierra Leone).

The MPA Tristão Islands is now home to one of the largest artisanal fishing ports in Guinea. Other fish landing points are scattered all around this MPA. Since fish processing is ensured there mainly thanks to mangrove wood from the surrounding areas, there is a very strong dependence of the exploitation of halieutic resources vis-à-vis the outside world. Overall, the success of the creation of the MPA Tristão Islands and its development depends on the integration of exploitation logics (capture and transformation) and trade of fishery resources in the process of its management. It is therefore necessary to find a balance in the integration of the dynamics of exploitation, transformation and trade of halieutic resources in the management processes of the MPA, whereas they are, at first sight, hardly compatible with the objectives of conservation. Integrating this experience into the management process is not easy. This is why the consideration of monitoring indicators for the implementation of the MPA management plan and the cartographic support of human activities linked to the exploitation of fishery resources constitute a major vector for the conservation of all the natural resources of the MPA and the neighbouring mangrove areas.

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10 Managed Community Nature Reserve



**Figure 9.4 MPA Tristão Map** Source: [panda.maps.arcgis.com](http://panda.maps.arcgis.com)



© Cyril Laffargue, *carrion culture*, Tristão, Guinea

## Maritime surveillance issue of RAMP AO MPAs

*Pierre Campredon*

MPAs today appear like oases in the middle of impoverished seas. The difference in resources between the inside and outside of MPAs inevitably attracts the desire of fishermen. In this context, MPAs find themselves faced with the problem of monitoring their maritime territory, which is complex for several reasons:

- boundary marking: physical marking is prohibitively expensive. Where it was attempted, the buoys quickly disappeared following the discontent of the fishermen. The boundaries, when defined in relation to the isobaths, are sinuous and therefore more difficult to locate with a GPS than if they were straight lines, if artisanal fishermen have this equipment at all;
- there are infinite “entry points” all around an MPA, compared with terrestrial PAs where access routes are limited, hence making it difficult to predict where an illegal fisher will enter; \_
- night-time surveillance in the marine environment poses specific problems, especially when patrol boats are not equipped with GPS plotters or radars;
- patrols have to face dangers, as illegal fishers are sometimes armed. Park rangers do not always have the full legitimacy to impose sanctions or to possess a weapon;
- fisheries surveillance, in general, is likely to foster corruption, especially when the people in charge of surveillance have modest salaries. The existence of mobile phones also makes it possible to inform fishermen when surveillance patrols are out;
- maritime surveillance is costly in terms of investment (boats) and operation (crew, fuel).

The equation is therefore complex to solve. Among the solutions to be recommended, we can mention the following:

- informing fishers about the existence of MPAs and the associated access rules. On this subject, let us cite the example of Bissau-Guinea in artisanal fishing licenses on the back of which the existence of MPAs is indicated. Ideally, licenses should be accompanied by a detailed map of each MPA. Better signage at ports and landing sites will help to inform fishermen;
- a better understanding of periods and sites sensitive to illegal fishing helps to target surveillance operations, particularly at night;

- surveillance missions should be organised as randomly as possible, in time and space, with destination decisions taken at the last minute to increase their dissuasive nature;
- dissuasive sanctions and in particular an amount of fines which must significantly exceed the value of the catches;
- participatory surveillance which involves community representatives within patrols alongside park rangers and other police authorities, with an interest in revenues from offenses; This participatory surveillance extends to all resident populations who, by their simple presence, contribute to monitor their territory and can denounce or report any possible illegal acts. Synergies are also possible with traditional management systems still in force such as signage of sacred sites;
- the establishment of certain rules which make it possible to automatically identify the presence of illegal fishermen such as the exclusivity granted to sailboats in the Banc d’Arguin National Park or the ‘ban on motors in sensitive areas of MPAs;
- identification of zoning limits based on physical landmarks such as islands or the layout of channels;
- the use of Cat-track type GPS devices on board the surveillance boats, which record their route and the points of contact with the fishermen’s canoes. This highly cost-effective system makes it possible to ascertain whether or not they are in an illegal situation; to document the progress of surveillance missions; to draw up statistics on routes, sensitive points, changes in the effectiveness of surveillance, distances travelled, the timing of operations, etc., all of which can be used to guide surveillance strategies;
- the use of more recent technologies such as drones which, however, require organisation and skills that are more difficult to obtain<sup>1</sup>.

However, all these solutions are only truly effective under certain conditions: strong involvement of the State in the desire to enforce the rules and apply sanctions in a transparent manner; community participation in the governance of MPAs from the definition of rules to the application of sanctions; funding that meets the challenges and which depends as little as possible on random projects and the ongoing training of those involved in surveillance.

As we can see, these conditions are not always met within the MPAs RAMP AO and justify the need for collective reflection with a view to updating maritime surveillance strategies that are both innovative (in terms of approach, technology) and proactive.

<sup>1</sup> In Senegal, the GAAL project is implementing, from 2022, low-cost beacons on board artisanal boats whose first goal is safety at sea, and the second is the geolocation of areas prohibited for fishing (and therefore in particular the georeferencing of the limits of MPAs) with an audible warning signal (F. Henry pers. com.).

## 9.7 Performance limits of marine protected areas

According to Garcia et al. (2013), several authors, including Mora and Sale (2011) show that despite a significant and sustained increase in protected areas globally, terrestrial and marine biodiversity have significantly declined since the 1970s on land and since the 1990s in the oceans. These authors highlight the contrast between the many enthusiastic studies showing the benefits of MPAs and the many studies showing that these effects are not universal. According to these authors and World Bank meta-analyses, many systematic reviews indicate that failure in MPAs is more the rule than the exception. A situation that, according to Gracia et al. (2013), is reminiscent of fisheries. The impact on people and their lifestyles is even less systematically studied and activities that are curtailed or excluded are hardly replaced or compensated for. When the socio-economic impact is negative, it tends to cancel out any positive results on the resource. The realization of positive impacts is strongly conditioned by factors external to the MPA, such as the political and economic framework, demographics, surrounding activities, the type of culture of users, etc. Under these conditions, even if the possibility for an MPA to generate a positive effect is relatively well established, there is never a guarantee that the conditions for such an effect are met (Botsford, 2010) or that the positive effects sufficiently compensate for the negative effects that exist, even if they have been little studied.

However, according to several authors, negative effects, such as increased fishing pressure in areas that remain open, occur quite quickly after MPA designation, well before the positive effects. Moreover, the setting aside of a marine ecosystem can have completely different effects depending on the species (Francour, 1993; Holland, 2000; Ferraris et al., 2003; Kulbicki et al., 2006) or the environments considered (Francour, 1993) and several authors cited by Gracia et al., (2013) publish results contradictory to these theoretical effects (Hatcher et al., 1989; Polunin, 1990; Roberts and Poulin, 1992).

While acknowledging the progress that has been made, Garcia et al. (2013) suggest that MPAs, important as emergency and functional measures, if well managed, are not able, on their own, to halt biodiversity degradation. New complementary approaches are needed, specifically addressing the known causes of this degradation: overpopulation and excessive consumption of resources. The authors highlight the lack of MPAs performance evaluation over the past decades, as well as the known limitations of the MPAs strategy: (i) slow growth of MPAs coverage; (ii) inadequate size and connectivity of MPAs; (iii) effectiveness of MPAs limited to certain anthropogenic threats; (iv) insufficient funding; (v) conflict with development needs.



© Cyril Laffargue, lesser flamingo, Mauritania



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### 9.7.1 Migration of fishers and its consequences in the sub-region

Whereas for a long time fishers migrated in order to follow the movements of migratory species (mainly small pelagics) or to capture species which were found in abundance at a given time and place (during the spawning period, for example), today, it is the scarcity of resources in traditional fishing areas that pushes small-scale fishers to go further, in order to exploit new stocks.

These migrations are favoured by the motorization of canoes, the use of isothermal boxes and the loading of ice for the conservation of fish (Binet et al., 2013 in Failler 2020), but also by the existence of fishing areas that are still little exploited, such as the Bijagos archipelago in Guinea-Bissau, the Tristão and Alcatraz Islands in Guinea, or by the weak capacity for surveillance and maritime control of artisanal fishing boats and the very high selling prices practiced by the export markets.

The seasonal and episodic nature of migrations has been replaced by a continuous presence in the fishing areas, transforming the temporary camps into real places to live. Thus, over the past two decades, migratory phenomena have increased, both spatially, temporally and numerically. A new form of migration, with Senegalese fishers as the main actors, is developing. Fishing resulting from migration contributes today up to 60% of the volume of fish exported by Senegal to the countries of the European Union (fish of high commercial value for the most part). “ Over the period 2006-2010, catches by West African migrant fishers amounted to around 300,000 tonnes annually, representing nearly 20% of the total of 1.6 million tonnes of fish caught in the EEZs of the 7 member countries of the Sub-Regional Fisheries Commission (SRFC) (Failler et al., 2020).

Given the scarcity of resources, fishing pressure is increasingly applied around and in protected areas. Whether in biosphere reserves such as the Bijagos Islands archipelago in Guinea-Bissau, the Banc d’Arguin Park in Mauritania or even in marine protected areas such as the Tristão and Alcatraz Islands in Guinea, the fishing activities of migrants are in total disagreement with the protective spirit of the marine environment. They cause important ecological, economic and social damage, and the intensity of conflicts between local and foreign fishers remains very high (see Box 9.2).

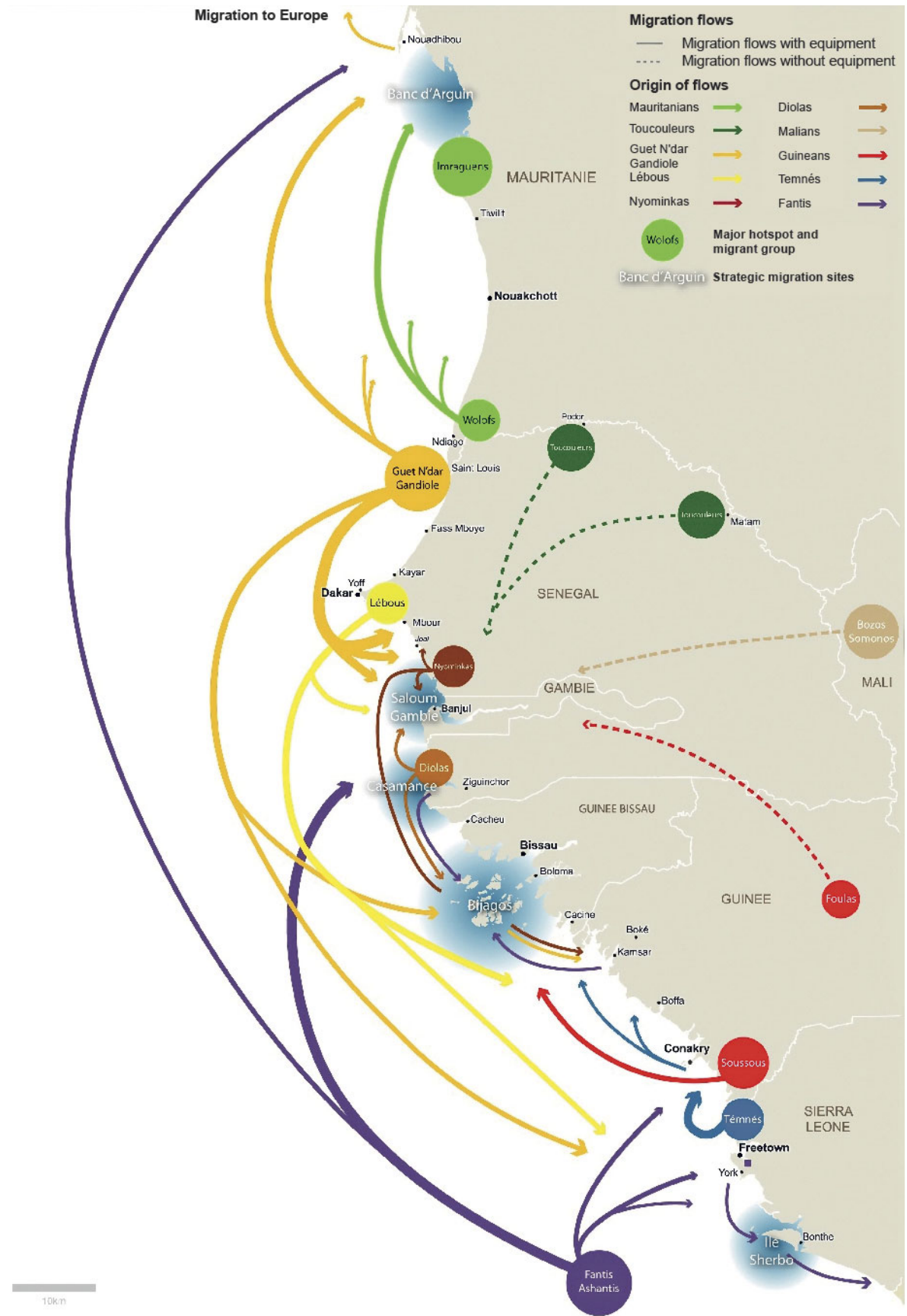


Figure 9.5 Migratory fishing on the West African coast in 2008 Source: Failler et al, 2020

## Box 9.2 Competitions and conflicts for access to space and fisheries resources in West African marine protected areas

*Alkaly Doumbouya*

The lack of commitment from the Government to market fisheries resources has significantly contributed to the tremendous dynamism of the fishing sector in West Africa, notably the multiplicity of small-scale and industrial fishing fleets, diversity of means and strategies implemented to access space and resources, the construction of fish processing facilities, creation of an extensive network for fishmongers, etc.

Origins of conflicts: Given the configurations of the West African continental shelves and the spatio-temporal distribution of fishery resources, small-scale and industrial fisheries share many fishing grounds<sup>1</sup>. Developments observed in maritime fisheries and the multi-specific nature of the exploitation of marine resources necessarily give rise to competition and competitiveness between the two types of fishing. In Guinea for example, spatial interactions between small-scale and industrial fishing result, on the one hand, from the extension of partly illegal activities of industrial fishing to take advantage of the high yields at the coast and, on the other hand, the extensive activities of small-scale fishing offshore, facilitated by the motorization of fishing boats.

The spatial distribution of observed conflicts thus indicates that skirmishes occur almost all along the Guinean coast but more frequently in the northern zone of the EEZ, from Cap Verga point to the border line, with Guinea-Bissau passing through the mouth of the Rio Compony and the area of Alcatraz Island. Incursions of industrial fishing in prohibited coastal zones, IUU fishing activities, infiltrations of artisanal fishers in the central areas of the MPA of the Tristão Islands, including coastal nurseries are thus manifest.

Competition between these two fisheries for access to the resource is addressed by analysing the specific composition of landings, either simple direct competition when the sizes of the target species are identical, or sequential competition if the sizes of the species are different. Harvesting by fisheries operating upstream (on small sizes) directly affect the abundance of size classes available downstream. Spatial interactions are more frequent between trawlers and small-scale longline and gillnet fishers in artisanal fishing, while demersal trawlers in IUU fishing are increasingly deployed closer to the coasts. There is also the approach of analysing catch volumes by landing zone or analysing by-catches, when a species caught incidentally by one of the competing fisheries may be the target species for the other fishery.

These competitions result in the loss and destruction of artisanal fishing gear (95% of conflicts), artisanal boats and drowning of crews. However, there is also a significant proportion of conflicts between passive small-scale fishing gear (lines and longlines) and active gear (encircling gillnets, drifting gillnets).

Due to its magnitude, the phenomenon of conflict between artisanal fishermen and industrial fishing trawlers in and around MPAs today constitutes one of the main concerns of fisheries administrations and artisanal fishing communities who are direct victims, despite the regulatory measures related to the zoning of fishing activities in maritime waters in general and in MPAs in particular. This characterization of the fishing areas of the MPA Tristão Islands makes it possible to enrich its zoning and the process of updating its management plan.

The mobility of the fishing unit also has a significant effect on the frequency of conflicts between small-scale fishing and industrial fishing, where the fishing effort has significantly increased. Spatial interactions are more frequent among motorized boats than those using sails or paddles.

Competition also increases in the rainy season, due to the increase in the abundance of marine fauna in the coastal area. This leads to a strong attraction of industrial fishermen towards the coastal zone, and considerably increases the risk of conflicts between industrial fishermen and artisanal fishing units.

<sup>1</sup> Doumbouya A, Camara OT, Mamie J, Intchama JF, Jarra A, Ceesay S, Guèye A, Ndiaye D, Beibou E, Padilla A and Belhabib D (2017): Assessing the Effectiveness of Monitoring Control and Surveillance of Illegal Fishing: The Case of West Africa, in *Front. Mar. Sci.* 4:50. Pages 1 to 10.



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### **Box 9.3 Fishing and marine protected areas: case of the Banc d'Arguin National Park in Mauritania**

*Djibril LY*

The Banc d'Arguin National Park (PNBA) will celebrate its 47th anniversary in 2023. A vast territory of 12,000 km<sup>2</sup> which is divided equally between marine and terrestrial environments, with the extensive coastal shallows that give the area the unique qualities that justify its status as a world double heritage site (Ramsar site in 1982 and World Heritage site in 1989). It has experienced over the last four decades a spectacular increase in fishing pressure emanating from local fishermen, the Imraguen, and that of the national artisanal fishing fleet and foreigners operating outside the protected area. A territory that was once isolated and difficult to access, the Banc d'Arguin has gradually opened up to international channels for marketing fishing products despite its status as a marine protected area. Fisheries for mullets, croakers and selachians (rays and sharks) have continued to attract the desire of Mauritanian migrant fishermen and fishermen from countries in the West African region. Between 2010 and 2020, the PNBA attracted no

less than 4,710 migrant fishermen distributed between 4,318 Mauritians and 393 foreigners. If the Park law grants the Imraguen alone an exclusive right of use over the resources of the MPA, the fishing dynamics currently at work within the park must seriously question the legislator on the application of such a regulatory provision, become de facto obsolete. More broadly, there is the issue of the territorial integrity of the PNBA and especially the sustainability of the exploitation of fishery resources, the income from which is essentially captured by external users rather than by the indigenous Imraguen fishermen who are supposed to exclusively benefit from the exploitation of fishery resources.



## What future for MPAs and their role for fisheries in the context of global changes

*Failler et al., 2012*

The effects of global change (rising water levels, rising surface temperature, acidification of waters) are already emerging: small pelagics are changing their distribution area to migrate further in addition towards the extremes where the waters are the coldest (Morocco for the north and Namibia for the south, even South Africa). Demersal species also seem affected since their seasonality is modified. Finally, spawning areas are affected by the increasing salinization of estuaries and mangroves, etc. Fish landings are and will therefore be disrupted, worsening or improving the food situation. In addition, the modification of the distribution areas of species gradually forces artisanal fishermen to migrate, overflowing the borders of national EEZs..

The governance of marine ecosystems is a whole new dimension in the fisheries world. It emerges with the observation that the oceans are very strongly involved in the carbon sequestration process and that they play a major role in climate regulation alongside forests. As a result, public decision-makers are now faced not only with the issue of managing fish stocks, but also with that of maintaining the capacity of ocean and coastal zone ecosystems to function. Actions taken against illegal fishing, which is the most destructive of marine habitats, take on a new dimension here in that their aim is to protect marine ecosystems. With the growing importance of international payments for ecosystem services (carbon sequestration, biodiversity production) and for mitigation and adaptation to climate change, marine ecosystems have acquired a new value which will very quickly become much greater than that resulting from the capture of fish.”

## 9.8 Conclusion

“It therefore remains true that MPAs are first and foremost tools dedicated to conservation. However, they authorize and even very certainly promote the goals of good fisheries management. Even though fishers do not derive an immediate benefit from it, which is the case in many situations, they have an objective interest in reconciling conservation imperatives and fish production objectives with a view to the sustainability of their businesses. Moreover, their involvement in this reconciliation contributes, in a context of environmental concerns of society, to the social acceptability of their activity” (Garcia et al., 2015).

The uses of MPAs should therefore not be limited to conservation alone. Their services must be beneficial to ecosystems and people. This is what Thibaut Roost<sup>11</sup> explains by the formula “supporting rather than limiting the uses”. In fact, according to this author, establishing an MPA with total protection reduces the space available for fishing, for example, which can affect the income from this activity and increase fishing pressure in other areas where the activity is still permitted. As is the case today in Africa, “fishers may have to travel farther and therefore spend more money to reach fish-rich areas. Therefore, “planning and managing these immediate costs is crucial to enjoy the support of sea users and gain the respect of all. It is also important to inform the public of the regulations in force and the importance of marine ecosystems, a task that is essential to the acceptance of management measures”.

On the other hand, although MPAs are tools that contribute to fisheries management, they cannot be directly assimilated to a management tool. They can only be effective if they are part of a pre-existing fisheries management and regulation system (F. Henry, personal communication).

Of course, in the diversity and richness of West African MPAs, in terms of their nature, human populations and cultures, the relationship between people and their natural environment is of paramount importance. The species and ecosystems constitute sources of food, materials and means of survival, but they are also sacred beings and sites, vital forces, places and supports of an intimate relationship which takes very diverse forms, but which is almost everywhere one of the foundations and cements of local society. However, these environments are in full mutation, and the balances that have been forged over the centuries are directly threatened. Commercial exploitation of resources using artisanal or industrial processes, population movements, development of the mining and oil industry, arrival of new technologies, various cultural influences – so many factors which can bring about a certain economic and social progress, but which are also too often synonymous with the depletion of natural resources, increased inequity and degradation of cultural and environmental heritage. These changes should be properly considered in the MPA governance mechanisms and translated into concrete measures, identified with the beneficiaries, which will make it possible to reconcile conservation and socio-economic development of the resident populations. This would undoubtedly contribute to strengthening the legitimacy of MPAs and to better adherence of States and populations to territorial conservation processes.

In this context, and as suggested by Yves Renard and Oussouby Touré (2012):

- The creation process should design the MPA as a tool for the conservation and management of natural resources, as well as a lever for development, and so should use the required knowledge and skills to successfully tackle the issue of development.
- As part of promoting alternative and complementary activities, it is essential that the redistribution of future benefits be negotiated between all stakeholders, in order to identify the beneficiaries and

<sup>11</sup> <https://seaescape.fr/blog/2022/01/15/aires-marines-protgees/>

define the formula for sharing revenue and potential compensation which will be demanded. In addition, one must be aware that the development of revenue-generating activities does not just a transfer pressure from one natural resource to another.

- Development projects should be conceived carefully; they should undergo feasibility studies, and they should only be launched when all the conditions necessary for their success have been assembled. Those in charge of the process should carefully examine the opportunities for development action offered by other partners, for if these initiatives fail, it will be the MPA, and not the external partner who will be held responsible for the failure by people. The implementation of development projects must also take into account and rely on existing legal and planning frameworks, in order to ensure a solid legal basis.
- Socio-economic development objectives must remain realistic and honest in line with the expectations and aspirations of all stakeholders, and in particular local populations. They should be integrated into the national development strategies of the territories in which the MPAs are located.

According to Grafton (2010), MPAs, essential fish habitat protection and protection of spawning aggregations, are and will remain necessary but may not be sufficient on their own in the to sustain fisheries face of the combined onslaught of climatic and non-climatic

stressors (offshore oil pollution, etc.) in the future. Again, to Garcia et al, (2013), these factors constitute serious threats to MPAs. Therefore, it is necessary that States take adequate measures to protect these critical sites from fishing pressure, pollution and mitigate climate change effects.

Given the migratory phenomena, we can wonder what will happen if nothing is done in the next few years to control this phenomenon: ever-increasing pressure on the reservoirs constituted by the MPAs, with more and more illegal intrusions, and even more distant migrations?

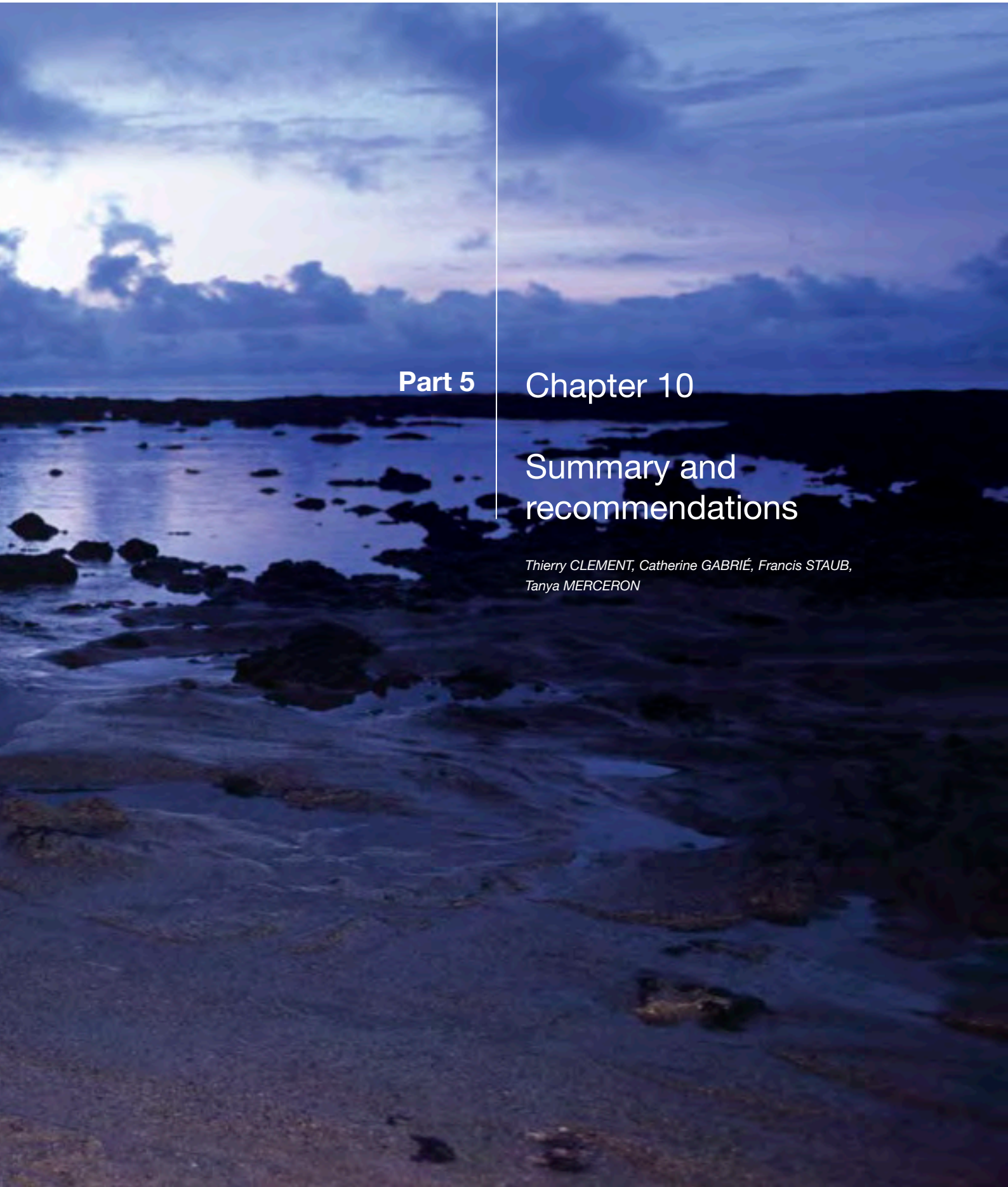
More supervised practices? And, for migrants, a life on board canoes? Permanent statelessness? The public authorities are beginning to take stock of the extent of the migration phenomenon, long ignored due to a lack of figures. Regional cooperation, the only possible outcome, requires coordinated initiatives, particularly within the Sub-Regional Fisheries Commission (SRFC) but also within the Economic Community of West African States (ECOWAS). At the scale of marine protected areas, this cooperation could be organised from RAMPAO, which nowadays has a sufficiently rich directory of tools and procedures on the topic and would be able to transform this migratory phenomenon into a sub-regional integration tool.



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**Part 5**

**Chapter 10**

**Summary and  
recommendations**

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## 10.1 Introduction

The West African coastal zone, on which is focussed the study on the State of West African marine protected areas (EdAMP), extends over an area of about 6,000 kilometres, from Mauritania in the north, through the deeply indented coastlines of the islands and estuaries (e.g. Guinea-Bissau with its Bijagós Archipelago), and then the coastal lagoons and barrier beaches of the Gulf of Guinea, to Nigeria. The small volcanic and mountainous island State of Cabo Verde, located some 600 kilometres west of Dakar (Senegal), completes this geography.

Three main types of ecosystems extend along the coastline:

- Senegalo-Mauritanian system characterised by upwellings;
- Cape Verdian system, which is mainly rocky islands;
- Guinea and Guinea-Bissau, mostly estuarine mangrove.

These coastal areas are characterised by a biodiversity of global importance: they include some of the world's most productive and diverse large marine ecosystems, including large areas of upwellings, extensive mangrove forests, saltmarshes, huge seagrass beds, seamounts and canyons, cold-water coral reefs, and, more rarely (e.g. Cabo Verde) warm-water (tropical) coral areas. Moreover, the region is home to the planet's largest breeding colony of monk seals and an exceptional bird community. Several species are listed by the

International Union for Conservation of Nature (IUCN) as Endangered, Vulnerable, or Threatened.

Thanks to the presence of seasonal upwellings, the region's marine waters are among the richest in fish resources on the planet, resources on which a significant proportion of the population depends.

The size distribution of key habitats in the region varies greatly between countries (Table 10.1).

However, marine ecosystem and coastal communities are facing numerous challenges, notably illegal, unreported and/or unregulated fishing, pollution, uncontrolled coastal development, etc. which affect habitats and species. Forward-looking studies carried out in the region show the growing strategic importance of the West African coastal area, and where more than 40% of the total population and around 60% of the urban population of coastal states depend, to varying degrees, on these coastal and marine resources, which are often the pillars of their economies. Climate change, with its visible impacts, is exacerbating these challenges.



Figure 10.1 Distribution of the main marine and coastal habitats of the region Source: UNEP-WCMC, 2022 / habitats.oceanplus.org

## 10.2 The dynamics of creating marine protected areas in West Africa and the importance of knowledge for decision-making

The International Union for Conservation of Nature (IUCN) defines protected areas, including marine protected areas (MPAs), as “a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values”.

It is now accepted that MPAs, if well managed, are effective tools for conserving biodiversity, protecting marine and coastal environments and their resources, and building ecosystem resilience. By protecting the coastal zone and enhancing carbon sequestration through marine ecosystems, they are increasingly considered as natural solutions to support efforts to adapt to and mitigate climate changes effects. Nevertheless, they are also the first to feel such effects, as evidenced by feedback from managers on coastal erosion, siltation of seagrass beds, etc. As such, they contribute directly to the achievement of the United Nations Sustainable Development Goals (SDGs) 14 (Life below water) and 13 (Climate action).

While MPAs are first and foremost tools dedicated to conservation, they are also often identified as tools for managing fisheries or sometimes other activities, such as tourism. However, while MPAs are indeed tools that contribute to fisheries management, they

Table 10.1 Distribution of the main marine and coastal habitats of the region

Country	Surface (km <sup>2</sup> )			
	Saltmarsh	Mangroves	Seagrass	Cold-water corals
Benin	0.00	1.40	1 343	1.00
Cabo Verde	0.00	0.00	0.00	34.30
Côte d'Ivoire	0.00	57.80	0.00	10.00
Gambia	200.00	598.00	0.00	0.00
Ghana	100.00	204.20	2 714	7.60
Guinea-Bissau	0.00	2 587	15 318	1.00
Liberia	0.00	189.20	0.00	6.90
Mauritania	12 133	0.80	0.00	39.60
Nigeria	0.00	6 881	8 829	9.20
Senegal	0.00	1246	1 482	4.20
Sierra Leone	0.00	1264	4 411	0.00
Togo	0.00	0.00	190	0.00
<b>Total</b>	<b>12 433</b>	<b>13 031</b>	<b>34 287</b>	<b>114</b>

Source: UNEP-WCMC, 2022

can only be effective when they are part of a pre-existing fisheries management and regulation system.

## International context

### 2022 context

- **SDG Target 14.5:** By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.
- **Aichi Target 11:** By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

### The Kunming-Montreal Global Biodiversity Framework Context

The Post-2020 Global Biodiversity Framework will not be adopted until December 2022 at the UN Biodiversity Conference (CBD COP 15) in Canada. The preparatory work has resulted in a framework that “has 22 action-oriented targets for urgent action over the decade to 2030”. Among these targets, and although the final figures have yet to be adopted, the following targets will be mainly retained as objectives for scaling up the West African MPAs Network:

**TARGET 1.** Ensure that marine and coast areas in West Africa are under integrated biodiversity-inclusive spatial planning or other effective use management processes, that (i) maintain, in

particular critical and threatened ecosystems and intact areas with high-biodiversity and (ii) improving connectivity, enhancing ecological integrity and maintaining ecosystem functions and services while safeguarding the rights of indigenous peoples and local communities.

**TARGET 2:** Increase the ecological integrity of at least 20 per cent of degraded marine and coastal areas through effective ecological restoration, focusing on areas of particular importance for biodiversity.

**TARGET 3:** Ensure that at least 30 per cent of marine and coastal waters are effectively conserved through networks of protected areas, including a substantial proportion of which that are strictly protected, and other effective area-based conservation measures (OECMS), in particular key biodiversity areas, ecologically or biologically significant areas, threatened ecosystems and other areas of particular importance for biodiversity. Countries will establish national targets/indicators aligned with this framework, while progress towards the national and global targets will be periodically reviewed and a related monitoring framework will be further developed.

**At the regional level,** these include the Regional Strategy for MPAs in West Africa and the development of a new additional protocol to the Abidjan Convention on marine protected areas.

However, many studies show that these effects are not always achieved and that MPAs alone are not capable of halting the degradation of biodiversity. Thus, complementary approaches are needed to tackle more specifically known causes of degradation (overpopulation and excessive consumption of resources, pollution, destruction of habitats, climate change, etc.) especially as many MPAs, which are not managed or are poorly managed, are in reality “paper” MPAs.

### 10.2.1 West African marine protected areas

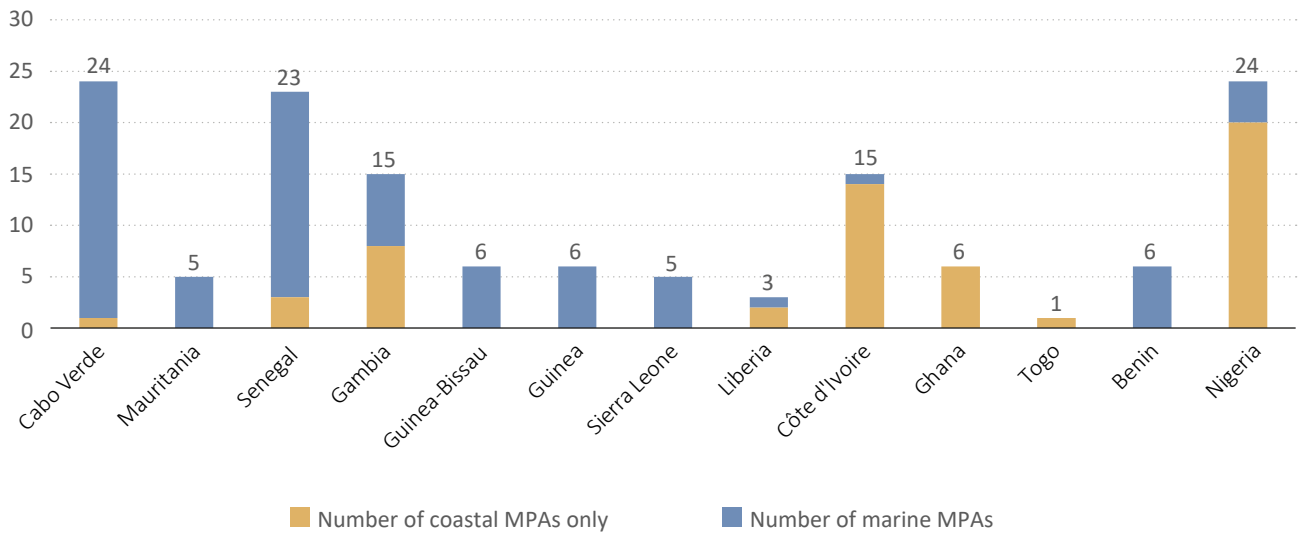
Mandated by the United Nations, the World Database on Protected Areas (WDPA), as part of the Protected Planet Initiative, is the most comprehensive database on protected areas in terrestrial and marine environments. Together with the World Database on Other Effective Area-based Measures (WD-OECMs), both databases are used to indicate progress towards the objectives of the global Convention on Biological Diversity (CBD).

However, this database is still incomplete, and work carried out under the EdAMP has identified MPAs that have not yet been included. Thus, the WDPA database contains 107 MPAs compared to the 141 MPAs identified by the authorities of the countries concerned.

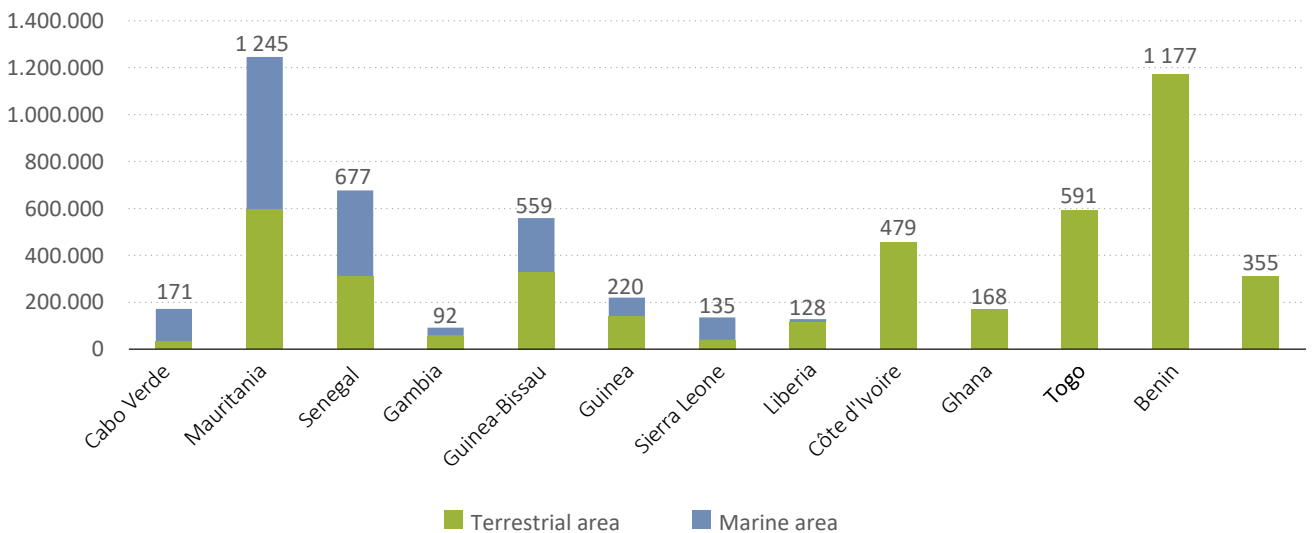
In addition to the MPAs considered up to now in the Regional Network of Marine Protected Areas in West Africa (RAMPAO), EdAMP is extending its analysis to other regional countries that do not have MPAs within RAMPAO (Liberia, Côte d’Ivoire, Ghana, Togo, Nigeria) and Benin (an MPA that is a member of RAMPAO).

The inventory work carried out within the EdAMP framework thus identifies 139 marine and coastal protected areas<sup>1</sup>, of which 84 are marine areas (with at least a small marine part), 55 solely coastal without a marine part but with saltwater intrusions enabling the growth of mangroves); 124 sites have been officially designated (by decree or order) and therefore have national status and 15 do not have national status, but have been designated as being of international interest (Ramsar site), to which 7 biosphere reserves must be added. These MPAs have very variable status, with

<sup>1</sup> Including the last MAP in Côte d’Ivoire.



**Figure 10.2 Total number of MPAs per country** Source: created from data collected by the authors



**Figure 10.3 Terrestrial and marine protected areas per country (ha)** Source: created from data collected by the authors

Note: keeping in mind that (1) for several countries, only the total areas are known, which explains why the total area does not correspond to the sum of the terrestrial + marine areas (e.g. Benin) and (2) the marine areas of MPAs are poorly known for Togo, Côte d'Ivoire, Benin, and Nigeria and are therefore underestimated.

managed resource protected areas (IUCN category VI) being the most numerous. However, 50% of the MPAs listed have not been classified by the authorities according to the IUCN categories. The Indigenous and Community Conservation Area (ICCAs), territories and areas conserved by indigenous peoples and communities, number around 20. As for other effective area-based conservation measures (OECMs), notably protected fisheries areas, their number and extent could not be listed.

These MPAs cover 60,000 km<sup>2</sup> of total surface area, of which 16,189 km<sup>2</sup> are declared marine areas<sup>2</sup>, that is less than 30%.

The importance of MPAs (with a marine component) in terms of number and surface area varies greatly from one country to another: some countries have a large number of MPAs (more than 20 for Cabo

Verde and Senegal), while others have not yet officially established an MPA (e.g. Ghana and Togo).

MPAs' size varies greatly, from 5 hectares for the smallest one (Alcatraz in Guinea) to 1,208,013 hectares for the largest one (Banc d'Arguin in Mauritania). Excluding the Banc d'Arguin and the Bolama Bijagos Archipelago in Guinea-Bissau (1,046,950 hectares), which are outside the standard, and the 3 MPAs for which the surface area was not communicated, the distribution of size classes shows that 85% of the MPAs size less than 50,000 hectares.

Four countries account for around 86% of the total marine protected area: Mauritania (40% of the marine protected area), Senegal (23%), Guinea-Bissau (14%), and Cabo Verde (8.46%). The importance of strong protections for biodiversity and resource conservation is

<sup>2</sup> Marine areas are not systematically reported, only the total area is.





**Figure 10.4 Map of ICCAs and OECM** *Source: Failler et al., 2018*

now well recognised. However, it was not possible to calculate the percentage of strongly protected areas within Western African MPAs.

On an international scale, these marine areas include:

- The Banc d'Arguin in Mauritania which is a UNESCO World Heritage Site;
- 47 Ramsar sites, with a total surface area of 64,823 hectares, including a transboundary site between the Gambia and Senegal; and
- 7 biosphere reserves with at least one marine part, including two transboundary reserves between Benin and Togo and between Senegal and Mauritania.

Although some countries are in the process of being included on the IUCN Green List, no site has been included to date. Through the information collected on the sites that have been assessed, in particular using the IMET tool<sup>3</sup>, EdAMP offers the possibility of progressing with the region's MPA labelling initiatives.

Given the immense wealth of the region, 23 Ecologically and Biologically Significant Areas (EBSAs) have been identified in West Africa, from Mauritania to Togo. The classification of these EBSAs provides an overview of the region's "high priority" marine and coastal systems, such as Boavista Island (Cabo Verde); Bijagos Archipelago (Guinea-Bissau); Tabou Canyon and Seamount (Côte d'Ivoire); the Canary-Guinea Current Convergence Zone (Senegal, Gambia, Guinea-Bissau, Guinea, Sierra Leone, Liberia); the Santa Luzia, Raso and Branco complex (Cabo Verde); or the Agbodrafo

coastal and marine habitat (Togo). Only 9 of these sites are currently protected, thus securing all these key sites would be essential to preserve marine biodiversity and maintain essential ecological processes. In addition, there are 38 Key Biodiversity Areas (KBAs) in the region, all of which are protected.

These MPAs are mostly grouped within the Regional Network of Marine Protected Areas in West Africa (RAMPAO), created in 2007 by 15 MPAs' founding members. Currently, the network counts 48 members. Its objectives are to ensure:

- The maintenance of a coherent set of critical habitats necessary for the dynamic functioning of ecological processes essential to the regeneration of the natural marine resources;
- The conservation of biodiversity for the benefit of local communities, through a functioning MPAs regional network.

The MPAs membership to the network is variable but growing: 15 MPAs in 2007, 23 in 2010, and 39 in 2017. From 2017 to 2022, there was almost no membership. Today (2022) and following the 9th edition of the RAMPAO General Assembly held in March 2022, the total number of network's MPAs members has risen to 48 and extends, in addition to the original members, to Cabo Verde, the Republic of Guinea, Sierra Leone and finally Benin, which is a recently admitted member.

<sup>3</sup> Integrated Management Effectiveness Tool: [https://www.observatoire-comifac.net/monitoring\\_system/imet](https://www.observatoire-comifac.net/monitoring_system/imet)

## 10.2.2 A network still far from meeting the Aichi Targets and other international commitments

- Whether one looks at the regional level, where 0.66% of the Exclusive Economic Zone (EEZ) are protected, or at the country level, **the 10% target is far from being reached**. All countries are below 4% and only Mauritania (3.93%), Senegal (2.46%), Guinea-Bissau (1.86%)<sup>4</sup>, the Gambia (1.52%) and Guinea (1.37%) are above 1%. All the other countries, that is 8 out of the 13 EdAMP countries, most of which are not RAMP AO members, are below 1%. The extension of protected areas should cover nearly 230,000 km<sup>2</sup> to reach 10% for all EdAMP countries. The next targets of the Post-2020 Global Biodiversity Framework will be even more stringent, both in terms of percentage of protection (30%) and connectivity and will therefore be even more difficult to achieve without a drastic expansion of protected areas.
- **In terms of representativeness**, previous studies for the RAMP AO's MPAs have shown the coastal aspect of the network, with a low representativeness of deep-sea and open sea areas. Nevertheless, there is good representativity of coastal habitats such as mangrove ecosystems, seagrass beds, beaches, but poor protection of deep-sea habitats such as canyons, seamounts, as well as cold-water coral reefs and permanent upwelling areas.
- Thus, as of January 2021, about 10% of seagrass habitat and 24.47% of mangrove forests in West African EEZ waters are covered by protected areas. Cold-water coral reefs achieve less than 1% protection. The protection of warm-water coral areas remains unknown.
- **Connectivity issues** are poorly understood. Recent work (Assis et al., 2021) shows that connectivity differs greatly between different ecological groups, ranging from highly connected species (e.g. fish and crustaceans) to predominantly isolated ecosystem-structuring species (e.g. corals, macroalgae, and seagrasses) that provide essential habitats for many species.

## 10.2.3 Challenging access to reliable and qualitative data

- EdAMP's work has been hampered by difficulty of access to data. Furthermore, despite the existence of RAMP AO and the Observatory for Biodiversity and Protected Areas in West Africa (OBAPAO), access to MPAs-related data in the region remains very challenging.
- The lack of reliable data on MPAs, their dispersion and the incredible challenge in collecting information and robust data, makes it difficult to thoroughly analyse the state of the MPAs network in West Africa, with much data still questionable.
- The surface areas are unknown for many MPAs (let alone the proportion of marine and terrestrial MPAs) and need to be calculated more precisely. As a result, after stabilising the list of MPAs with the countries, a precise mapping of all MPAs and their zoning must be undertaken, specifying the strong protection zones. This inventory is a first step towards data centralisation.
- Analysis of the representativeness of the network's various biodiversity elements (habitats and species populations) requires

Table 10.2 Level of protection of some key habitats in the area

Habitat	Area (km <sup>2</sup> )	Habitat protection (km <sup>2</sup> )	Percentage of protection
Mangroves	15.333,19	3.752,03	24,47 %
Seagrass beds	46.532,28	4.663,87	10,02 %
Cold-water coral reefs	114,84	0,998	0,86 %

Note: Figures from various sources differ slightly from UNEP's figures.  
Source: UNEP-WCMC (2022)

in-depth knowledge of the extent of the various habitats in the MPAs, which must be mapped more precisely.

- Data collection, quality improvement, and centralisation in national, regional, and international platforms must involve more effective collaboration with governments, with a more regular workflow, frequency of updates, and improved data sharing. The role of RAMP AO and OBAPAO are pivotal not only to this relationship with governments, but also to maintaining robust and up-to-date databases on MPAs in the region. This work is essential.

## 10.2.4 Consolidating progress and strengthening the network to meet international commitments

Although countries' efforts to protect marine and coastal areas are sustained, as shown by the evolution of designations since the 1970s, there is scope for even greater improvement, particularly in non-member countries of the RAMP AO. The following recommendations, which are in line with the recommendations already made in the framework of the RAMP AO baseline study (Failler et al., 2018, 2020), should spur the strengthening of the quality of the West African MPAs Network.

To achieve the Aichi Targets (particularly target 11 which consisted of protecting at least 10 per cent of the marine environment, while bearing in mind that today the international objectives go much further), the MPA surface area must therefore be greatly extended on:

- All identified but not protected sites (of ecological or biological importance).
- Poorly represented habitats (canyons, seamounts, cold-water coral reefs, warm-water coral formations).
- Structuring habitats (e.g. reefs, seaweed areas, seagrass beds, etc.) and habitats with high carbon sink potential such as seagrass beds, mangroves, and saltmarshes.
- Habitats playing a key role in carbon sequestration (e.g. seagrass beds, mangroves).
- Areas of importance for the life cycle of species (e.g. living and breeding areas, nurseries, migration corridors, etc.), which must be listed, as has just been done for small pelagic fish (Sub-regional Atlas of Important Small Pelagic Sites – PRCM).
- Offshore areas, provided they can be monitored and protected from exploitation and fishing activities.

<sup>4</sup> But nearly 10% if counting the entire Bolama Bijagos Archipelago



**Figure 10.5 Additional marine areas to be covered for each country to achieve the Aichi Target 11**

*Note : By cumulating existing and additional areas to be covered, each country reaches the 10% target of protected EEZs. The location and outline of additional MPAs are free and virtual. These MPAs are generally placed arbitrarily in relation to seamounts and sea trenches. Source: Failler et al., 2020 / <https://bluehabitats.org/>*

Work on gap analysis (Tendeng et al., 2012) and more recently on RAMPAO's MPAs provide pathways for strengthening the network.

**Strong protection zones**, in which interventions are limited to a minimum, play a major role in maintaining biodiversity and fisheries resources. They must be inventoried to gain a better understanding of the current situation, before being multiplied and extended.

Considering the international objectives, which aim for an ambitious target of 30% of protected EEZs, other conservation measures by zone must be encouraged.

Lastly, in addition to the areas of extension of the MPAs network within the EEZs, the recent work of the TARA Foundation on oceanic plankton has led to the emergence of "KOPAs" (Key Ocean

Planktonic Areas), that is oceanic regions of great biological and climatic importance, based on the quantification of the ecosystem services provided by plankton (upwelling areas for example).

On the other hand, **connectivity** issues need to be researched in much greater depth, with a focus on transition zones (e.g. Guinea-Bissau) and source zones. For example, the connectivity study (Assis et al., 2021) shows that MPAs in Cabo Verde, Guinea, Senegal, and Sierra Leone "may play a key role toward connectivity in the face of future environmental changes, by acting as stepping-stones for the dispersal of propagules between different islands or regions/countries". This study highlights the need to protect and ensure the continuity of isolated species structuring the ecosystem by identifying key areas that function as connectivity corridors.

**Transboundary protected areas** contribute to the integration and will promote sub-regional cooperation, while enhancing the conservation status of marine and coastal biodiversity in West Africa. To date, there are three sites (the Niimi-Saloum transboundary Ramsar site between Gambia and Senegal and two transboundary reserves between Benin and Togo and the Senegal River delta between Senegal and Mauritania). It would be desirable to multiply them.

Habitats are essential for the survival of species and their protection is a priority objective. “MPA management in West Africa should **strongly focus on ecosystem structuring species**”. The **monitoring of the evolution of habitats**, their surface area and condition, which is lacking, particularly for structuring habitats, must be organised on a regional scale and the data banked and saved, an imperative objective for reporting on conservation efforts and management performance. The same applies to the **monitoring of species populations**, especially threatened species. These monitoring objectives are essential and must be supported by the RAMP AO, which must launch a project in this respect.

The role of **MPAs networks and managers** has proved to be very effective in strengthening MPAs management (e.g. the Mediterranean Marine Protected Area Managers’ Network or MedPAN). It is therefore strategic (i) to extend the membership of RAMP AO to MPAs from countries that are currently under-represented and (ii) to strengthen the role of RAMP AO in improving knowledge, data collection and the networking of network managers for enhanced learning exchanges. Moreover, it is essential to implement harmonised monitoring between all MPAs on the evolution of the biodiversity elements (habitats/species) and the effectiveness of management, based on a small number of biological, social and economic indicators common to MPAs, thus making it possible to evaluate the effectiveness of the network in the fight against biodiversity loss, habitats degradation, and the improvement of the living conditions of local communities. RAMP AO also has a central role to play in developing the capacity of communities, managers, and government officials to manage MPAs more effectively through capacity building initiatives. As mentioned earlier, it is important that RAMP AO takes up the issue of developing robust, geo-located databank covering all MPAs in its network. Building a reliable database remains an essential objective for RAMP AO. The new RAMP AO strategy, currently being developed, should facilitate further progress in that direction.

## 10.3 Governance of marine protected areas

Based on the brief and non-exhaustive trends review regarding the governance diversity and quality in the region, the following conclusions can be drawn.

The region is characterised by mainly government-led MPAs, shared governance and some examples of community conserved areas.

As for MPAs, it would be necessary to provide data on the type of governance and management category to determine the types of support MPAs might need.

In many MPAs labelled as “community-based”, the organisational fragility of the management bodies, the delicate coexistence between the community and governmental approach, and the need for greater coherence in the fisheries governance framework at the local level are some of the main constraints encountered. Unsurprisingly, there remains a large gap between both CBD and IUCN guidelines and the reality on the ground, reported at national level.

This lack of legal recognition is acknowledged by the Joal-Fadiouth’s MPA:

*“I am particularly proud today to see that we, local actors, are recognised and respected, not only for our local and traditional knowledge, but also because we have developed our capacities and can sit around a table with directors, ministers and talk about MPAs in all their forms. Our main challenge is the legal recognition of local leaders and to have an adequate representation of all stakeholders”.*

It is interesting to note that there are no private marine protected areas reported in the region, as may be the case in other parts of the world.

With ICCAs, there is a delicate cohabitation between the formal structures and the traditional system. Although favourable legal frameworks exist in some places, a problem in these public domain areas along with limits to decentralisation mechanisms remain to fully empower these local actors.

Miguel de Barros/Tiniguena - Remarks on the Uruk Islands Community-Managed MPA:

*“In institutionally fragile states contexts, the greatest challenge is the discontinuity of sectoral public policies subject to political calculations. One of the main achievements of protected and conserved areas is the involvement of traditional and local actors and structures at the centre of governance, not only as members of the sites’ community management, but also as members with formal and public recognition of MPAs decision-making. This new political positioning of these important actors, previously neglected, has contributed to the continuity of co-management processes, ensuring the conservation of natural, cultural, and economic heritage, as well as the vitality of the participatory governance process itself”.*

Other effective area-based conservation measures (OECMs) remain relatively less known both in terms of their contribution to marine conservation and the kind of recognition and support they require. This demonstrates a gap or an opportunity for further research, all the more so as the West African region abounds in cultural practices in line with biodiversity conservation.

Overall, progress has been made in recent years to diversify MPAs governance modes in West Africa. Nevertheless, the main challenge remains the establishment and maintenance of qualitative governance, with appropriate mechanisms that are not only legitimate and useful, but also contextually appropriate.

There are few studies on the management effectiveness of MPAs in the area. Most have focused on the tools used and their use frequency, but little on the results achieved. These analyses show

that the “compass card” (using the radar chart function in Excel) and the Rapid Assessment and Prioritisation of Protected Area Management (RAPAM) tools are the most widely used tools in the area. The compass card has been adopted by RAMPAO to extend it throughout its network. The Senegal’s Directorate of Community marine protected areas (DAMCP) has been using it routinely since 2020 throughout its MPAs network.

However, while many tools have been implemented in the region over the past two decades to assess the effectiveness of MPAs management, no in-depth regional study has been conducted to date showing how effective or ineffective current MPAs management is. This is therefore a task that remains to be completed, and in our view, one that RAMPAO should take on in the coming years to highlight the results of the efforts made by countries and their supporters.

## 10.4 Funding marine protected areas

- Funding for marine protected areas in West Africa is currently insufficient. There is an urgent need to find complementary funding mechanisms, while strengthening philanthropic and government funding. Indeed, governments and donors will continue to play a crucial role, not only as donors, but also as partners in conservation activities, while other sources will complement their contributions. As an example, the funding gap to be filled to achieve the conservation objectives set out in the management and development plans of the MPAs in the RAMPAO network is about €6 million over the 2022-2030 period (based on the business plans carried out for 37 West African MPAs).

- To achieve this, MPAs managers need to develop diversified and sustainable self-generated revenue streams that can have conservation impacts. The successful use and application of financial tools will depend on a variety of strategies and will need to consider the timing and amount of funding required. For instance, some funding mechanisms can be implemented relatively easily, with quick results, while others require time, resources, and investment.
- This sustainable funding will cover the costs of operating, maintaining, and investing in MPAs in the long-term.
- Furthermore, data on MPAs funding remains difficult to obtain, particularly at national level. Furthermore, very little data is available on the financial needs of MPAs. Currently, there are too few sustainable funding mechanisms in place.
- Support the long-term financial sustainability of MPAs through capacity development and sustainable funding mechanisms;
- Create and/or support dedicated sustainable funding mechanisms for MPAs at national and local levels;
- Ensure that each MPA has a business plan and/or financial strategy in line with the MPAs management plan; and
- Strengthen local and national MPAs staff and administrations capacities on fundraising, funding mechanisms and fund management.

Table 10.3 IUCN governance types for protected and conserved areas

Governance Type	Sub-types	Example from the region
<b>Type A:</b> Governance by government	National Ministry or a protected area agency Subnational agency (at all levels)	Banc d’Arguin National Park (PNBA) in Mauritania João Vieira e Poilão marine national park in Guinea-Bissau Saloum Delta National Park in Senegal Niimi National Park in The Gambia
<b>Type B:</b> Shared governance by diverse rightsholders and stakeholders together	Transboundary governance arrangements Joint or collaborative governance bodies	Joal-Fadiouth and Cayar MPAs in Senegal Urok islands community-based MPA in Guinea-Bissau Tristão & Alcatraz MPA in Guinea
<b>Type C:</b> Private governance	Individual landowners, Religious entities, Non-profit or for-profit organisations	None reported
<b>Type D:</b> Governance by Indigenous People and/or local communities, (often called ICCAs or territories of life)	Indigenous Peoples’ conserved territories and areas – established and run by Indigenous People Community conserved areas – established and run by local communities	Kawawana in Senegal Bolong Fenyo in Gambia

Source: Borrini-Feyerabend et al., 2013

## 10.5 Threats, stakes and challenges

The diversity and richness of West African MPAs lie within their nature, but also their human settlements and cultures, in which the relationship between people and their natural environment is of primary importance. These species and ecosystems are sources of food, materials and means of survival, but also sacred beings and sites, vital forces, places and supports of an intimate relationship that takes diverse forms, but which is almost everywhere one of the foundations and cements of local society. However, these environments are evolving rapidly, and the balances that have been forged over the centuries are under direct threat. Commercial exploitation of resources using artisanal or industrial processes, population movements, the development of the mining and oil industries, the emergence of new technologies, and various cultural influences – all these factors can bring a certain amount of economic and social progress, but all too often they are also synonymous of natural resources depletion, increased inequity, and cultural and environmental heritage degradation. These changes should be properly considered in MPAs' governance mechanisms and translated into concrete measures, identified with the beneficiaries, which will permit to allow conservation and the socio-economic development of resident populations. This would undoubtedly contribute to strengthening the legitimacy of MPAs and improving a better adherence by States and populations for the conservation processes in these territories.

Uncontrolled fishing is the main threat to West African coastal MPAs. Erosion, pollution, overexploitation of natural land resources (mainly logging) and climate change complete the inventory of the most important threats identified by the network's MPAs managers. Their recurrent nature raises the issue of the effectiveness of the management measures implemented for several years to contain and counter them. Indeed, management measures are focusing on uncontrolled fishing and the overexploitation of non-fishery biological resources, but neglecting erosion, pollution, and climate change despite the importance of their impacts. Moreover, most measures are limited to monitoring, surveillance, and awareness-raising. Easy to implement, these are more akin to the basic functioning of MPAs than to actions adapted to the current situation, which requires sub-regional sustained and coordinated efforts to maintain the resilience of the ecosystems in the face of anthropic pressures and climate change.

## 10.6 The issue of pollution, degradation, and threats in West African marine protected areas

The United Nations Convention on the Law of the Sea (UNCLOS) defines marine pollution as “introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities”. It is evident that marine noise is included in the above-mentioned definition as “energy” and should therefore be treated as a form of marine pollution (Ocean care, 2017)<sup>5</sup>.

Over 80% of marine pollution is land-based. This pollution arrives in marine environments and, later in MPAs via waterways (rivers and run-off), winds and/or direct discharges (industrial and urban discharges). Most of the pollution load of the oceans, including urban, industrial and agricultural wastes, as well as atmospheric deposition, emanates from these land-based activities and negatively affect MPAs and the most productive areas of the marine environment, particularly estuaries, lagoons and near-shore coastal waters. As a result, industrial and urban discharges heavily pollute the coastline and consequently the protected areas within it (CCLME, 2014)<sup>6</sup>.

When contaminants enter marine waters (and thus MPAs), they change the characteristics of the environment through various chemical and/or biological reactions, which can pose serious risks to the health of the ecosystem and the populations. In addition, they can be absorbed by living organisms (bioaccumulation) and can also evaporate, degrade, precipitate before penetrating sediments. Biotransformation can also occur when pollutants interact with each other to form new compounds that are environmentally harmful (CCLME, 2014).

Marine and coastal areas play an extremely essential economic and social role in West African countries, through fishing, tourism, oil and gas exploitation, and the concentration of industries and populations. However, they are subject to multiple pressures which, if left unchecked, may damage the integrity of the ecosystems they shelter and reduce their productivity, which is already the case in several areas.

Special efforts should be undertaken by authorities, research centres and universities to help improve pollution-related knowledge (mainly) and the factors that contribute to the degradation of MPAs. Pollution-related information in MPAs is scattered and figures are often lacking. Similarly, the lack of a baseline for several MPAs is detrimental to a proper understanding of the issues and the management of these MPAs.

<sup>5</sup> Ocean Care, 2017. Underwater noise and the Sustainable Development Goals. Ocean Care, 5 p.

<sup>6</sup> Canary Current Large Marine Ecosystem Project (CCLME), 2014. Évaluation des activités terrestres pouvant constituer des sources de pollution marine et côtière des pays du Grand Écosystème Marin du Courant des Canaries. UNEP/GEF/Abidjan Convention, 110 p.

Currently, the situation regarding pollution and the factors that contribute to the degradation of MPAs is not alarming yet, except for solid waste, for which a special effort must undoubtedly be made. MPAs located far from large urban centres and areas of industrial concentration are the best preserved. This is particularly the case in the Bijagos Islands of Guinea-Bissau. However, with the short-term prospects for the development of oil and gas activities and extractive industries in general in the sub-region, it would be beneficial to develop an action plan for the conservation of West African MPAs in the context of the development of oil and gas activities. This action plan should include a mechanism for monitoring risks in the marine and coastal environment. Satellite images will be of great importance in this monitoring system.

Furthermore, if the attractiveness and socio-economic dynamism of the West African marine and coastal zone is to be maintained, given the important role that MPAs play in maintaining the productivity of ecosystems and the maintenance of biodiversity (at local, national, sub-regional and global levels), it is essential that authorities representing the MPAs of the area be associated with the negotiations between States and oil/mining companies so that MPAs can benefit from a part of the compensation credits associated with

these operations. There are land examples in the sub-region, such as in Guinea, which could usefully be emulated.

Finally, offshore oil and gas exploitation is close to significant development in the sub-region. It is therefore essential to ensure not only that this does not compromise the environmental management and protection in general, and MPAs in particular, but also that it does not come at the expense of other resources and/or sectors, notably fisheries and tourism. The current negotiations leave room for MPAs to benefit from these industrial developments, for example by creating ecological compensation funds for the protection of MPAs and sensitive hotspots, promoting scientific research of the seabed located in the bathyal zone. Missing such an opportunity to support conservation through development would be extremely regrettable.



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## 10.7 West African marine protected areas and climate change

“Anthropogenic climate change has exposed ocean and coastal ecosystems to conditions that are unprecedented over millennia” (IPCC, 2022): ocean warming, sea level rise, acidification, deoxygenation and increased extreme events are the main issues increasing the sensitivity and exposure of these environments as well as the human communities that depend on them. Climate change is leading to the degradation of marine and coastal ecosystems. It poses a major threat to habitats and coastal populations.

For marine and coastal species, the unusual warming and frequency of warm extremes will result in significant physiological changes that may lead to mortality and extinction of less resilient species, migration to other areas, and significant physiological alterations to adapt to new ambient environmental conditions. Climate change therefore affects the growth and viability of certain species (corals, bivalves, crustaceans, plankton as well as turtles, birds, etc.). The attached warming and deoxygenation disrupt fish reproduction and growth, leading to reduced adult size and sometimes early mortality.

Almost all studies evaluating the effectiveness of MPAs in West Africa and surveys of managers have shown that climate change, in its various forms, is one of the main threats that affect the management of protected marine and coastal ecosystems. This is illustrated by the many examples of managers facing erosion of their coastlines (St-Louis, Joal-Fadiouth), silting of seagrass beds (Joal-Fadiouth), drought and increased salination of soils which sometimes lead to a decline of the mangrove (Joal-Fadiouth) or the abandonment of rice fields (Abéné), etc.

However, strict and effective managed MPAs have an important role to play and are among the Nature-Based Solutions (NBS) to maintain and restore ecosystem resilience in a changing climate. Adapting to the effects of climate change is therefore one of the challenges faced by MPAs managers who need to be prepared and trained. A recent study (Jacquemont et al, 2022) shows that ocean conservation, and particularly MPAs, could contribute to climate change mitigation and adaptation.

MPAs networks can provide continued protection as species shift their distribution in response to climate change, and conserve genetic diversity across species' ranges. Large MPAs support greater genetic, species and functional diversity, increasing resilience and recovery.

It appears in particular that strong protection of blue carbon ecosystems, which play an important role in climate change mitigation, is essential. “Coastal wetlands – particularly mangroves, tidal marshes and coastal seagrasses – are by far the best long-term carbon sinks and should therefore be primarily protected. They sequester and store up to 10 times more carbon per unit area than terrestrial forests or other marine ecosystems, such as coral reefs or phytoplankton!” (Jennifer Howard). West Africa has about 20% of the world's mangroves and “blue carbon” MPAs (protecting mangroves, seagrasses, etc.) need to be multiplied and widely extended.

However, knowledge is extremely limited, and few studies have so far analysed the potential impacts of climate hazards on MPAs worldwide, particularly in West Africa. This situation leads to a lack of data and information on the different regions, especially African ones, which limits the implementation of adequate adaptation solutions.

The understanding of the ecological and socio-economic consequences of ocean acidification in African coastal waters is still minimal. This area requires support from national governments, regional and international organisations, and global scientific collaborations, through cooperative programmes and regional convention bodies. Addressing the impacts of climate change, ocean acidification and its mitigation will require a drastic reduction in global CO<sub>2</sub> emissions.

Nevertheless, it is possible to develop local adaptive solutions to increase ecosystem resilience by addressing specific societal priorities of coastal communities. For this purpose, it is essential to have strategic data on ocean acidification and other impacts to develop and implement such solutions, responding to the needs of coastal communities and their sustainable development, in particular by identifying acidification hotspots: research support, technical and scientific cooperation in research and monitoring, development of observation networks and environmental monitoring programmes, regional training programmes for researchers, and training and capacity building for decision-makers, national administrations and NGOs. Efforts should focus on the most affected sectors (e.g. fisheries, aquaculture) and on commercially relevant marine species and ecosystem engineer species, which are essential for maintaining food webs.

But fundamental measures to reduce eutrophication, acid rain, CO<sub>2</sub> emissions and habitat loss would be valuable steps in helping coastal ecosystems adapt to increasingly acidic oceans.



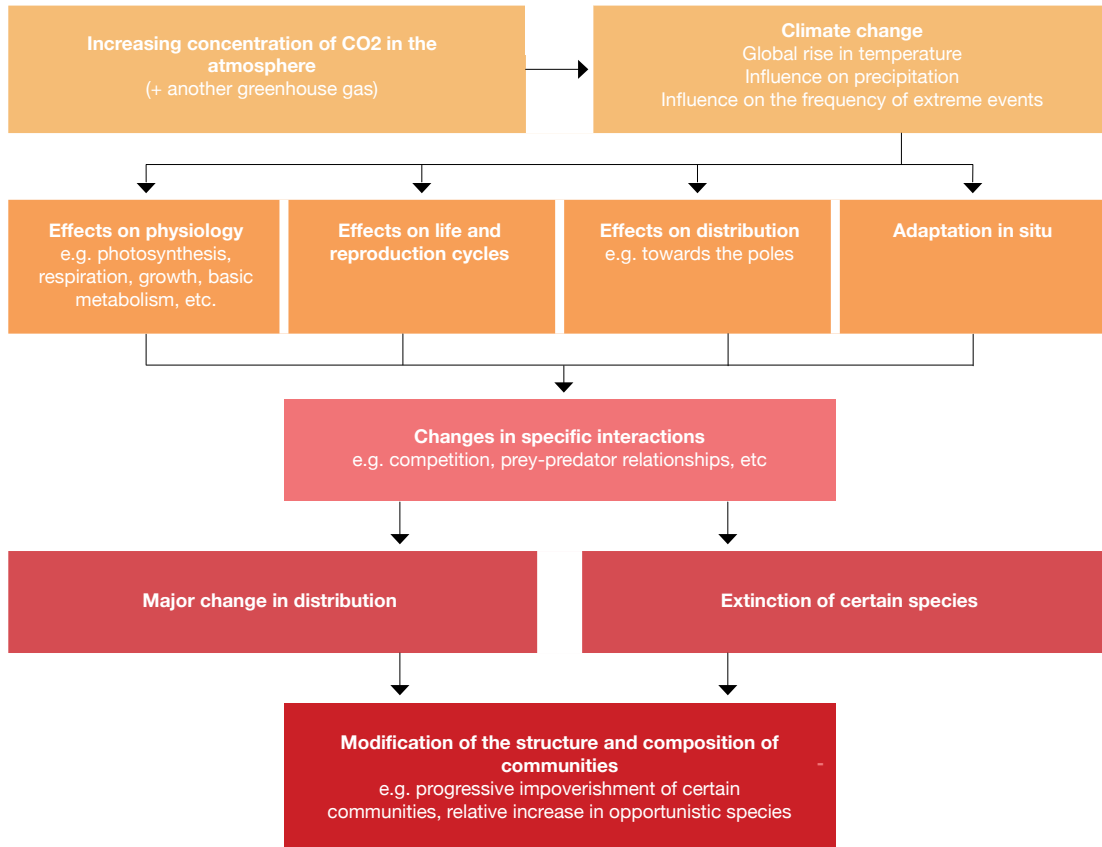


Figure 10.6 Diagram on the impacts of climate change on marine and coastal biodiversity Source: Hughes, 2000

## 10.8 Marine protected areas and fisheries

In most West African coastal countries, the fisheries sector is one of the pillars of the national economy, in terms of budgetary revenues, food security, and employment.

The region's marine waters are among the world's richest in fisheries resources. This great wealth results from the specific regional oceanographic conditions, with the presence of cold-water upwellings, which favour a high biological production, and important terrigenous contributions, drained by the large southern rivers, which enrich the environment. In addition to its richness, the fisheries sector in this region is characterised by the (i) presence of straddling marine stocks, shared between regional countries, with a continuum of migration and spawning areas, and a sharing of the same ecosystems, (ii) high mobility of fishers, and (iii) high level of fish stocks overexploitation, mainly due to the overcapacity and the absence of regulation of access to resources (Garcia et al., 2013).

Whether marine protected areas are dedicated to the conservation of biodiversity or the preservation of fisheries resources, fishing has almost always played a central role. Moreover, among the anthropogenic pressures MPAs are faced with, MPAs managers place uncontrolled fishing first (Failler et al., 2020). This shows the major challenge that fisheries management represents in the context of MPAs management. Fishing pressure involves ships' incursions into non-fishing zones of MPAs with trawls degrading seabed and

other non-selective fishing gear that causes biodiversity erosion. This fishing (Illegal, Unreported and Unregulated fishing or IUU fishing) also affects juveniles and spawners.

Add to that catches of endangered species: fish species studies show that more than 40 endangered species are caught by industrial and artisanal fishing for a total of 767,000 tonnes, representing 5.7% of total catches (26 Vulnerable, 16 Endangered and 6 Critically Endangered species). The Madeiran sardinella (*Sardinella maderensis*) is the most threatened overfished species along the West African coast, with more than 2 million tonnes caught during the last 10 years.

*"It remains therefore true that, first and foremost, MPAs are conservation tools. Yet, they may aim and certainly facilitate reaching good fishery management objectives. Even though fishers might not draw an immediate benefit (this is likely to be the case in many situations), they have an objective interest to improve: (1) their enterprises sustainability through reconciliation of conservations imperatives with marine production objectives; (2) the social acceptability of their activity to contribute, in a context of societal environmental concerns, through their involvement in this reconciliation"* (Garcia et al., 2015).

The uses of MPAs should therefore not be limited to conservation alone. Their services must be beneficial to ecosystems and populations. MPAs are tools that contribute to fisheries management, but they cannot be directly assimilated to a management tool because

they can only be effective when they are part of a pre-existing fisheries management and regulation system (F. Henry com. pers.).

Several studies have highlighted the positive eco-biological effects of MPAs within the reserves. For instance, in the Banc d'Arguin National Park (Parc National du Banc d'Arguin or PNBA), the work of Bonnin et al. (2015) showed that the specific diversity in the PNBA area is significantly higher than in adjacent areas, that the average abundance value in the reserved area (PNBA) is much higher than the values found outside in the sectors exploited by artisanal and industrial fisheries, values that decrease the further away one is from the PNBA. As far as commercial fisheries are concerned, catches inside the PNBA are always higher than those outside. It has been shown that the PNBA plays a critical role in fish production (Trégarot et al, 2020). Numerous studies on the Bamboung Bolong have also shown the interesting role of the closure of the Bolong on the modification of fish population and in Senegal, the DAMCP reports a biological recovery of certain species in Kayar.

Despite these obvious impacts, fishers are often reluctant to create MPAs. For instance, in Bamboung, 58% of fishers in the area surveyed as part of the Narou Hueleuk project evaluation were against the MPA, despite the recognition that catches in the vicinity of the MPA were better (acknowledged by 52% of those surveyed).

Therefore, for greater acceptability, the processes of creating and managing MPAs must conceive MPAs as a conservation tool for contributing to natural resource management, but also as a pillar for development, and will therefore need to use the knowledge and capacity required to properly address development issues. The redistribution of benefits, especially to those who "lose out" as a result of protection, must be negotiated between all stakeholders. MPAs managers need to carefully consider the opportunities for development actions offered by partners, ensuring that the development of income-generating activities does not result in a simple transfer of pressure from one resource to another. Socio-economic development objectives must remain realistic and in line with the expectations and aspirations of all stakeholders, particularly the local populations. They should be widely involved into the national development strategies of the territories in which the MPAs are located.

MPAs now appear as oases in the middle of impoverished seas. The difference in resources inside and outside MPAs inevitably arouses fishers' desire. In this context, MPAs are faced with the issue of monitoring their maritime territory, which is essential for rules compliance, but complex for many reasons. Solutions must be found on a case-by-case basis for MPAs, so that surveillance is sufficiently dissuasive: good information for fishers, sufficient and operational resources at sea, adequate organisation of surveillance campaigns, participatory surveillance, etc.

Given the migratory phenomena, which are having an increasing impact on MPAs, one can ask oneself what will happen if nothing is done in the next few years to oversee this phenomenon: ever greater pressure on the reservoirs that MPAs constitute, with more and more illegal intrusions, even more distant migrations? More controlled practices? And for migrants, a life doomed to be lived

on board canoes? Permanent statelessness?. Public authorities are beginning to take the measure of the scale of the migratory phenomenon, which has long been ignored as figures were not available. Regional cooperation, the only possible way out, requires coordinated initiatives, particularly within the Sub-Regional Fisheries Commission (SRFC) but also within the Economic Community of West African States (ECOWAS). At the level of marine protected areas, this cooperation could be organised based on RAMPAC, which now has a sufficiently rich inventory of tools and procedures on the topic and would be able to transform this migratory phenomenon into a sub-regional integration tool.

However, marine protected areas, which are essential fish habitat protection, and the protection of spawning aggregations are and will remain necessary but may not be sufficient to sustain fisheries in the face of the combined effects of climatic and non-climatic stress factors in the future (offshore oil pollution and other pressure-causing activities). According to Garcia et al. (2013), these factors constitute serious threats to MPAs. Therefore, States need to take adequate measures to protect these critical sites from fishing pressure and mitigate the climate change effects (Grafton, 2010).

## 10.9 Ecosystem services provided by West African marine protected areas and the economic impact – Blue economy

Monetary valuation is a relevant tool for integrating the environment into the economic, political, and social spheres (Binet et al., 2012; UNEP and GRID-Arendal, 2016). Quantifying ecosystem services in monetary terms allows us to compare different types of habitats and compare them with income-generating economic activities (Bonnin, Failler and Laë, 2015; Bacon et al., 2019). Moreover, it is possible to estimate the costs of political inaction (Trégarot, Failler and Maréchal, 2017), particularly since healthy ecosystems are more resilient to pressures (such as climate change). This approach enables to highlight ecosystem benefits in the planning of public policies, with human, social and economic capital being more fully informed than natural capital (Failler et al., 2015; Pascal et al., 2018). For example, a study on land use change in Nigeria estimated that natural environments had lost almost 5% of their monetary value in 10 years, representing US\$ 2.53 billion (Olusha Arowolo et al., 2018). On the one hand, these monetary estimates allow to make investment choices for protection/conservation, for example by taking into account little-known habitats that were previously set aside, such as seagrass beds. On the other hand, monetary valuation of ecosystems further allows for greater balance in decision-making regarding the use of spaces: economic activities to the detriment of ecosystems versus risk-averse management of these ecosystems due to their high economic value.

Given the recurrent lack of data and studies on African coastal and marine ecosystem services (Wangai, Burkhard and Müller, 2016; Willcock et al., 2016), it seems to be essential to advocate for the development of this research field. By reviewing the titles of thousands of scientific articles, Jamouli & Allali (2020) highlighted

Table 10.4 Occurrence and degree of severity of anthropogenic threats identified by the managers

MPA	Uncontrolled fishing	Overexploitation of land resources	Pollution	Industry	Agriculture	Hunting	Habitat loss	Infrastructures	Demography	Tourism	Transports
Diawling	Severe	Severe		Mild				Very severe			
Banc d'Arguin	Severe		Mild	Severe			Mild				Mild
Bamboung	Mild				Mild		Mild				
Saint-Louis	Severe		Severe	Severe	Severe						
Sangomar	Severe			Severe			Severe				
Cayar	Severe			Severe							
Kawawana											
Joal-Fadiouth				Severe							Mild
Langue de Barbarie											
Palmarin	Severe		Severe		Severe						
Popenguine	Mild			Mild	Mild						
Îles de la Madeleine	Very severe		Very severe								
Abéné	Severe	Severe		Very severe				Severe			
Gandoul	Mild										
Somone								Mild			
Santa Luzia	Severe		Mild								Mild
Boa Vista	Severe		Severe		Severe					Severe	
Bao Bolong	Severe		Very severe								
Nuimi	Very severe	Mild					Severe				
Tanbi	Severe	Severe	Very severe								
Tanji	Severe	Severe	Very severe								
Rio Cacheu	Mild										
Cantanhez	Severe			Severe	Mild		Severe		Severe		
João Vieira e Poilão	Severe	Severe		Severe		Mild				Severe	
Urok	Mild					Mild					
Tristão	Severe	Severe		Severe							
Alcatraz	Severe	Severe		Severe							
Loos	Severe	Severe		Severe							

□ Non-existent threats    □ Mild threats    ■ Severe threats    ■ Very severe threats

Source: Failler et al (2019, 2020). Authors' elaboration.

that those natural habitats located in most West African countries had not been the subject of assessments of ecosystem services.

- Indirect use values predominate in most studies. Among the most “valuable” services are, for example, fisheries biomass production and carbon sequestration. Therefore, as noted by Binet et al. (2012), “to be effective, the MPAs management must be geared towards preserving these supporting and regulating services. Management measures aimed at preserving these services would have the immediate effect of improving the net benefits of MPAs”. In addition, to maintain their services, MPAs

must guarantee the general good state of health of ecosystems, by limiting human uses.

- Protect the most “valuable” natural habitats. In many of these studies, seagrass beds and mangrove habitats were highly valuable, as they were involved in many services (carbon sequestration, spawning grounds/shelter/nurseries areas for marine resources, waves, water treatment, etc.). While the role of mangroves is already well known in the region, this is not the case for seagrass beds. Monetary valuations therefore highlight these highly valuable habitats.
- State the cost of inaction. As far as possible, monetary valuations should include the notion of the cost of inaction, i.e. the difference

**Table 10.5 Selection of ecosystem services to be quantified in order to determine their monetary value**

	Provisioning services				Regulating services					Cultural services
MPA	1. Fisheries economic services (small pelagics)	2. Fisheries economic services (excluding small pelagics: other marine species, shellfish)	3. Wood supply + pharmacopoeia	4. Agriculture (livestock + market gardening)	5. Spawning /Nursery/ Biomass production (small pelagics)	6. Migration corridor	7. Coastal protection	8. Bioremediation	9. Carbon Sequestration	10. Tourism
Diawling	X	X	X	X	X			X	X	X
Joal-Fadiouth	X	X	X*		X	X	X	X	X	X
Sangomar	X	X	X		X	X	X	X	X	X
Niumi	X	X	X		X	X		X	X	X
Abéné	X	X	X*		X	X	X	X	X	X
João Vieira e Poilão	X	X	X		X	X		X	X	X

*Note: In this example, only the main services have been considered, in relation to the local context. However, the "cultural" aspect has not been addressed to any great extent. Source: Extract from Tournon-Gardic et al. (forthcoming).*

between the economic value of ecosystems functioning at full capacity and their current functioning. It may be useful to conduct scenarios on the evolution of natural habitats, in order to highlight the potential monetary losses. It should also be highlighted that these monetary losses are not just "environmental losses": they will regularly have to be compensated for by costly human actions (erosion control facilities, imports of fish, etc.).

- Increase basic information and disseminate data. This is constant in these studies: they are mainly based on spatial data sets and on counting resource harvesting (fish, shellfish, wood, etc.). However, the availability of data is lacking at all levels in the sub-region: there is no accounting of timber harvesting (this activity is officially banned, but informal activity is very developed), no estimates of fish catches within MPAs (although data in main sites are relatively substantial in some countries), land use that is not mapped or taken from old maps (lack of data on seabed), etc. Finally, very little is known about the "spillover" effect of fisheries resources from inside to outside MPAs. A few MPAs have hosted pilot projects (Brochier et al., 2013; Mbaye et al., 2015), but this research has not led to the implementation of protocols that can be replicated systematically across all the MPAs in the region. It is imperative to strengthen the basic information data in order to develop effective natural habitat conservation strategies.
- Integrate monetary valuations into a broader process of sustainable financing of MPAs. Monetary valuations highlight the importance of MPAs in guaranteeing many economic activities. Moreover, "willingness-to-pay" evaluations provide an idea of the price to access to certain services. Thus, financing mechanisms (taxes, access fees) can be implemented, as part of a "cost-benefit" approach to protect habitats in MPAs. Mauritania, for example, has introduced a "payment for ecosystem services" system as part of its fisheries agreement with the European Union,

under which part of the EU's financial contribution is allocated to the PNBA (Binet et al., 2013).

- Develop the eco-tourism potential. The region's MPAs have strong tourism potential, due to the beauty of their landscapes and the presence of emblematic animals (birds, marine mammals, etc.). However, tourism is not very well developed in these sites, despite some promising attempts (the Bamboung MPA and Somone MPA in Senegal, the Diawling National Park in Mauritania, etc.). The introduction of sustainable tourism would also generate economic income that would compensate for the loss of income resulting from reduced pressure on resources (Chloé, Gale and Cobb, 2010; Kane, 2014).
- Integrate MPAs and ecosystem services accounting into the Blue Economy strategies of West African countries (including multi-national strategies). The concept of blue economy is developing worldwide. As a continent, Africa already has its own strategy, as do certain states and groups of states. This general framework includes and organises all activities related to maritime space. The monetary value of ecosystem services should therefore be integrated from the earliest stages of designing these strategies (which is the case in many of these documents). In West Africa, such strategic tools should soon be created. These documents are a prime opportunity to integrate ecosystem services into public development policies.



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## 10.10 Closing remarks

This first EdAMP edition shows that the protection of marine and coastal areas is progressing and that the 139 MPAs listed in this publication play, at their own scale, a role in the conservation and, in some cases, thanks to their ecological roles, in the development of local and even distant populations.

The region is close to major offshore oil and gas development. It would be very regrettable if this development was not accompanied by the implementation of dedicated funding to create and support MPAs' operations in the area.

In this dynamic, RAMPAO has a role to play in the selection of areas to be protected for better regional ecological connectivity, in the collection of reliable data on the MPAs network, and in managers' capacity building. During negotiations with investors, governments are the first to be concerned so as to ensure that most vulnerable MPAs to potential oil accidents are included in these discussions and receive dedicated support.

The recommendations to decision-makers are geared towards expanding the MPAs network in the region and, particularly creating MPAs in countries which do not yet have them or have few of them, and in areas that are still poorly represented. Moreover, strong protection areas need to be critically strengthened. The recommendations also concern knowledge, which is still far too incomplete, but above all they point to the weakness of the management of several of these MPAs, which must be provided with human and financial resources to ensure their proper functioning, in particular surveillance, ecological and economic monitoring, and capacity building for both authorities and communities.

In order to meet the 2030 targets set by the Convention on Biological Diversity, priority must be given to other area-based effective conservation measures (OECMs), particularly through highlighting the added value of West African cultural practices in line with biodiversity conservation, in order to strengthen marine protected areas.



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## Bibliography



## Chapter 1 - Monograph of West African marine protected areas

Lo, M. & Touré, O. (2016). *Analyse des dynamiques socio-économiques et évaluation du cadre institutionnel dans la zone du Ndiâël dans la perspective de la remise en eau de la réserve*. UICN, OLAG.

Mondial (2020). Global Mangrove Watch. <https://www.globalmangrovetwatch.org/>

Observatoire pour la Biodiversité et les Aires protégées en Afrique de l'Ouest (OBAPAO) (n.d). Localisation des AMP Gambie. *Étude sur l'état des Aires Marines Protégées*. OBAPAO.

OBAPAO, (n.d). Localisation des AMP Guinée. *Étude sur l'état des Aires Marines Protégées*. OBAPAO.

OBAPAO, (n.d). Localisation des AMP Libéria. *Étude sur l'état des Aires Marines Protégées*. OBAPAO.

OBAPAO, (n.d). Localisation des AMP Mauritanie. *Étude sur l'état des Aires Marines Protégées*. OBAPAO.

OBAPAO, (n.d). Localisation des AMP Sierra Léone. *Étude sur l'état des Aires Marines Protégées*. OBAPAO.

OBAPAO, (n.d). Localisation des AMP Sénégal. *Étude sur l'état des Aires Marines Protégées*. OBAPAO.

Portail officiel du Gouvernement de Côte d'Ivoire (2022). *Adoption par le Conseil des Ministres du décret portant création de l'Aire Marine Protégée de Grand Béréby*. Abidjan, Côte d'Ivoire. [https://www.gouv.ci/\\_conseil-ministre-details.php?recordID=449](https://www.gouv.ci/_conseil-ministre-details.php?recordID=449)

Protected Planet (2015). *Rio Grande de Buba*. Protected Planet. <https://www.protectedplanet.net/317051>

Rede das Areas Protegidas na Guinea-Bissau. *Sistema Nacional das Areas Protegidas da Guinea-Bissau*. <https://ibapgbissau.org/areas-protegidas/>

République Islamique de Mauritanie (2013). *Plan d'aménagement et de gestion d'une aire marine protégée à usages multiples dans la baie de l'étoile*. UNESCO. <http://aires-marines.uqar.ca/id/eprint/84/1/PAG%20AMP%20Baie%20Etoile.pdf>

Réseau Régional d'Aires Marines Protégées en Afrique de l'Ouest (RAMPAO) (n.d). *Période d'application des plans de gestion des AMP du Sénégal*. <https://rampao.org/accueil/>

Organisation des Nations Unies pour l'éducation, la science et la culture (UNESCO) (2012). *Delta du Fleuve Senegal Transboundary Biosphere Reserve, Mauritania/Senegal*: UNESCO <https://en.unesco.org/biosphere/africa/delta-fleuve-senegal>

West Africa Biodiversity and Climate Change (WA BiCC) (n.d). *Sherbro River Estuary Co-Management Plan*. WA BiCC.

Direction des Aires Marines Communautaires Protégées (DAMCP) (n.d). *Réseau des aires protégées gérées par la Direction des Aires marines communautaires protégées*. Dakar, Sénégal: DAMCP.

## Chapter 2 - Dynamics of West African marine protected areas

À propos de l'ICCA Registry. (n.d.). ICCA registry. <https://www.iccaregistry.org/?locale=fr>

Assis, J., Failler, P., Fragkopoulou, E., Abecasis, D., Touron-Gardic, G., Regalla, A., Sidina, E., Dinis, H., Serrao, E. (2021). *Potential Biodiversity Connectivity in the Network of Marine Protected Areas in Western Africa*, *Frontiers in Marine Science*, 8. <https://doi.org/10.3389/fmars.2021.765053>

BirdLife International (2021). *Atlas de sensibilité écologique et biologique dans les zones côtières et offshore de l'Afrique de l'Ouest, notamment en Mauritanie, au Sénégal, en Guinée-Bissau, avec une référence particulière au développement du pétrole et du gaz dans la région*. Cambridge, U.K.: BirdLife International.

Day, J., Dudley, N., Hockings, M., Holmes, G., Laffoley, D., Stolton, S., Wells, S. (2012). *Application des catégories de gestion aux aires protégées: Lignes directrices sur les meilleures pratiques pour les aires protégées No.19*. Gland, Suisse: UICN. <https://portals.iucn.org/library/node/10203>

Diop, S., Barousseau, JP., & Descamps, C. (2014). *The Land/Ocean Interactions in the Coastal Zone of West and Central Africa*. Estuaries of the World (EOTW). Earth and Environmental Science- Earth and Environmental Science (R0). Springer, Cham. <https://doi.org/10.1007/978-3-319-06388-1>

Dudley, N. (2008). *Lignes directrices pour l'application des catégories de gestion aux aires protégées*. Gland, Suisse: UICN. <https://doi.org/10.2305/IUCN.CH.2008.PAPS.2.fr>

Failler, P., Sadio, O. & Touron-Gardic, G. (2018). *État de référence des aires marines protégées du RAMPAO*. Dakar, Sénégal. RAMPAO.

Failler, P., Touron-Gardic, G., Traoré, M., & Phang, S. (2020). *Évaluation de la réalisation officielle de l'objectif 11 d'Aichi pour les pays d'Afrique de l'Ouest: Un double défi de précision et de rattrapage*. Science de l'environnement total. 698 (2020) 134284

Failler, P., Touron-Gardic, G., Traoré, M., & Phang, S. (2020). *Evaluating the official achievement of Aichi Target 11 for West African countries: A twofold challenge of accuracy and catching-up*. Science of The Total Environment. Elsevier B.V. (698), 134284. <https://doi.org/10.1016/j.scitotenv.2019.134284>

- Guizien Katell (2014). *Connectivité et conservation de la biodiversité marine*. Société Française d'Écologie et d'Évolution. <https://sfecologie.org/regard/r60-k-guizien-connectivite-marine/>
- Howard, J., Sutton-Grier, A., Herr, D., Kleypas, J., Landis, E., Mcleod, E., ... Simpson, S. (2017). Clarifying the role of coastal and marine systems in climate mitigation. *Frontiers in ecology and the environment*. V5, Issue 1 <https://doi.org/10.1002/fee.1451>
- Institut Mauritanien de Recherche Océanographique et des Pêches (2013). 4ème Rapport National de la CDB, MDEDD 2012 & *Atlas de vulnérabilité*. (Rapport). IMROP.
- IUCN Green List of Protected and Conserved Areas. (n.d.). IUCN Green List.
- Lisa, M., Andrieu, J., Le Brun, O., Delord, E., Deslarze, K., & Pioch, S. Monitoring mangrove restoration projects in Senegal, Benin, and Costa-Rica using remote sensing.
- MAVA, (2016). *Stratégie MAVA, 2016-2022: programme Afrique de l'ouest*. [Brochure]. Gland, MAVA, Fondation pour la Nature. <https://doi.org/10.22005/bcu.293968>
- Ministère de l'Environnement et du Développement Durable de Mauritanie (2013). *Projet de stratégie nationale pour l'établissement et la gestion d'un réseau national représentatif des aires protégées marines et côtières (2014 – 2020)*.
- Montpetit, S. (2013). *Les aires protégées transfrontalières: au-delà de la conservation de la biodiversité*, [Rapport de maîtrise], Université de Sherbrooke, Canada. [https://savoirs.usherbrooke.ca/bitstream/handle/11143/8124/Montpetit\\_Sandrine\\_MEI\\_2013.pdf?sequence=1&isAllowed=y](https://savoirs.usherbrooke.ca/bitstream/handle/11143/8124/Montpetit_Sandrine_MEI_2013.pdf?sequence=1&isAllowed=y)
- Monteiro, J., Almeida, C., Freitas, R., Delgado, A., Porteiro, F., & Santos, R. S. (Eds). (2008). Coral assemblages of Cabo Verde: preliminary assessment and description, Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, Session number 26.
- Ocean Surface Currents. Map of the coast of west Africa with main rivers and marine currents (n.d.). *Surface Currents in the Atlantic Ocean*.
- Programme des Nations Unies pour l'environnement - World Conservation Monitoring Centre (PNUE-WCMC) (2022). *Ocean + Habitats* [Online]. [habitats.oceanplus.org](http://habitats.oceanplus.org)
- Protected Planet (N.d.). *The World Database on Protected Areas (WDPA)*. <https://www.protectedplanet.net/>
- Sajeva, G., Borrini-Feyerabend, G. & Niederberger, T. (2019). Meanings and More...: Policy Brief of the ICCA Consortium [Barcelona]. *Science of The Total Environment*, 7(698), 2020. <https://www.iccaconsortium.org/wp-content/uploads/2019/11/ICCA-Briefing-Note-7-Final-for-websites.pdf>
- République Islamique de Mauritanie (2013). *Quatrième Rapport National CBD- Version Finale*. (Report). CDB. <https://www.cbd.int/doc/world/mr/mr-nr-04-fr.pdf>
- Secrétariat de la Convention sur la Diversité biologique (2020). Aires marines d'importance écologique ou biologique (AIEB). Endroits spéciaux des océans du monde. Volume 6: *L'océan Atlantique Sud-Est*. Montréal, Canada: CBD. <https://www.cbd.int/marine/ebsa/booklet-06-SEA-fr.pdf>
- Tendeng, P. S., Taibou, B. A., & Karibuhoye, C. (2012). Analyse des lacunes écologiques du réseau régional d'aires marines protégées en Afrique de l'Ouest (RAMPAO). (Rapport RAMPAO). FIBA, PRCM.
- Union Internationale pour la Conservation de la Nature (UICN) (2003). *Stratégie régionale pour les aires marines protégées d'Afrique de l'Ouest*. Gland, Switzerland: UICN.
- Zwarts (2014). *Mangrove dynamics in West Africa. (A&W-report 2029)*: Fondation MAVA, Gland, Suisse. <https://www.altwym.nl/wp-content/uploads/2019/03/2131-Mangrove-West-Africa-AW-2014report-2029.pdf>

### **Chapter 3 - Knowledge and monitoring at the heart of decision making in the creation and management of West African marine protected areas**

- Base de données mondiales sur les aires protégées (World Database on Protected Areas ou WDPA) et Frontières des pays (terrestres et maritimes): PNUE-WCMC. <https://www.protectedplanet.net>
- Bunting, P., Rosenqvist, A., Lucas, R., Rebelo, L-M., Hilarides, L., Thomas, N., ... & Finlayson, C.M. (2018). The Global Mangrove Watch – a New 2010 Global Baseline of Mangrove Extent. *Remote Sensing* 10(10): 1669. <https://doi.org/10.3390/rs10101669>
- Flanders Marine Institute (2019). *Maritime Boundaries Geodatabase*, version 11. <https://doi.org/10.14284/382>
- Freiwald, A., Rogers, A., Hall-Spencer, J., Guinotte, JM., Davies, AJ., Yesson, C., ... Weatherdon, LV. (2021). *Global distribution of cold-water corals* (version 5.1). Fifth update to the dataset in Freiwald et al. (2004) by PNUE-WCMC, in collaboration with Andre Freiwald and John Guinotte. Cambridge (UK): UN Environment Programme World Conservation Monitoring Centre. <https://doi.org/10.34892/72x9-rt61>
- Froese, R. & D. Pauly. (2022). FishBase. <https://www.fishbase.se/search.php>

Global Administrative Unit Layers (GAUL) (2015). Ensemble de données, mise en œuvre par la FAO au sein des projets CountrySTAT et Système d'Information sur les Marchés Agricoles (SIMA): GAUL

Gorud-Colvert, K., Sullivan-Stack, J., Roberts, C., Constant, V., Horta E Costa, B., Pike, E. P., Kingston, N., Laffoley, D., Sala, E., Claudet, J., Friedlander, A. M., Gill, D. A., Lester, S. E., Day, J. C., Gonçalves, E. J., Ahmadi, G. N., Rand, M., Villagomez, A., Ban, N. C., ... Lubchenco, J. (2021). The MPA guide: A framework to achieve global goals for the ocean. *Science*, 373(6560). <https://doi.org/10.1126/science.abf0861>

Hockings, M., Stolton, S., Leverington, F., Dudley, N., & Courrau, J. (2008). *Evaluation de l'efficacité : un cadre pour l'évaluation de l'efficacité de la gestion des aires protégées (2e éd.)*. Lignes directrices sur les meilleures pratiques pour les aires protégées No.14. Gland, Suisse: UICN. UK. <https://portals.iucn.org/library/node/9255>

Jouffray, J-B., Blasiak, R., Norström, A.V., Österblom, H., & Nyström, M. The Blue Acceleration: The Trajectory of Human Expansion into the Ocean. *One Earth*, 1(2), 43-54. <https://doi.org/10.1016/j.oneear.2019.12.016>

Li, Z., Zan, Q., Yang, Q., Zhu, D., Chen, Y., & Yu, S. (2019). Remote Estimation of Mangrove Aboveground Carbon Stock at the Species Level Using a Low-Cost Unmanned Aerial Vehicle System. *Remote Sens.* 11, 1018. <https://doi.org/10.3390/rs11091018>

Lo Iacono, C., Mateo, M. A., Gràcia, E., Guasch, L., Carbonell, R., Serrano, L., ... Dañobeitia, J. (2008). Very high-resolution seismo-acoustic imaging of seagrass meadows (Mediterranean Sea): Implications for carbon sink estimates. *Geophysical Research Letters*, 35(18), L18601. <https://doi.org/10.1029/2008GL034773>

Ondiviela, B., Losada, I. J., Lara, J. L., Maza, M., Galván, C., Bouma, T. J., ... van Belzen, J. (2014). The role of seagrasses in coastal protection in a changing climate. *Coastal Engineering*, 87, 158–168. <https://doi.org/10.1016/J.COASTALENG.2013.11.005>

Organisation des Nations Unies pour l'Alimentation et l'Agriculture (FAO) (2020). *La situation mondiale des pêches et de l'aquaculture 2020. La durabilité en action*. Rome, Italy: FAO. <https://doi.org/10.4060/ca9229fr>

Outil de suivi de la conservation, système d'information de référence mondial (n.d.). BIOPAMA RIS. [https://rris.biopama.org/conservation\\_tracking](https://rris.biopama.org/conservation_tracking)

PAME Dashboard – Assessments. (n.d.). BIOPAMA RIS. <https://rris.biopama.org/pame/assessments>

Pauly, D., Zeller, D. & Palomares, M.L.D. (2020). *Sea Around Us Concepts, Design and Data*. <https://searoundus.org/>

PNUE-WCMC (2022). *Ocean+ Habitats* [En ligne], février 2022. <https://habitats.oceanplus.org/>

PNUE-WCMC, Short FT (2021). *Global distribution of seagrasses* (version 7.1). Seventh update to the data layer used in Green and Short (2003). Cambridge (UK): UN Environment Programme World Conservation Monitoring Centre. <https://doi.org/10.34892/x6r3-d211>

Tableau de bord des aires protégées — Système d'information de référence. (n.d.). BIOPAMA RIS. <https://rris.biopama.org/dashboard>

*The Marine Protection Atlas*. (n.d.). Marine protection Atlas. Home | Marine Protection Atlas ([mpatlas.org](http://mpatlas.org))

Union Internationale pour la Conservation de la Nature (UICN) (2020a). *Liste rouge mondiale des espèces menacées de l'UICN* (version 1). <https://www.iucnredlist.org/resources/spatial-data-download>

World Database on Protected Areas. (2022). Cambridge, Royaume-Uni: PNUE-WCMC et UICN. [www.protectedplanet.net](http://www.protectedplanet.net)

## Chapter 4 - Governance, equity and management of marine protected areas

APAC de Kawawana. (n.d.). ICCA Registry. <https://www.iccaregistry.org/en/explore/Senegal/kawawana>

Bolongfeno Reserve, *The Gambia*. (n.d.) ICCA registry.

Commission mondiale des aires protégées de l'UICN, 2017.

Consortium APAC, (2021). *Rapport 2021 sur les territoires de vie*. (Rapport) en ligne. <https://www.iccaconsortium.org/fr/2021/05/29/le-consortium-apac-lance-un-nouveau-rapport-majeur-sur-les-territoires-de-vie/>

Consortium APAC. *Page d'accueil* (n.d.). <https://www.iccaconsortium.org/fr/decouvrir/>

Convention on Biological Diversity (CBD) (2018). *Décision 14.8. Protected and conserved areas governance in the convention on Biological diversity: a review of key concepts, experiences, and sources of guidance*: CDB. <https://www.cbd.int/doc/c/75d4/07a8/95d2c59b0963a9845fd40d3d/sbstta-22-inf-08-en.pdf>

Convention sur la diversité biologique (CDB) (2020). *Mise à jour de l'avant-projet zéro du Cadre mondial de la biodiversité pour l'après-2020*: CDB. <https://www.cbd.int/article/zero-draft-update-august-2020>

Dème, B., Failler, P. & Touron-Gardic, G. (2021). La gouvernance des aires marines protégées au Sénégal: difficulté de la gestion participative et immobilisme des comités de gestion. *VertigO — La revue électronique en sciences de l'environnement*, 1(21). <https://doi.org/10.4000/vertigo.30880>

- Diatta, C. S., Diouf, M., Karibuhoye C., & Sow, A. A. (2017). Sites naturels sacrés et conservation des ressources marines et côtières en milieu traditionnel diola (Sénégal). *Revue d'ethnoécologie*, 11. <https://doi.org/10.4000/ethnoecologie.2900>
- Enhancing our Heritage (EoH)*. (n.d.). BIOPAMA RIS. <https://rris.biopama.org/fr/node/18803>
- Explore the World's Protected Areas*. (n.d.). Protected Planet. PNUE-WCMC: <https://www.protectedplanet.net/2290>
- Fonds Fiduciaire du Banc d'Arguin et de la Biodiversité Côtière et Marine (BACoMaB) (2020). *Rapport annuel 2020*. (Rapport). BACoMaB. [https://bacomab.org/wp-content/uploads/2021/07/Rapport-BACoMaB-2020\\_forWe\\_finale.pdf](https://bacomab.org/wp-content/uploads/2021/07/Rapport-BACoMaB-2020_forWe_finale.pdf)
- Franks, P., Small, R. & Booker, F. (2018). *Social Assessment for Protected and Conserved Areas (SAPA)*. Methodology manual for SAPA facilitators, Second edition. London, UK: IIED. <https://www.iied.org/14659iied>
- Gannon, P., Dubois, G., Dudley, N., Ervin, J., & Ferroer, S. (2019). Editorial essay: An update on progress towards Aichi biodiversity target 11. *PARKS* 25(2), 7–18. <https://doi.org/10.2305/IUCN.CH.2019.PARKS-25-2PG.en>
- Gurney, G.G., Darling, E.S., Ahmadi, G.N., Agostini, V.N., Ban, N.C., Blythe, J., Claudet, J., Epstein, G., Estradivari, Himes-Cornell, A., Jonas, H.D., Armitage, D., Campbell, S.J., Cox, C., Friedman, W.R., Gill, D., Lestari, P., Mangubhai, S., McLeod, E., Muthiga, N.A., ... Jupiter, S.D. (2021). *Biodiversity needs every tool in the box: use OECMs*. *Nature* 595, 646–649. <https://doi.org/10.1038/d41586-021-02041-4>
- Management Effectiveness Tracking Tool (METT)* (n.d.). BIOPAMA RIS. <https://rris.biopama.org/node/18794>
- Oldekop, J.A., Holmes, G., Harris, W.E., & Evans, K.L. (2016). A global assessment of the social and conservation outcomes of protected areas. *Conservation Biology*. 30, 133 – 141. <https://doi.org/10.1111/cobi.12568>
- Ostrom, E. (1990). *Governing the commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press. <https://doi.org/10.1017/CBO9780511807763>
- Outil intégré de suivi de l'efficacité de la gestion*. (n.d.). BIOPAMA RIS. <https://rris.biopama.org/fr/node/18795>
- Oyono, P.R., Fall, S.M., Said, C.K., Said, A.R., Sidibeh, L., & Sow, M. (2012). *Les Sites Naturels Sacrés de l'Ecorégion Côtière et Marine Ouest-Africaine. Une Exploration et des Options de Reconnaissance Institutionnelle*. Dakar, Sénégal: FIBA. <https://www.iccaconsortium.org/wp-content/uploads/2015/08/example-sacred-site-west-africa-oyono-2012-fr.pdf>
- RAPPAM Methodology*. (2003). WWF. [https://wwf.panda.org/wwf\\_news/?6502/RAPPAM-Methodology](https://wwf.panda.org/wwf_news/?6502/RAPPAM-Methodology)
- Said, A. R., Cardoso, L., Indjai, B., & Nhaga, H. S. (2012). *Identification et caractérisation des sites naturels sacrés côtiers et marins en Afrique de l'Ouest. Rapport de la Guinée-Bissau*. (Rapport). FIBA, Dakar, Sénégal.
- Sambou, S. & Chatelain, C. (2021). *Kawawana — Lorsque la mobilisation communautaire pour l'environnement ramène la bonne vie au village, Sénégal*. <https://report.territoiresoflife.org/fr/territoires/kawawana-senegal/>
- Saraiva, C. (2015). *Os Sítios Sagrados no Arquipélago dos Bijagós*. IMVF-Tiniguena. [https://research.unl.pt/ws/portafiles/portal/2337958/sitios\\_sagrados\\_2\\_.pdf](https://research.unl.pt/ws/portafiles/portal/2337958/sitios_sagrados_2_.pdf)
- Renard, Y. & Touré, O. (2012). *Itinéraires de création d'aires marines protégées (AMP) en Afrique de l'Ouest – Expériences et leçons apprises*. Dakar, Sénégal. FIBA/RAMPAO/PRCM.
- République du Sénégal. DAMCP/MEED (2014). *Évaluation et actualisation du Plan d'Aménagement et de gestion de l'AMP de Joal-Fadiouth. Révision pour la période 2014-2018*.
- République Islamique de Mauritanie (2020). Parc national du Banc d'Arguin. *Plan d'aménagement et de gestion 2020-2024*.
- UICN/PACO, (2012). *Acteurs et gouvernance des aires protégées d'Afrique de l'Ouest: quelle contribution à la conservation ?* Ouagadougou, Burkina Faso: UICN/PACO. [https://papaco.org/wp-content/uploads/2015/08/Etude-papaco-12\\_acteurs.pdf](https://papaco.org/wp-content/uploads/2015/08/Etude-papaco-12_acteurs.pdf)
- UICN, PNUE et WWF (1980). *Stratégie mondiale de la conservation: La conservation des ressources vivantes au service du développement durable*. Gland, Suisse: UICN. <https://portals.iucn.org/library/node/6425>
- UICN (2016). *Résolution WCC-2016-Res-050-FR. Accroître l'étendue des aires marines protégées pour assurer l'efficacité de la conservation de la biodiversité*: Gland, Suisse: UICN. <https://portals.iucn.org/library/node/46467>
- UICN (2009). *Résolution 4.048. Les peuples autochtones, les aires protégées et la mise en œuvre de l'Accord de Durban*. WCC 2008 RES 048. Gland, Suisse: UICN. <https://portals.iucn.org/library/node/44198>
- UNEP-WCMC (2022). *Protected areas map of the world*. UNEP-WCMC. [www.protectedplanet.net](http://www.protectedplanet.net)
- Verschuuren, B., Wild, R., McNeely, J., & Oviedo, G. (2010). *Sacred Natural Sites Conserving Nature and Culture*. Earthscan, London, Washington DC. <https://portals.iucn.org/library/node/9662>

## Chapter 5 - Sustainable financing mechanisms for West African marine protected areas

- Ajonina, G.N., Kairo, J., Grimsditch, G., Sembres, T., Chuyong, G., & Diyouke, E. (2014). Assessment of Mangrove Carbon Stocks in Cameroon, Gabon, the Republic of Congo (RoC) and the Democratic Republic of Congo (DRC) Including their Potential for Reducing Emissions from Deforestation and Forest Degradation (REDD+). In S. Diop et al. (eds.), *The Land/Ocean Interactions in the Coastal Zone of West and Central Africa, Estuaries of the World*. [https://doi.org/10.1007/978-3-319-06388-1\\_15](https://doi.org/10.1007/978-3-319-06388-1_15)
- Alvarez, I., Calas J. & Victorine, R. (2014). *L'innovation dans le financement de la biodiversité. Regards sur la terre*.
- Binet, T., Diazabakana, A. & Hernandez, S. (2015). *Financement durable des Aires Marines Protégées en Méditerranée : analyse financière*. Vertigo Lab, MedPAN, RAC/SPA, WWF Méditerranée.
- Bohorquez, J.J., Dvarkas, A. & Pikitch, E.K. (2019). *Filling the Data Gap – A Pressing Need for Advancing MPA Sustainable Finance*. *Frontiers in Maritime Science*. 6, 45. <https://doi.org/10.3389/fmars.2019.00045>
- de Graaf, G. & Garibaldi, L. (2014). *The value of African fisheries, FAO Fisheries and Aquaculture Circular No. 1093*. Rome, Italie: FAO.
- Dia, M. (2019). *Conceptualisation et Approche méthodologique de l'élaboration des Stratégies nationales de financement durable des Aires protégées dans les pays du bassin du Congo*. GEF-PNUD, Projet Régional de Financement durable des Aires protégées du Bassin du Congo (PIMS 3447), Yaoundé, Cameroun.
- Diouf, P.S. (2014). *Etude de faisabilité de la mise en place de mécanismes de financement durable pour les Aires Marines Protégées du Sénégal*.
- FAO, (2009). *The State of World Fisheries and Aquaculture 2008*. Rome, Italie: FAO.
- Hockings, M., Stolton, S. & Dudley, N. (2000). *Evaluating Effectiveness: A Framework for Assessing the Management of Protected Areas*. Best Practice Protected Area Guidelines Series No. 6. Gland, Switzerland and Cambridge, UK: IUCN. <https://portals.iucn.org/library/node/9701>
- Hogan, R. (2003). Environmentalists target EU access agreement, *Science in Africa*, online magazine.
- IUCN (1993). *Parks for Life: Report of the IVth World Congress on National Parks and Protected Areas*. (Report). Gland, Switzerland: The World Conservation Union.
- Kabelong, B.L.P.R., Noupa P. & Ouedraogo R.A.J.E. (2021). *Financement durable des aires protégées en Afrique centrale et occidentale. Rapport état des lieux des modes de financement des aires protégées et conservées*. (Rapport). BIOPAMA.
- Kabelong Banoho, L.P.R. (2019). *Evaluation monétaire des services écosystémiques des forêts tropicales humides du Cameroun: Cas des forêts sempervirentes et semi-décidues*. [Thèse de Doctorat/Ph.D], Université de Yaoundé I.
- Landreau, B. (2012). *Guide pour l'élaboration des Plans d'Affaire simplifiés pour les Aires Protégées*. RAMP/PAO/FIBA/FFME/AFD. <https://aires-marines.uqar.ca/id/eprint/42/1/Guide%20plans%20affaires%20FIBA.pdf>
- Le BACoMaB, Fonds Fiduciaire du Banc d'Arguin et de la Biodiversité Côtière et Marine : Un mécanisme de financement durable pour la sauvegarde de la biodiversité marine et côtière en Mauritanie*. (n.d.). Fonds Fiduciaire du Banc d'Arguin et de la Biodiversité Côtière et Marine. <https://bacomab.org/>
- Marcos, C., Díaz, D., Fietz K., Forcada, A., Ford, A., García-Charton, J.A., ... Pérez-Ruzafa, A. (2021). Reviewing the Ecosystem Services, Societal Goods, and Benefits of Marine Protected Areas. *Frontiers in Marine Science*. 8:613819. <https://doi.org/10.3389/fmars.2021.613819>
- Matthew, S. (2003). Small-scale fisheries perspectives on an ecosystem-based approach to fisheries management. In Sinclair M. and Valdimarsson G. (eds), *Responsible Fisheries in the Marine Ecosystem*. Rome, Italie: FAO. <https://doi.org/10.1079/9780851996332.0047>
- O'Leary, B.C., Ban, N.C., Fernandez, M., Friedlander, A.M., García-Borboroglu, P., Golbuu, Y., ... Robertset, C. M. (2018). Addressing criticisms of large-scale marine protected areas. *Bioscience*, 68, 359–370. <https://doi.org/10.1093/biosci/biy021>
- Organisation for Economic Co-operation and Development (OECD) (2015). *Sustainable financing for marine ecosystem services in Mauritania and Guinea-Bissau*. OECD *Environment Policy Paper* N° 10. OECD.
- OECD, (2018). *Sustainable financing for marine ecosystem services in Mauritania and Guinea-Bissau*. OECD *Environment policy paper* N° 10. OECD. <https://www.oecd.org/countries/mauritania/Policy-Paper-Sustainable-financing-for-marine-ecosystem-services-in-Mauritania-Guinea-Bissau.pdf>
- Parcs Canada (2008). *Guide de la planification de la gestion de Parcs Canada*. Agence Parcs Canada.
- Parcs Canada (2013). *Aire marine nationale de conservation du Lac-Supérieur : Stratégie de l'expérience du visiteur*. Agence Parcs Canada.
- UICN/PACO, (2010). *Le tourisme dans les aires protégées d'Afrique de l'Ouest : quelle contribution à la conservation ?* Ouagadougou, BF: UICN/PACO.

## Chapter 6 - Pollution, degradation and threats in West African marine protected areas

- Afeti, G. M., & Resch, F. J. (2000). Physical characteristics of Saharan dust near the Gulf of Guinea. *Atmospheric Environment*, 34(8), 1273–1279. [https://doi.org/10.1016/S1352-2310\(99\)00296-4](https://doi.org/10.1016/S1352-2310(99)00296-4)
- African Clean Cities Platform (ACCP) (2019). Africa Solid Waste management. *Data Book 2019*. African Clean Cities Platform. [https://africancleancities.org/sites/default/files/2023-06/2\\_Africa\\_Solid\\_Waste\\_Management\\_Data\\_Book\\_2019.pdf](https://africancleancities.org/sites/default/files/2023-06/2_Africa_Solid_Waste_Management_Data_Book_2019.pdf)
- Agromssidayu, (2022). *Qu'est-ce que la pollution thermique ?* Agromssidayu.
- Anonyme, (2022). *Pollution visuelle : caractéristiques, causes, types, effets, exemples - environnement*. Journal mural.
- Anonyme, (n.d.). *Les sous-couches électroniques*.
- Antoine M., K., I. (2009). *Impact de l'exploitation Pétrolière sur la santé des populations locales et de l'environnement à Moanda : Cas de la firme Perenco*. Réseau Ressources Naturelles (R.R.N) Plate - Forme de Monitoring et de Gouvernance.
- Bally M., (2016). *Tourisme en Afrique : une richesse inestimable encore insuffisamment exploitée*. Azalaï Hotels. <https://blog.secteur-prive-developpement.fr/2016/06/27/tourisme-en-afrique-une-richesse-inestimable-encore-insuffisamment-exploitee/>
- Bauer, S. E., Im U., Mezuman, K., & Gao, C. Y. (2019). Desert dust, industrialization, and agricultural fires: Health impacts of outdoor air pollution in Africa. *Journal of Geophysical Research: Atmospheres*, 124, 4104–4120. <https://doi.org/10.1029/2018JD029336>
- Baur, B., Duelli, P., Edwards, P.J., Jenni, M., Klaus, G., Künzle, I., ... Suter W. (2004). *La biodiversité en Suisse. Etat, sauvegarde, perspectives*. Forum Biodiversité Suisse, Haupt Verlag Bern, Suisse.
- Binet, T., Failer, P. & Thrope, A. (2012). *Migration of Senegalese Fishers: A Case for Regional Approach to Management*. *Maritime Studies*, 1(11), 1-14. <https://doi.org/10.1186/2212-9790-11-1>
- Borrini-Feyerabend, G. (2010). *En gouvernance partagée ! Un guide pratique pour les aires protégées en Afrique de l'Ouest*. PRCM/UICN/CEESP, Dakar, Sénégal. <https://www.iccaconsortium.org/wp-content/uploads/2016/07/engouvernancebat3.pdf>
- Bourzac, K. (2019). *Air pollution kills 780,000 people in Africa each year*. <https://cen.acs.org/environment/pollution/Air-pollution-kills-780000-people/97/i17>.
- Boutrais, J. (2006). *Pastoralisme et aires protégées en Afrique de l'Ouest et de l'Est. Séminaire de clôture de l'ATI Aires Protégée*. IRD, Parc naturel régional du Queyras. [https://horizon.documentation.ird.fr/exl-doc/pleins\\_textes/divers18-02/010043950.pdf](https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers18-02/010043950.pdf)
- Branch, N. (2016). *La pollution – le rejet de déchets illégaux en Afrique de l'Ouest*. <https://rightforeducation.org/fr/2016/09/23/la-pollution-le-rejet-de-dechets-illegaux-en-afrique-de-louest/>
- Bruderer, B., Peter, D. & Steuri, T. (1999). Behaviour of migrating birds exposed to X-band radar and a bright light beam. *Journal of Experimental Biology* 2002. 1015-1022. <https://doi.org/10.1242/jeb.202.9.1015>
- Canary Current Large Marine Ecosystem Project (CCLME) (2014). *Évaluation des activités terrestres pouvant constituer des sources de pollution marine et côtière des pays du Grand Ecosystème Marin du Courant des Canaries : PNUE/GEF/Convention d'Abidjan*. <https://www.fao.org/in-action/cclme/documentation/detail/fr/c/881394/>
- Chrystelle, M. (2018). *Pollution et présence des aérosols en Afrique de l'Ouest : les grandes conclusions du « DACCIWA » présentées aux décideurs politiques*. Savoir News. <https://www.savoirnews.net/pollution-et-presence-des-aerosols-en-afrique-de-louest-dacciwa-presente-les-grandes-conclusions-aux-decideurs-politiques/>
- Club du Sahel et de l'Afrique de l'Ouest/OCDE, (2006). *Crevetticulture durable en Afrique de l'Ouest : opportunité et coopération Sud-Sud. Table ronde régionale Conakry (Guinée)*. Club du Sahel et de l'Afrique de l'Ouest: OCDE.
- Cormier-Salem, M. & Panfili, J. (2016). Mangrove Reforestation: Greening or Grabbing Coastal Zones and Deltas? Case Studies in Senegal. *African Journal of Aquatic Science*, 1 (41), 89-98.
- Croitoru, L., Miranda, J. J. & Sarraf, M. (2019). *Le coût de la dégradation de la zone côtière en Afrique de l'Ouest : Bénin, Côte d'Ivoire, Sénégal et Togo*. Avec Fadi Doumani et Jia Jun Lee. Banque mondiale.
- DACCIWA, (2016). *Mieux comprendre les impacts de la pollution en Afrique de l'Ouest*. Communiqué de presse national. <https://www.cnrs.fr/fr/presse/dacciwa-mieux-comprendre-les-impacts-de-la-pollution-en-afrique-de-louest>
- Dahou, T., Weigel, J.-Y., Ould Saleck, A. M., Da Silva, A.-S., Mbaya, M., & Noel, J.-F. (2004). *La gouvernance des aires marines protégées : leçons ouest-africaines*. Vertigo, tome 5, article n° 3. <https://doi.org/10.4000/vertigo.3327>
- De Longueville, F., Hountondji, Y.-C., Henry, S., & Ozer, P. (2010). What do we know about effects of desert dust on air quality and human health in West Africa compared to other regions? *Science of the Total Environment*, 409(1), 1–8. <https://doi.org/10.1016/j.scitotenv.2010.09.025>

- Descroix, L., Genthon, P., Peugeot, C., Mahé, G., Malam, A.-M., Vanderevaere, J.-P., ... Zannou, A. (2015). *Paradoxes et contrastes en Afrique de l'Ouest : impacts climatiques et anthropiques sur les écoulements*. Géologues, tome 187, 47-52.
- Diouf, P. S. & Sané, K. (2019). *Stratégie Nationale des Aires Marines Protégées du Sénégal*. DAMCP/MEDD.
- Diouf, P. S. (2019). *Plan d'Action National de Gestion des déchets dangereux (2020 – 2024)*. PRODEMUD, GEF, ONUDI.
- Diouf, P. S. (2022). *Les impacts du développement des infrastructures sur les mangroves, herbiers marins et tortues marines dans les zones d'intérêt écologique ou biologique du Cabo Verde, de la République de Guinée, de la Mauritanie et du Sénégal*. RAMPAAO.
- Diouf, P. S., Ngom, M. & Fall, M. (2016). *Ichtyofaune et pêche dans le lac de Guiers et la réserve du Ndiàël*. UICN/OLAG.
- Diop, S., ND. *Les écosystèmes marins et côtiers de l'Afrique de l'Ouest : enjeux de leur gestion à long terme et de leur développement durable - Exemple du Sénégal*. PNUE.
- Doamba, S. W. M. F., Savadogo, P. & Nacro, H. B. (2014). *Rôle des feux de savane sur les caractéristiques biogéochimiques des sols en zone soudanienne du Burkina Faso*. International Journal of Biological and Chemical Sciences 8(2): 777-793. <https://doi.org/10.4314/ijbcs.v8i2.34>
- Dolidon, H. (2007). *La multiplicité des échelles dans l'analyse d'un phénomène d'interface nature/société. L'exemple des feux de brousse en Afrique de l'Ouest*. <https://doi.org/10.4000/cybergeogeo.4805>
- Ensemble, relevons les défis de l'Eau et de l'Environnement*. (n.d.). BRL Ingénierie. <https://brli.brl.fr/eau-&-risques-89.html>
- Failler, P. & Ba, T. (2017). *Évaluation finale du projet gestion intégrée des zones côtières –Sénégal. Rapport final*. (Rapport). Contrat cadre bénéficiaires 2013, EuropeAid/132633/C/SER/Multi, Lot 6: Environnement, Requête n°2016/379204-1.
- Failler, P., Sadio, O. & Touron-Gardic, G. (2018). *État de référence des aires marines protégées du RAMPAAO*, Dakar, Sénégal. RAMPAAO.
- Failler, P., Touron-Gardic, G., Sadio, O., & Traore M. S. (2019). *Menaces sur les aires marines protégées en Afrique de l'Ouest : de la pêche non contrôlée aux changements climatiques*. Mondes en développement, 2019/3 (187), (133 – 152). <https://www.cairn.info/revue-mondes-en-developpement-2019-3-page-133.htm?ref=doi>
- FAO, (2018). *Les polluants issus de l'agriculture représentent une menace sérieuse pour l'eau du monde entier*: FAO. <https://news.un.org/fr/story/2018/06/1017092>
- Faye, I. (2010). *Dynamique du trait de côte sur les littoraux sableux de la Mauritanie à la Guinée-Bissau (Afrique de l'Ouest) : approches régionale et locale par photo-interprétation, traitement d'images et analyse de cartes anciennes*, [Thèse de doctorat en géographie], Université de Bretagne Occidentale, Brest.
- Gaia Planète, ND. *La pollution sonore des océans, le monde du silence n'est plus*. Gaia Planète.
- Garba, I., Abdou Amadou, S., Barry, B., & Ouedraogo, S. (2021). *Suivi des feux de brousse en Afrique de l'Ouest et au Sahel, un outil d'aide à la décision*. International Journal of Biological and Chemical Sciences. 15(6): 2636-2651. <http://dx.doi.org/10.4314/ijbcs.v15i6.30>
- Garcin, M., Gicquel, C., Billy, J., Desmazes, F., & Maspataud, A. (2020). *Impact des activités humaines sur l'évolution du littoral en Afrique de l'Ouest - Contribution des données historiques de WACA-F*. XVIèmes Journées Nationales Génie Côtier. Génie Civil, Le Havre. <http://dx.doi.org/10.13140/RG.2.2.34796.31364>
- Géoportail*. (n.d.). République française. <https://www.geoportail.gouv.fr/donnees/plan-ign-v2#>
- Gemenne, F., Blocher, J., De Longueville, F., & Vigil, S. (2017). *Climate Change, Natural Disasters and Population Displacements*. West Africa, Geo-Eco-Trop, vol. 41, n° 3, 317-337.
- GI WACAF, (2019). *L'Initiative mondiale pour l'Afrique occidentale, centrale et australe - Renforcer les capacités de préparation et de lutte contre les déversements d'hydrocarbures - Contribuer à une meilleure protection du milieu marin dans la région*. GI WACAF/OMI/PIECA. <https://www.giwacaf.net/fr/publications/presentation-du-gi-wacaf>
- Goeury, D. (2014). *La pollution marine*. In Woessner Raymond (dir.), *Mers et océans*, Paris: Atlante, Clefs concours. <https://hal.science/hal-01091818>
- Johnson, D. E., Martinez, C., Vestergaard, O., Duval-Diop, D., Romani, M., Mc Connell, M. C., ... Brown, K. (2014). *Building the Regional Perspective: Platforms for Success, Aquatic Conservation*. *Marine and Freshwater Ecosystems*. vol. 24, n° S2, 75-93. <https://doi.org/10.1002/aqc.2515>
- Joyeux, C., Gale, J. & Cobb, S. (2010b). *Analyse du contexte régional pour le financement durable des AMP d'Afrique de l'ouest - proposition de renforcement de leur financement durable des AMP d'Afrique de l'Ouest - proposition de renforcement de leur durabilité*. PRCM/RAMPAAO/FIBA, Dakar, Sénégal.
- Kaluza, P., Kölzsch, A., Gastner M.T., & Blasius, B. *The complex network of global cargo ship movements*. Journal of the Royal Society Interface. <https://doi.org/10.1098/rsif.2009.0495>

- Kameda, T., Azumi, E., Fukushima, A., Tang, N., Matsuki, A., Kamiya, Y., ... Hayakawa, K. (2016). Mineral dust aerosols promote the formation of toxic nitropolycyclic aromatic compounds. *Scientific Reports*, 6(1), 24427. <https://doi.org/10.1038/srep24427>
- Kamrowski, R. L., Limpus, C., Moloney, J., & Hamann, M. (2012). Coastal light pollution and marine turtles: Assessing the magnitude of the problem Agriculture and marine pollution. *Endangered Species Research*, (19), 85–98. <https://research-repository.griffith.edu.au/bitstream/handle/10072/400768/Kamrowski454897-Published.pdf?sequence=2&isAllowed=y>
- Kana, C. E. & Etouna, J. E. (2006). Apport de trois méthodes de détection des surfaces brûlées par imagerie Landsat ETM+: application au contact forêt- savane du Cameroun. *European Journal of Geography*. <https://doi.org/10.4000/cybergeo.2711>
- Kane, A. (2014). *Programme d'action mondiale pour la protection du milieu marin contre la pollution due aux activités terrestres : le cas du Sénégal*. CCLME.
- Karibuhoye, C. (2008). *Le programme aires marines protégées de la Fondation internationale pour le Banc d'Arguin*. Numéro spécial Aires Marines Protégées. N°6, 2-3. <https://papaco.org/fr/wp-content/uploads/2015/07/lettreAPAO-6-0308.pdf>
- Kloff, S., Wicks, C. & Siegel, P. (2010). *Industries extractives et développement durable : « Guide de meilleures pratiques pour l'exploitation pétrolière et gazière offshore dans l'Écorégion Marine Ouest-Africaine »*. WWF.
- Kobler, R. (2002). *Die Lichtverschmutzung in der Schweiz. Mögliche Auswirkungen und praktische Lösungsansätze*.
- Larinier, M. & Boyer-Bernard, S. (1991). Downstream migration of smolts and effectiveness of a fish bypass structure at halsou hydroelectric powerhouse on the nive river. *Bulletin Français de la Pêche et de la Pisciculture*, 321, 72–92
- Meier, S., Andersen, E.T., Hasselberg, L., Kjesbu, O.S., Klugsøyr, J., & Svardal, A. (2002). Hormonal effects of C4-C7 Alkylphenols on cod (*Gadus morhua*). Report to the Norwegian Oil Industry Association, *Norwegian Institute of Marine Science*. [www.imr.no/](http://www.imr.no/)
- Molenaar de, J.G., Jonkers, D.A. & Sanders, M.E. (2000). *Road illumination and nature. III. Local influence of road lights on a Black-tailed Godwit (Limosa l. limosa) population*. Wageningen. The Netherlands: Alterra. <https://research.wur.nl/en/publications/road-lightning-and-grassland-birds-local-influence-of-road-lightn>
- Mission d'Observation du Littoral Ouest Africain (MOLOA), (2021). *Bilan 2020 des littoraux d'Afrique de l'Ouest/document général*. UEMOA.
- Moore, M. V. & Kolher, S. J. (2002). *Measuring light pollution in urban lakes and its effects on lake invertebrates. Part of the conference Ecological Consequences of Artificial Night Lighting*. Abstract available online: <http://www.urbanwildlands.org/abstracts.html>
- Moore, M.V., Pierce, S.M., Walsh, H.M., Kvalvik S. K., & Lim, J. D. (2000). Urban light pollution alters the diel vertical migration of *Daphnia*. *Verh. International Verien Limnology* 27: 779-782. [https://www.researchgate.net/publication/233966352\\_Urban\\_light\\_pollution\\_alters\\_the\\_diel\\_vertical\\_migration\\_of\\_Daphnia](https://www.researchgate.net/publication/233966352_Urban_light_pollution_alters_the_diel_vertical_migration_of_Daphnia)
- Ndour, N., Dieng, S. & Fall, M. (2012). *Rôles des mangroves, modes et perspectives de gestion au delta du saloum (Sénégal)*. *Vertigo*, vol. 11, n° 3.
- Nemeth, R. S. & Aderson, J. J. (1992). Response of juvenile coho and chinook salmon to strobe and mercury vapor lights. *North American Journal of Fisheries Management*, 12(4):684–692.
- Nionko, S. (2020). *La surveillance de l'AMP de Sangomar demande plus de moyens, selon son conservateur*. <https://www.koldanews.com/2020/10/07/la-surveillance-de-lamp-de-sangomar-demande-plus-de-moyens-conservateur-a1260594.html>
- Ocean Care, (2017). *Le bruit en milieu marin et les objectifs de développement durable*. Ocean Care.
- Oceancampus, (2018). *L'océan et la menace plastique*. Surfrider Foundation Europe.
- Sustainable management of the Canary Current Large Marine Ecosystem (CCLME)*. (n.d.). Organisation des Nations Unies pour l'Alimentation et l'Agriculture (FAO). <https://www.fao.org/in-action/canary-current-lme>
- Patin, S. (1999). *Environmental impact of the offshore oil and gas industry*. EcoMonitor Publishing East Northport, New York. [www.offshore-environment.com](http://www.offshore-environment.com)
- Persohn, C., Helloco, L., Baudinière, E., & Martinez L. (2020). *Préconisations pour limiter les impacts des émissions acoustiques en mer d'origine anthropique sur la faune marine*. Ministère de la Transition Ecologique et Solidaire.
- Pierce, S.M. & Moore, M.V. (1998). *Light pollution affects the diel vertical migration of freshwater zooplankton*. *Annual Meeting of the Ecological Society of America*. Baltimore, MD.
- PRCM, (2011). *À la découverte de l'environnement côtier et marin en Afrique de l'Ouest – Cahier de connaissances. Programme Régional d'Éducation à l'Environnement*. UICN Guinée-Bissau.
- PRCM, (2012). *Agir ensemble dans la même direction, une coalition pour faire face aux défis de la zone côtière en Afrique de l'Ouest, Nouakchott*. PRCM.
- Raaschou-Nielsen, O., Andersen, Z. J., Beelen, R., Samoli, E., Stafoggia, M., Weinmayr, G., Hoffmann, B., Fischer, P., Nieuwenhuijsen, M. J., Brunekreef, B., Xun, W. W., Katsouyanni, K., Dimakopoulou, K., Sommar, J., Forsberg, B., Modig, L., Oudin, A., Oftedal, B., Schwarze,



- P. O., ... Hoek, G. (2013). Air pollution and lung cancer incidence in 17 European cohorts: Prospective analyses from the European Study of Cohorts for Air Pollution Effects (ESCAPE). *The Lancet Oncology*, 14(9), 813–822. [https://doi.org/10.1016/s1470-2045\(13\)70279-1](https://doi.org/10.1016/s1470-2045(13)70279-1)
- Réveillard, M-F. (2020). *Un continent qui étouffe sous la pollution urbaine*. Afrique la tribune. <https://afrique.latribune.fr/entreprises/industrie/energie-environnement/2020-03-06/un-continent-qui-etouffe-sous-la-pollution-urbaine-841312.html>
- Sakho, I., Mesnage, V., Deloffre, J., Lafiotte, R., Niang, I., & Faye, G. (2011). The Influence of Natural and Anthropogenic Factors on Mangrove Dynamics over 60 Years: The Somone Estuary, Senegal, Estuarine. *Coastal and Shelf Science*, (94), 93-101. <http://dx.doi.org/10.1016/j.ecss.2011.05.032>
- Salmon, M. (2003). Artificial night lighting and sea turtles. *Biologist*. 50, 163–168
- Sandra, K. & Wicks, C., ND. *Gestion environnementale de l'exploitation de pétrole offshore et du transport maritime pétrolier*. WWF, IUCN, FIBA, Wetlands International, CSRP.
- Sandra, K., Clive, W. & Siegel, P. (2010). *Industries extractives et développement durable : « Guide de meilleures pratiques pour l'exploitation pétrolière et gazière offshore dans l'Écorégion Marine Ouest-Africaine »*. WWF.
- Sarr, O. (2005). *Aire marine protégée, gestion halieutique, diversification et développement local : le cas de la Réserve de Biosphère du delta du Saloum (Sénégal)*, [Thèse de doctorat en biologie marine], Université de Bretagne occidentale (UBO), Brest. <http://hdl.handle.net/1834/2617>
- Senegal Black Rainbow, (2014). *Aire marine protégée de Joal-Fadiouth*.
- Shah, A. S., Langrish, J. P., Nair, H., McAllister, D. A., Hunter, A. L., Donaldson, K., Newby, D.E., Mills, N. L. (2013). Global association of air pollution and heart failure: A systematic review and meta-analysis. *The Lancet*, 9897 (382), 1039 – 1048. [https://doi.org/10.1016/S0140-6736\(13\)60898-3](https://doi.org/10.1016/S0140-6736(13)60898-3)
- Siblet, J-P. (2008). *Impact de la pollution lumineuse sur la biodiversité. Synthèse bibliographique*. Service du Patrimoine Naturel, Département Ecologie et Gestion de la Biodiversité.
- Staub, F., Duval-Diop, D. & Tendeng P. (2014). *Analyse de compétences et lacunes des acteurs du réseau régional d'aires marines protégées en Afrique de l'Ouest et recommandations*. RAMPAO.
- Takahata, C., Amin, R., Sarma, P., Banerjee, G., Oliver W., & Fa, J. E. (2010). Remotely-Sensed Active Fire Data for Protected Area Management: Eight-Year Patterns in the Manas National Parks. *Indian Environmental Management*, 45: 414-423. <https://doi.org/10.1007/s00267-009-9411-8>
- Teyssèdre, A. (1996). *L'orientation des animaux – Méthodes et mécanismes*. Nathan.
- Touré, A., Ndiaye, M.-L., Traoré, V. B., Faye, G., Cissé, B., Ndiaye, A., ... Wade, C. T. (2016). Présence de métaux lourds et de résidus médicamenteux dans les effluents des établissements de santé de Dakar (Sénégal). *International Journal of Biological and Chemical Sciences*, vol. 10, n° 3, 1422-1432.
- Triplet, P. (2018). *Sénégal : le Parc national des oiseaux du Djoudj, un monument naturel menacé*. ResearchGate, 7 p. [https://www.researchgate.net/publication/326447957\\_Senegal\\_le\\_Parc\\_national\\_des\\_oiseaux\\_du\\_Djoudj\\_un\\_monument\\_naturel\\_menace/link/5b4e189e45851507a7a98b8c/download](https://www.researchgate.net/publication/326447957_Senegal_le_Parc_national_des_oiseaux_du_Djoudj_un_monument_naturel_menace/link/5b4e189e45851507a7a98b8c/download)
- UEMOA, M. (2017). *Bilan 2016 des littoraux d'Afrique de l'Ouest. Document général*. UEMOA
- Union Economique et Monétaire Ouest Africaine (UEMOA). & Union Internationale pour la Conservation de la Nature (UICN). (2010). *Etude de suivi du trait de côte et schéma directeur littoral de l'Afrique de l'Ouest. Etude de suivi du trait de côte et schéma directeur littoral de l'Afrique de l'Ouest*. UEMOA – Prescriptions détaillées. UICN.
- Valea, F. & Ballouche, A. (2012). Les feux de brousse en Afrique de l'Ouest : contraintes environnementales ou outil de gestion environnementale ? L'exemple du Burkina Faso. *Territoire d'Afrique*, 3, 36–47. <https://www.researchgate.net/publication/257298202>
- WACA, 2016. *Réduire la pollution marine et côtière*. WACA/Groupe de la Banque mondiale, Fiche de Connaissance n°5.
- Warbletoncouncil (2022). *Pollution visuelle : caractéristiques, causes, types, effets, exemples* : Warbletoncouncil. <https://fr1.warbletoncouncil.org/contaminacion-visual-9246#menu-8>
- Weigel, J.-Y., Féral, F. & Cazalet, B., 2011. *Governance of Marine Protected Areas in the Least-Developed Countries: Case Studies from West Africa*. FAO Fisher, FAO. <https://www.fao.org/3/i2378e/i2378e00.htm>
- West, J. J., Cohen, A., Dentener, F., Brunekreef, B., Zhu, T., Armstrong, B., Bell, M. L., Brauer, M., Carmichael, G., Costa, D. L., Dockery, D. W., Kleeman, M., Krzyzanowski, M., Künzli, N., Lioussé, C., Candice Lung, S-C., Martin, R. V., Pöschl, U., Pope 3rd, C. A., ... Wiedinmyer, C. (2016). What we breathe impacts our health: Improving understanding of the link between air pollution and health. *Environmental Science & Technology*, 50(10), 4895–4904. <https://doi.org/10.1021/acs.est.5b03827>
- Witherington, B. E. (1997). *The problem of photopollution for sea turtles and other nocturnal animals*. In CLEMMONS, J.R. & BUCHOLTZ, R., (eds). Behavioral approaches to conservation in the wild (pp 303-328). Cambridge University Press.

- Wood, D. (2021, Oct. 26). *Satellites Can Spy a Menace in West Africa: Invasive Flowers*. <https://www.wired.com/story/satellites-can-spy-a-menace-in-west-africa-invasive-flowers/>
- WWF & PNUD. (2014). *Évaluation de l'efficacité de gestion des aires marines protégées de l'éco-région WAMER par l'outil RAPPAM 1*, Dakar, Sénégal: PNUD.
- Wyzga, R. E., & Rohr, A. C. (2015). Long-term particulate matter exposure: Attributing health effects to individual PM components. *Journal of the Air & Waste Management Association*, 65(5), 523–543. <https://doi.org/10.1080/10962247.2015.1020396>
- Yurk, H. & Trites, A.W. (2000). Experimental attempts to reduce predation by Harbour seals on out-migrating juvenile salmonids. *Transactions of the American Fisheries Society*, 6 (129), 1360-1366. [https://doi.org/10.1577/1548-8659\(2000\)129%3C1360:EATRPB%3E2.0.CO;2](https://doi.org/10.1577/1548-8659(2000)129%3C1360:EATRPB%3E2.0.CO;2)

## Bibliography on the offshore oil industry in Senegal

- ACET. (2012). *Bulletin Politique « Services des Ressources Durables »*. Atelier d'information sur l'organisation du comité consultatif scientifique et technique de la direction des aires marines communautaires protégées (DAMCP), édition 2022, tenu le 25 mai.
- Bakun, A. (1996): Enrichment processes (enriching the “broth”) In *Ocean processes and marine population dynamics*, (pp 43-56). University of California Sea Grant.
- Bommier, S. (2016). *A flawed development. Land dispossession, transnational social movements and extraterritorial corporate regulation. Michelin in Tamil Nadu*. [Ph.D Thesis], Sciences Po Paris.
- Bommier, S., Renouard, C., (2020). « RSE », Groupe Cynorodhon, *Dictionnaire critique de l'Anthropocène*, Paris, France: Editions du CNRS. (717-720).
- Groupe de la Banque mondiale. *Rapport d'évaluation des industries extractives*. (2004).
- Magrin, G., Van Dessel, B. & Van Vliet, G. (2009). *Panel scientifique indépendant sur les activités pétrolières et gazières en République Islamique de Mauritanie : « la Mauritanie et la mer, et si le pétrole aidait à mieux gérer l'insécurité écologique »*. Rapport définitif, Nouakchott, Mauritanie: UICN.
- Patin, S. (1999). *Environmental impact of the offshore oil and gas industry*. New York, USA: EcoMonitor Publishing East Northport. [www.offshore-environment.com](http://www.offshore-environment.com)
- Steiner, R. (2003). *Background document on offshore oil for Stakeholders of the Baltic Sea region*. [Unpublished manuscript].
- World Bank. (2004). *The extractive industries review*. The Executive Summary of the Report has been translated into Spanish, French and Russian languages. World Bank. [https://www.eib.org/attachments/thematic/extractive\\_industries\\_en.pdf](https://www.eib.org/attachments/thematic/extractive_industries_en.pdf)

## Chapter 7 - West African marine protected areas and climate change

- Alcala, A. C., & Russ, G. R. (1990). A direct test of the effects of protective management on abundance and yield of tropical marine resources. *ICES Journal of Marine Science*, 47(1), 40-47. <https://doi.org/10.1093/icesjms/47.1.40>
- Ali, (2011). Climate variability and change in the Sahel. Understanding the current situation by observing. Climate change in the Sahel. A challenge for sustainable development. *AGRHYMET Monthly Bulletin* (Special Issue), 17–20.
- Barange, M., Heip C. & Meysman, F. (2011). Biological changes. In *Climate Change and Marine Ecosystem Research Synthesis of European Research on the Effects of Climate Change on Marine Environments*, (59-82). Clamer.
- Barousseau, J. P., Diop, E. H. S., Giresse, P., Monteillet, J., & Saos, J. L. (1986). *Conséquences sédimentologiques de l'évolution climatique fini-holocène (10 puissances 2-10 puissance 3) dans le delta du Saloum (Sénégal)*.
- Barrière, O., Behnassi, M., David, G., Douzal, V., Fargette, M., Libourel, T., ... Morand, S. (2019). *Coviability of Social and Ecological Systems: Reconnecting Mankind to the Biosphere in an Era of Global Change*. [https://doi.org/10.1007/978-3-319-78111-2\\_11](https://doi.org/10.1007/978-3-319-78111-2_11)
- Belle, E.M.S., Burgess N.D., Misrachi, M., Arnell, A., Masumbuko, B., Somda, J., Hartley, A., Jones, R., Janes, T., McSweeney, C., Mathison, C., Buontempo, C., Butchart, S., Willis, S. G., Baker, D. J., Carr, J., Hughes, A., Foden, W., Smith, R. J., ... Kingston, N. (2016). *Impacts du changement climatique sur la biodiversité et les aires protégées en Afrique de l'Ouest. Résumé des résultats du projet PARCC, Aires protégées résilientes au changement climatique en Afrique de l'Ouest*. Cambridge, Royaume-Uni: PNUD-WCMC.
- Bindoff, N.L. J., Willebrand, V., Artale, A., Cazenave, J., Gregory, S., Gulev, K., ... Unnikrishnan, A. (2007). *Observations: Oceanic Climate Change and Sea Level*. In *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B.Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.
- Biona, C. B., Mpounza, M., (n. d.). *Impacts des effets actuels et attendus des changements climatiques en République du Congo*.
- Bodian A. (2011). *Approche par modélisation pluie-débit de la connaissance régionale de la res source en eau : Application au haut bassin du fleuve Sénégal*, [thèse de doctorat], Université Cheikh Anta Diop. <https://dx.doi.org/10.4000/physio-geo.2561>

- Boero F., Féral J.P., Azzurro E., Cardin V., Riedel B., Despalatović M., ... Briand, F. (2008). Climate warming and related changes in Mediterranean marine biota. In F. Briand (Ed.), *CIESM Workshop Monographs* No. 35 (pp. 5-21). Monaco: CIESM.
- Bonnin, M., Laë, R. & Behnassi, M. (2015). *Toujours plus d'aires marines protégées ! introduction*. IRD. [https://horizon.documentation.ird.fr/exl-doc/pleins\\_textes/divers18-08/010065598.pdf](https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers18-08/010065598.pdf)
- Boulanodji, E. (2014). *Analyse et compréhension des liens existant entre le changement climatique, les aires protégées et les communautés au Tchad*. In press, PNUE-WCMC technical report.
- Contribution déterminée au niveau national (CDN) (2016). *Evaluation de la vulnérabilité du Secteur de la biodiversité au climat et de l'adaptation aux changements climatiques dans le cadre de la Contribution Déterminée au niveau national (CDN)*. Centre Régional AGRHYMET. (n.d.). AGRHYMET. <https://agrhymet.cilss.int/>
- Chaboud, C., Galletti, F., David, G., Ambroise Brenier, A., MÉRAL, P., Andriamahefazafy, F., ... Ferraris, J. (2008). Aires marines protégées et gouvernance : contribution des disciplines et évolution pluridisciplinaire. In Aubertin, C., Rodary, E. (éd.) *Aires protégées : Espaces durables ?* IRD Éditions, coll. Objectif Suds: 55-81. [https://horizon.documentation.ird.fr/exl-doc/pleins\\_textes/ed-06-08/010045265.pdf](https://horizon.documentation.ird.fr/exl-doc/pleins_textes/ed-06-08/010045265.pdf)
- Chakour, S. C., & Dahou, T. (2009). Gouverner une AMP, une affaire publique ? Exemples Sud-Méditerranéens. Vertigo - la revue électronique en sciences de l'environnement, (Hors-série 6). <https://id.erudit.org/iderudit/044554ar>
- Cheung, W.W.L., Lam, V.W.Y., Sarmiento, J. L., Kearney, K., Watson, R. & Pauly, D. (2009). Projecting global marine biodiversity impacts under climate change scenarios, *Fish and Fisheries* 10(3): 235-251. <https://doi.org/10.1111/j.1467-2979.2008.00315.x>
- Christidis, N., Stoot, P.A., Hegerl, C.G., Brown Set Caesar, J. (2005). Detection of changes in temperature extremes during the second half of the 20 the century. *Geophysical Research Letters*. <https://doi.org/10.1029/2005GL023885>
- Cooper, A. (2011). Coastal erosion. In C. Heip et al., *Marine Board Special Report - Climate Change and Marine Ecosystem Research Synthesis of European Research on the Effects of Climate Change on Marine Environments* (pp. 21-25). CLAMER Project, Marine Board-ESF. <https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/Climate%20Change%20Research%20Results-70.pdf>
- Dabo, B. (2006). *Erosion côtière au Sénégal : l'exemple de Mbour*. [Thèse de Doctorat 3ème cycle], Université Cheikh Anta Diop. <http://bibnum.ucad.sn/viewer.php?c=ths&d=THS-7195>
- Day, J., Dudley, N., Hockings, M., Holmes, G., Laffoley, D., Stolton, S., Wells, S. (2012). *Application des catégories de gestion aux aires protégées : lignes directrices pour les aires marines*. Lignes directrices sur les meilleures pratiques pour les aires protégées No.19. Gland, Suisse: UICN. <https://portals.iucn.org/library/node/10203>
- De Wasseige C., Marshall M., Mahe G. & Laraque A. (2015). Interactions entre les caractéristiques climatiques et les forêts. In De Wasseige, C., Tadoum, M., Eba'a Atyi, R. & Doumenge, C. (Eds.), *Les forêts du bassin du Congo. Forêts et changements climatiques*. Weyrich, Neufchâteau, Belgique, 53-64.
- Descroix, L., Genthon, P., Peugeot, C., Mahé, G., Abdou M.M., Vandervaere, J-P., ... Zannou, A. (2015). Paradoxes et contrastes en Afrique de l'Ouest : impacts climatiques et anthropiques sur les écoulements. *Géologues*, (187), 47-52. <https://hal.ird.fr/ird-02153159>
- Dramé, T. (2013). *Analyse et compréhension des liens existant entre le changement climatique, les aires protégées et les communautés au Mali*. PNUE-WCMC technical report.
- Dudley, N. (2008). *Lignes directrices pour l'application des catégories de gestion aux aires protégées*. Gland, Suisse: UICN.
- Dudley, N., Stolton, S., Belokurov, A., Krueger, L., Lopoukhine N., Mackinnon K., ... Sekhran N. (2010). *Natural Solutions: Protected areas helping people cope with climate change*. IUCN-WCPA, The Nature Conservancy, UNDP, Wildlife Conservation Society, The World Bank and WWF, Gland, Switzerland, Washington DC and New York.
- Eba'a Atyi, R., Loh Chia, E. & Pérez-Terán, A.S. (2015). Vulnérabilité et adaptation des forêts et des communautés en Afrique centrale. In De Wasseige, C., Tadoum, M., Eba'a Atyi, R., & Doumenge, C. (Eds.). *Les forêts du bassin du Congo. Forêts et changements climatiques*. (pp 65-77). Neufchâteau, Belgique: Weyrich.
- Failler P., Touron-Gardic G., Drakeford B., Sadio, O., & Traore, M. S. (2020). Perception of threats and related management measures: The case of 32 marine protected areas in West Africa. *Marine Policy* 117 103936. <https://doi.org/10.1016/j.marpol.2020.103936>
- Failler, P., Touron-Gardic, G., Sadio, O., & Traore M. S. (2019). Menaces sur les aires marines protégées en Afrique de l'Ouest : de la pêche non contrôlée aux changements climatiques. *Mondes en développement*, 2019/3 (187), (133 – 152). <https://www.cairn.info/revue-mondes-en-developpement-2019-3-page-133.htm?ref=doi>
- FAO, (2009). The relevance of mangrove forests to African fisheries, wildlife and water resources *Nature & Faune*, 1(24). Accra, Ghana: FAO.
- Faye, A., Lejeune, Q., Sylla, M. B., Neyo O., Theokritoff, E., & D'Haen, S. (2019). *Points clés pour l'Afrique de l'Ouest du rapport spécial du GIEC sur le changement climatique et les terres*. [https://climateanalytics.org/media/resume\\_ipcc\\_wa\\_v6\\_french\\_final.pdf](https://climateanalytics.org/media/resume_ipcc_wa_v6_french_final.pdf)

- Faye, I. (2010). *Dynamique du trait de côte sur les littoraux sableux de la Mauritanie à la Guinée-Bissau (Afrique de l'Ouest) : approches régionale et locale par photo-interprétation, traitement d'images et analyse de cartes anciennes*. [Thèse de doctorat en géographie], Université de Bretagne Occidentale, Brest.
- Groupe d'experts intergouvernemental sur l'évolution du climat (GIEC, ou IPCC). (n.d.). <https://www.ipcc.ch/documentation/>
- Guelly, K.A. & Segniagbeto, H.G. (2013). *Analyse et compréhension des liens existant entre le changement climatique, les aires protégées et les communautés au Togo*. PNUE-WCMC technical report.
- Hartley, A.J., Nelson, A., Mayaux, P., & Gregoire, J.M. (2007). *The assessment of African protected areas, Scientific and Technical Report*. Office for Official Publications of the European Communities. Luxembourg, Belgium.
- Hays, G.C., Broderick, A.C., Godley, B.J., Luschi, P., & Nichols, W.J. (2003). Satellite telemetry suggests high levels of fishing-induced mortality in marine turtles. *Marine Ecology Progress Series*, 262, 305–309. <https://doi.org/10.3354/MEPS262305>
- Hegerl, G.C., Zwiers, F.W., Braconnot, P., Gillett, N.P., Luo, Y., Marengo Orsini, J.A., ... Stott, P.A. (2007). *Understanding and attributing climate change. In Climate Change: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 235-236). Cambridge University Press.
- Herr, (2011). *Blue carbon policy framework. Based on the first workshop of the International Blue Carbon Policy Working Group*. Gland, Switzerland: IUCN and Arlington, USA, CI.
- Hughes, L. (2000). Biological consequences of global warming: is the signal already apparent? *Trends in Ecology and Evolution*, (15), 56-61. [https://doi.org/10.1016/S0169-5347\(99\)01764-4](https://doi.org/10.1016/S0169-5347(99)01764-4)
- INTAC, (2011). *Etude de la vulnérabilité de la biodiversité dans la zone côtière du parc national du delta du Saloum*. Rapport d'étude, projet INTAC.
- Jacquemont, J., Blasiak, R., Le Cam, C., Le Gouellec, M., & Claudet, J. (2022). Ocean conservation boosts climate change mitigation and adaptation. *One Earth*, 10 (5), 1126-1138. <https://doi.org/10.1016/j.oneear.2022.09.002>
- Jalloh, A., Nelson, G. C., Thomas, T. S., Zougmore, R., & Roy-Macauley, H. (2010). *nálisisran agriculture and climate change: a cnálissive analysis*.
- Jentoft, S., van Son, T.C. & Bjørkan, M. (2007). Marine protected areas: a governance system analysis. *Human Ecology*, 35, 611-622. <https://doi.org/10.1007/s10745-007-9125-6>
- Ly, M., Traore, S.B., Agali, A., & Sarr, B. (2013). Evolution of some observed climate extremes in the West African Sahel, *Weather and Climate Extremes*, (1) 20-24. <https://doi.org/10.1016/j.wace.2013.07.005>
- Maloney, J. E., Darian-Smith, C., Takahashi, Y., & Limpus, C. J. (1990). The environment for development of the embryonic loggerhead turtle (*Caretta caretta*) in Queensland. *Copeia*, 378-387. <https://doi.org/10.2307/1446343>
- Matsuzawa, Y., Sato, K., Sakamoto, W., & Bjørndal, K. (2002). Seasonal fluctuations in sand temperature: effects on the incubation period and mortality of loggerhead sea turtle (*Caretta caretta*) pre-emergent hatchlings in Minabe, Japan. *Marine Biology*, 140 (3), 639-646. <https://doi.org/10.1007/s00227-001-0724-2>
- Ndiaye, A. & Ndiaye, P. (2013). *Changement climatique, dégradation environnementale et quête d'utilisation des ressources naturelles : mira le ou mirage ? Harare, Zimbabwe*. Fondation pour le renforcement des capacités en Afrique.
- Otero, M., Garrabou, J. & Vargas, M. (2013). *Les aires marines protégées (AMP) méditerranéennes et le changement climatique : guide dédié au suivi régional et aux opportunités d'adaptation*. Malaga, Spain. UICN. <https://www.iucn.org/fr/content/les-aires-marines-protégees-mediterraneennes-et-le-changement-climatique>
- Petit, M. (2009). *Le réchauffement climatique et les tortues marines. Synthèse bibliographique des connaissances actuelles : Te mana o te moana*.
- RAND, M. (2020). *Les réserves marines peuvent aider les océans et les hommes à faire face au changement climatique*. RAND M. <https://www.pewtrusts.org/-/media/assets/2020/06/pbol-updates/marine-reserves-can-help-oceans---fr.pdf>
- République du Sénégal (2016). *Contribution Prévue Déterminée au Niveau National (CPDN)*, UNFCCC. <https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Senegal/1/CPDN%20-%20S%C3%A9n%C3%A9gal.pdf>
- Ringard, J. (2014). *Etude rétrospective et prospective des vagues de chaleur en Afrique de l'Ouest*. [Mémoire de master 2], Université Joseph Fourier.
- Rizk, C., Semelin, J. & Karibuhoye, C. (2011). *Guide méthodologique pour l'élaboration des plans de gestion des aires protégées en Afrique de l'Ouest*. FIBA.
- Roberts, C. M., O'leary, B. C., Mccauley, D. J., Cury, P. M., Duarte, C. M., Luon Theenco, J., ... & Castilla, J. C. (2017). Marine reserves can mitigate and promote adaptation to climate change. *Proceedings of the National Academy of Sciences*, 114(24), 6167-6175. <https://doi.org/10.1073/pnas.1701262114>

- Russ, G. R., Alcalá, A. C., & Maypa, A. P. (2003). Spillover from marine reserves: the case of *Naso vlamingii* at Apo Island, the Philippines. *Marine Ecology Progress Series*, 264, 15-20. <http://dx.doi.org/10.3354/meps264015>
- Sarr, M. A., Zorome, M., Seidou, O., Bryant, C. R., Gachon, P. (2013). Recent trends in selected extreme precipitation indices in Senegal – A change-point approach. *Journal of Hydrology*, (505), 326-334. <https://dx.doi.org/10.1016/j.jhydrol.2013.09.032>
- Sarr, O. (2005). *Aire marine protégée, gestion halieutique, diversification et développement local : le cas de la Réserve de Biosphère du Delta du Saloum (Sénégal)*. [Thèse de doctorat en Sciences économiques], Université de Bretagne Occidentale. <https://hdl.handle.net/1834/2617>
- Serrano, O. (2011). *Insights in the mat of Posidonia oceanica: biogeochemical sink and paleoecological record*. [PhD Thesis, Ecology Department], University of Barcelona.
- Somero, G. (2012). The physiology of global change: linking patterns to mechanisms. *Annual Review of Marine Science*, (4), 39–61. <https://doi.org/10.1146/annurev-marine-120710-100935>
- Sow, E. H. (2019). *Dynamique de l'écosystème mangrove de la réserve de biosphère du delta du Saloum (RBDS), Sénégal, de 1965 à 2017 et analyse des politiques de restauration*. [Thèse de Doctorat unique], Université Gaston Berger de Saint-Louis.
- Stolton, S., Dudley, N., Avcioglu Çokçaliskan, B., Hunter, D., Ivanic, K.-Z., ... Waitthaka, J. (2015). Valeurs et avantages des aires protégées. In G. L. Worboys, M. Lockwood, A. Kothari, S. Feary, & I. Pulsford (Éds.), *Gouvernance et gestion des aires protégées* (pp. 153-177). Canberra, Australia: ANU Press. <http://doi.org/10.22459/GGAP>
- SY B. A., SY A. A. (2010). Dynamique actuelle du cordon littoral de la Grande Côte sénégalaise de Saint-Louis à Niayam et ses conséquences. *Revue de Géographie de Saint-Louis (RGSL)*, (8), 197-214.
- Thorpe, A., Failler, P. & Bavinck, J.M. (2011). Marine Protected Area (MPAs). (Special Feature: Editorial). *Environmental Management*, 47 (4), 519 - 524. <https://link.springer.com/content/pdf/10.1007/s00267-011-9664-x.pdf?pdf=button>
- Treguer, P. & Gehlen, M. (2011). Ocean acidification. In C. Heip et al., *Marine Board Special Report - Climate Change and Marine Ecosystem Research Synthesis of European Research on the Effects of Climate Change on Marine Environments* (pp. 47-51). CLAMER Project, Marine Board-ESF. <https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/Climate%20Change%20Research%20Results-70.pdf>
- Trenberth, K.E., Jones, P.D., Ambenje, P., Bojariu, R., Easterling, D., Klein Tank, ... Zhai, P. (2007). Observations: Surface and Atmospheric Climate Change. In Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K.B., ... Miller, H.L. (eds.) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. (pp.235-336). Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.
- Tsimplis, M., (2011) Sea-level Changes. In C. Heip et al., *Marine Board Special Report - Climate Change and Marine Ecosystem Research Synthesis of European Research on the Effects of Climate Change on Marine Environments* (pp. 47-51). CLAMER Project, Marine Board-ESF. <https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/Climate%20Change%20Research%20Results-70.pdf>
- PNUE-WCMC (2020). *World Database on Protected Areas*. United Nations Environment World Conservation Monitoring Centre – IUCN. <https://www.protectedplanet.net/>
- Van Beusekom, J. & Ludwig, W. (2011). Riverine Discharge and Nutrient Loads. In C. Heip et al., *Marine Board Special Report - Climate Change and Marine Ecosystem Research Synthesis of European Research on the Effects of Climate Change on Marine Environments* (pp. 43-46). CLAMER Project, Marine Board-ESF. <https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/Climate%20Change%20Research%20Results-70.pdf>
- Von Storch, H. (2011). Storm frequency and intensity. In C. Heip et al., *Marine Board Special Report - Climate Change and Marine Ecosystem Research Synthesis of European Research on the Effects of Climate Change on Marine Environments* (pp. 33-37). CLAMER Project, Marine Board-ESF. <https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/Climate%20Change%20Research%20Results-70.pdf>
- World Wildlife Fund (WWF) (2011). *Rapport Atelier Régional de l'Afrique de l'Ouest : Changements Climatiques, Pêcheries, et AMP*. Mbodiène, Sénégal: WWF.
- WWF, (2014). *Living Planet Report. Species and spaces, people and places*. Gland, Switzerland: WWF.

## Chapter 8 - Ecosystem services provided by West African marine protected areas and the economic impact – Blue Economy

- Abdel Hamid, M. L. (2018). Évaluation économique des services écosystémiques offerts par les aires marines protégées en Afrique de l'Ouest : Exemple Parc National du Banc d'Arguin-Mauritanie [Thèse de doctorat en économie], Université de Montpellier. <https://tel.archives-ouvertes.fr/tel-02047962/document>

- African Ministerial Conference on the Environment, African Union and PNUE (2019). Promouvoir l'économie bleue/océanique en Afrique : Note du secrétariat. In *Conférence ministérielle africaine sur l'environnement Dix-septième session*.
- Akanni, A., Onwuteaka, J., Uwagbae, M., Mulwa, R., & Olalekan Elegbede, I. (2018). The Values of Mangrove Ecosystem Services in the Niger Delta Region of Nigeria. In *The Political Ecology of Oil and Gas Activities in the Nigerian Aquatic Ecosystem* (pp 387-437). Academic press. <https://doi.org/10.1016/B978-0-12-809399-3.00025-2>
- Aleph Conseil (2011). Enquête socio-économique sur les revenus des populations et les activités génératrices de revenus dans l'aire du PND.
- Bacon, E., Gannon, P., Stephen, S., Seyoum-Edjigu, E., Schmidt, M., Lang, B., Sandwith, T., Xin, J., Arora, S., Naim Adham, K., Rhodes Espinoza, A. J., Qwathakana, M., Leite Prates, A.P., Shestakov, A., Cooper, D., Ervin, J., de Souza Dias, B.F., Leles, B., Attallah, M., Jo Mulongoy, J., ... Babu Gidda, S. (2019). Aichi Biodiversity Target 11 in the like-minded megadiverse countries, *Journal for Nature Conservation*. ( 51(March 2020), p. 125723). Elsevier. <https://doi.org/10.1016/j.jnc.2019.125723>
- Binet, T., Borot de Battisti, A. & Failler, P. (2012). Évaluation de la valeur socio-économique des écosystèmes marins et côtiers des Aires marines protégées de l'Afrique de l'Ouest : Rapport Final.
- Binet, T., Failler, P., Chavance, P.N. & Abidine Mayif, M. (2013). First international payment for marine ecosystem services: The case of the Banc d'Arguin National Park, Mauritania, *Global Environmental Change*. Elsevier Ltd, 6 (23), 1434–1443. <https://doi.org/10.1016/j.gloenvcha.2013.09.015>
- Bonnin, M., Failler, P. & Laë, R. (2015). La résilience des écosystèmes au sein des AMP. In *Aires Marines Protégées Ouest-Africaines* (pp 197–209). Paris, France: IRD Editions.
- Bonnin, M., Laë, R. & Behnassi, M. (2015). *Aires marines protégées Ouest-africaines: Défis scientifiques et enjeux sociétaux*. Marseilles, France: IRD Editions. <https://doi.org/10.4000/books.irdeditions.8955>
- Bonnin, M., LY, I., Queffelec, B. & Ngaido, M. (2016). Droit de l'environnement marin et côtier au Sénégal. In Brehmer, P., BA, B. & KRAUS, G. (Eds), *International Conference ICAWA 2016*: IRD Editions.
- Brochier, T., Ecoutin, J.M., de Morais, L.T., Kaplan, D. M., & Lae, R. (2013). A multi-agent ecosystem model for studying changes in a tropical estuarine fish assemblage within a marine protected area, *Aquatic Living Resources*, 2 (26), 147–158. <https://doi.org/10.1051/alr/2012028>
- Bryan, T., Virdin, J., Vegh, T., Y. Kot, C.Y., Cleary, J., & Halpin, P.N. (2020). Blue carbon conservation in West Africa: a first assessment of feasibility, *Journal of Coastal Conservation*, 8 (24). <https://doi.org/10.1007/s11852-019-00722-x>
- Canal Current Large Marine Ecosystem (CCLME) (2016). *Analyse Diagnostique Transfrontalière du CCLME. Résumé exécutif*. Dakar, Sénégal. <https://www.fao.org/3/bo646f/bo646f.pdf>
- Chloé, J., Gale, J. & Cobb, S. (2010). Analyse des mécanismes de financement des aires marines protégées d'Afrique de l'Ouest - Tome 3: *Le financement durable des aires protégées terrestres et marines : principes, mécanismes et expériences*.
- Chukwuone, N. A., Ukwe, C.N., Onugu, A., & Ibe, C.A. (2009). Valuing the Guinea current large marine ecosystem: Estimates of direct output impact of relevant marine activities, *Ocean and Coastal Management*. Elsevier Ltd, 3–4 (52), 189–196. <https://doi.org/10.1016/j.ocecoaman.2008.12.008>
- Coffman, M., Burnett, K., Durham, W.H., & Driscoll, L.R. (2009). The Value of a Wave: An analysis of the Mavericks Region & An Analysis of the Mavericks Wave from an Ecotourism Perspective. [http://www.valueofwaves.org/uploads/1/1/4/2/11420190/final\\_combined\\_wave\\_valuation\\_report.pdf](http://www.valueofwaves.org/uploads/1/1/4/2/11420190/final_combined_wave_valuation_report.pdf)
- Convention on Biological Diversity (CBD) (2018). Pan-African Action Agenda on Ecosystem Restoration for Increased Resilience. *UN Biodiversity Conference: CBD COP 14*, 38.
- David Dan-Woniowe, F. (2020). An Advocacy for Marine Protected Areas Initiative for Conservation of Ecological Resources and Survival of Coastal Communities in Nigeria, *Journal of Political Science and International Relations*, 3(3), 56. <https://doi.org/10.11648/j.jpsir.20200303.12>
- Defaux, V., Failler, P. & Rey-Valette, H. (2017). Évaluation rétrospective et prospective du Protocole à l'accord de partenariat dans le domaine de la pêche durable entre l'Union européenne et la République de Côte d'Ivoire - Rapport final. Publications Office. <https://data.europa.eu/doi/10.2771/662085>
- Failler, P. & Pan, H. (2007). Global value, full value and societal costs; capturing the true cost of destroying marine ecosystems, *Social Information Journal*, 1 (46), 109-134. <https://doi.org/10.1177/0539018407073660>
- Failler, P. (2014). Climate variability and Food Security in Africa: The case of Small Pelagic Fish in West Africa, *Journal of Fisheries & Livestock Production* 2(2). <https://doi.org/10.4172/2332-2608.1000122>
- Failler, P., Binet, T. & Borot de Battisti, A. (2009). *Évaluation de la valeur économique et sociale des écosystèmes associés aux AMP d'Afrique de l'Ouest*, (Rapport N°1: Cadrage méthodologique), projet « Appui au renforcement institutionnel du Réseau Régional d'AMP en Afrique de l'Ouest et à la mise en œuvre. Dakar.

- Failler, P., Pètre, É. & Maréchal, J.-P. (2010). Valeur économique totale des récifs coralliens, mangroves et herbiers de la Martinique Total Economic Value of Coral Reefs, Mangroves and Seagrass of Martinique, *Études Caraïbéennes*, (15), 0–25. <https://doi.org/10.4000/etudescaribeennes.4410>
- Failler, P., Pètre, E., Binet, T. & Maréchal, J.-P. (2015). Valuation of marine and coastal ecosystem services as a tool for conservation: The case of Martinique in the Caribbean, *Ecosystem Services*, 11, 67–75. <https://doi.org/10.1016/j.ecoser.2014.10.011>
- Failler, P., Touron-Gardic, G. & Traore, M. S. (2019). Is Aichi Target 11 Progress Correctly Measured for Developing Countries?, *Trends in Ecology & Evolution*. Elsevier Ltd, 10 (34), 875–879. <https://doi.org/10.1016/j.tree.2019.07.007>
- Failler, P., Touron-Gardic, G., Traoré, M., & Phang, S. (2020). Evaluating the official achievement of Aichi Target 11 for West African countries: A twofold challenge of accuracy and catching-up, *Science of The Total Environment*. Elsevier B.V. (698), 134284. <https://doi.org/10.1016/j.scitotenv.2019.134284>
- Fall, S. (2018). Contribution à l'évaluation socio-économique des biens et services écosystémiques de l'Aire Marine Protégée de Saint-Louis (SENEGAL) [Mémoire de Master 2], Université de Thies. <https://chm.cbd.int/api/v2013/documents/EF5130E7-3FEA-13F9-B281-97F78B1EB4D4/attachments/Evaluation%20BSE%20AMP%20Saint%20Louis.pdf>
- FAO (2019). Comité des pêches pour l'Atlantique Centre-Est: Synthèse du rapport. Roma, Italy. <https://www.fao.org/3/cb0490fr/cb0490fr.pdf>
- Hagedoorn, L., Kinney, K., van Beukering, P., Adzah, S., Koetse, M., Commodore, T., Addo, K.A., ... Kamstra, J. (2021). *Economic valuation of ecosystem services at the Ghanaian coast Background and methods*. IVM-VU, TDI, University of Ghana, ResearchLime and IUCN-NL. <https://pdfs.semanticscholar.org/456c/541801332566339d0dc333d8fcb5bb079958.pdf>
- Interwies, E. (2011). *The Economic and Social Value of the Guinea Current Ecosystem - A First Approximation*. <http://diktas.iwlearn.org/gclme-ac/publications/our-publications/the-economic-and-the-social-value-of-gclme>
- Interwies, E. & Gorlitz, S. (2013). *Economic and social valuation of the CCLME ecosystem services*. [https://www.researchgate.net/profile/Stefan\\_Goerlitz/publication/261471610\\_Protection\\_of\\_the\\_Canary\\_Current\\_Large\\_Marine\\_Ecosystem\\_\(CCLME\)\\_-\\_Economic\\_and\\_Social\\_Valuation\\_of\\_the\\_CCLME\\_Ecosystem\\_Services/links/0f31753454bab28768000000.pdf](https://www.researchgate.net/profile/Stefan_Goerlitz/publication/261471610_Protection_of_the_Canary_Current_Large_Marine_Ecosystem_(CCLME)_-_Economic_and_Social_Valuation_of_the_CCLME_Ecosystem_Services/links/0f31753454bab28768000000.pdf)
- IPBES (2018a). *The Regional Assessment Report On Biodiversity And Ecosystem Services For Africa: Summary For Policymakers Of The Ipbes Regional Assessment Report On Biodiversity And Ecosystem Services For Africa* IPBES. [www.ipbes.net](http://www.ipbes.net)
- IPBES (2018b). *The Regional Assessment Report On Biodiversity And Ecosystem Services For Africa*. Bonn, Germany: IPBS. [www.ipbes.net](http://www.ipbes.net)
- IMET, outil régional de suivi des aires protégées. (n.d.). Observatoire des forêts d'Afrique centrale. [https://www.observatoire-comifac.net/monitoring\\_system/imet](https://www.observatoire-comifac.net/monitoring_system/imet)
- Jamouli, A. & Allali, K. (2020). Economic valuation of ecosystem services in Africa, *E3S Web of Conferences*, 183, 1–16. <https://doi.org/10.1051/e3sconf/202018301002>
- Kane, O. (2014). *Etude de faisabilité de la mise en place de mécanismes de financement durable pour les Aires Marines Protégées du Sénégal*.
- Laë, R., Ecoutin, J.-M., Tito de Morais, L., Kaimuddin, A.H., & Ould El Vally, Y. (2015). Bénéfices attendus et réels des AMP pour la restauration et la gestion des ressources marines en Afrique de l'Ouest. In Bonnin, M., Laë, R., Behnassi, M., (ed.) *Aires marines protégées ouest-africaines*, (pp 117–141). IRD Editions.
- Leenhardt, P., Low, N., Pascal, N., Micheli, F., & Claudet, J. (2015). The Role of Marine Protected Areas in Providing Ecosystem Services. In Arim, M., Belgrano, A., Berzategui, M., Berg, S., Bista, I., Borthagaray, A.I., Brey, T., Claudet, J., Creer, S., Dell, A.I., Demars, B.O.L., Eklöf, A., Falciani, F., Fisher, J.A.D., Fowler, C.W., Frank, K.T., Fryxell, D.C., Gray, C., Jacob, U., Jonsson, T., ... Woodward, G. *Aquatic Functional Biodiversity - An Ecological and Evolutionary Perspective*, Elsevier, (211-239). <https://doi.org/10.1016/B978-0-12-417015-5.00009-8>
- Ly, O. K. & Ould Moulaye Zein, S. A. (2009). *Évaluation économique d'une zone humide : le cas du Diawling, Mauritanie*. Gland, Switzerland: IUCN. <https://portals.iucn.org/library/node/9387>
- Mbaye, B. C., Brochier, T., Echevin, V., Lazar, A., Lévy, M., Mason, E., ... Machu, R. (2015). Do *Sardinella aurita* spawning seasons match local retention patterns in the Senegalese-Mauritanian upwelling region?, *Fisheries Oceanography*, 24(1), 69–89. <https://doi.org/10.1111/fog.12094>
- Millenium Ecosystem Assessment (2003). *Les écosystèmes et le bien-être de l'homme: Un cadre d'évaluation*: Millenium Ecosystem Assessment. <https://www.millenniumassessment.org/fr/Framework.html>
- Olusha Arowolo, A. (2018). Assessing changes in the value of ecosystem services in response to land-use/land-cover dynamics in Nigeria. *Science of the Total Environment*, 636, 597-609. <https://doi.org/10.1016/j.scitotenv.2018.04.277>
- Pascal, N., Brathwaite, A., Brander, L., Seidl, A., Philip, M., & Clua, E. (2018). Evidence of economic benefits for public investment in MPAs, *Ecosystem Services*, 30, 3–13. <https://doi.org/10.1016/j.ecoser.2017.10.017>

- PNUE & GRID-Arendal (2016). The Socio-Economics of the West, Central and Southern African Coastal Communities: A Synthesis of Studies Regarding Large Marine Ecosystems. Nairobi, Abidjan and Arendal. [https://gridarendal-website-live.s3.amazonaws.com/production/documents/:s\\_document/323/original/AfricanLME\\_screen.pdf?1491297440](https://gridarendal-website-live.s3.amazonaws.com/production/documents/:s_document/323/original/AfricanLME_screen.pdf?1491297440)
- PNUE-WCMC (2016a). Impacts du changement climatique sur la biodiversité et les aires protégées en Afrique de l'Ouest, Résumé des résultats du projet PARCC, Aires protégées résilientes au changement climatique en Afrique de l'Ouest. Cambridge, UK; PNUE-WCMC. [http://parcc.protectedplanet.net/system/comfy/cms/files/files/000/000/164/original/PARCC\\_FR\\_WEB.pdf](http://parcc.protectedplanet.net/system/comfy/cms/files/files/000/000/164/original/PARCC_FR_WEB.pdf)
- PNUE-WCMC (2016b). The State of Biodiversity in Africa: A mid-term review of progress towards the Aichi Biodiversity Targets. Cambridge, UK: PNUE-WCMC.
- PRCM (2019). Importance économique, sociale et écologique des petits pélagiques au Sénégal, en Mauritanie et en Guinée-Bissau - Rapport d'étude: PCRM.
- PNUE-WCMC (2022). *Ocean + Habitats* [Online]. [habitats.oceanplus.org](http://habitats.oceanplus.org)
- Roost, T. (2022). *Les aires marines protégées comme outil de protection de la biodiversité*. SEA(E)SCAPE. <https://seascape.fr/blog/2022/01/15/aires-marines-protégees/>
- Sall Ndiaye, F. (2017). Evaluation des BSE de l'Aire Marine Protégée du Gandoul (AMPG) et de la Réserve Naturelle Communautaire de Palmarin (RNCP), *Projet Go-Wamer: DAMCP & PNUD*,. [https://chm.cbd.int/api/v2013/documents/444E5F03-4B67-2DB2-66C0-D5BDD9529058/attachments/BSE%20Gandoul%20et%20Palmarin\\_Rapport%20final.pdf](https://chm.cbd.int/api/v2013/documents/444E5F03-4B67-2DB2-66C0-D5BDD9529058/attachments/BSE%20Gandoul%20et%20Palmarin_Rapport%20final.pdf)
- Salles, J.-M. & Figuières, C. (2013). Current issues in ecosystem services valuation (ESV). *20th Annual Conference of the European Association of Environmental and Resource Economists*. 26–29. <https://hal.inrae.fr/hal-02748592/document>
- Sumaila, U. R. (2016). Socio-economic benefits of Large Marine Ecosystem valuation: The case of the Benguela Current Large Marine Ecosystem, *Environmental Development*, 17, 244–248. <https://doi.org/10.1016/j.envdev.2015.10.002>
- Tittensor, D.P., Walpole, M., Hill, S.L.L., Boyce, D.G., Britten, G.L., Burgess, N.D., Butchart, S.H.M., Leadley, P.W., Regan, E.C., Alkemade, R., Baumung, R., Bellard, C., Bouwman, L., Bowles-Newark, N.J., Chenery, A.M., Cheung, W.L., Christensen, V., Cooper, H.D., Crowther, A.R., ... Ye, Y. (2014). A mid-term analysis of progress toward international biodiversity targets, *Science*, 346(6206), 241–244. <https://doi.org/10.1126/science.1257484>
- Touron-Gardic, G., Dème, E.H.B., Thiaw, M., Domingos Da Costa, D., Teeuw, R., Argyriou, A., ... Failler P. (2021). *Etude sur la valeur écosystémique de 6 AMP du RAMPAO présentant des sites critiques pour les petits pélagiques* : RAMPAO.
- Trégarot, E., Catry, T., Pottier, A., Cornet, C., Maréchal, J-P., Fayad, V., Sidi Cheick, M.A., David, D., Daïm Dia, A., Fall, A.D., Sarr, O., El Valy, Y., Hamet Wagne, O., Meisse B., Abou Kane, E., Ball, A.C., Haidallah, M.S., Braham, C.B., Dia, M., Hamid, M.L.A., ... Failler, P. (2018a). *Evaluation des services écosystémiques du Banc d'Arguin : Rapport intermédiaire - Méthode adoptée pour l'évaluation de la valeur des services*.
- Trégarot, E., Catry, T., Pottier, A., Cornet, C., Maréchal, J-P., Fayad, V., Sidi Cheick, M.A., David, D., Daïm Dia, A., Fall, A.D., Sarr, O., El Valy, Y., Hamet Wagne, O., Meisse B., Abou Kane, E., Ball, A.C., Haidallah, M.S., Braham, C.B., Dia, M., Hamid, M.L.A., ... Failler, P. (2018b). *Évaluation des services écosystémiques du Banc d'Arguin, Mauritanie : Rapport Final*. <https://www.afd.fr/sites/afd/files/2022-01-05-18-49/rapport-final-PNBA-2018.pdf>
- Trégarot, E., Caillaud, A., Cornet, C.C., Taureau, F., Catry, T., Cragg, S.M., Failler, P. (2020a). Mangrove ecological services at the forefront of coastal change in the French overseas territories, *Science of the Total Environment*, (763) 143004. <https://doi.org/10.1016/j.scitotenv.2020.143004>
- Trégarot, E., Touron-Gardic, G., Cornet, C.C., & Failler, P. (2020b). Valuation of coastal ecosystem services in the Large Marine Ecosystems of Africa, *Environmental Development*, (36) 100584 <https://doi.org/10.1016/j.envdev.2020.100584>
- Trégarot, E., Failler, P. & Maréchal, J. P. (2017). Evaluation of coastal and marine ecosystem services of Mayotte: Indirect use values of coral reefs and associated ecosystems, *International Journal of Biodiversity Science, Ecosystem Services and Management*: Taylor & Francis, 13(3), 19–34. <https://doi.org/10.1080/21513732.2017.1407361>
- Troni, J., Petersen, C., Diouf, H.R., Mills, J.T., Baumwoll, J., Garmer, L.W., ... Tadross, M. (2014). Climate Change Adaptation in Africa: UNDP Synthesis of Experiences and Recommendations, *Climate Change Adaptation in Africa*, 102. <https://doi.org/10.4324/9781315794907>
- UNECA (2016). *Africa's Blue Economy: A policy handbook*. Addis Ababa. [https://www.un.org/africarenewal/sites/www.un.org.africarenewal/files/Africa%27s\\_Blue\\_Economy\\_A\\_policy\\_handbook.pdf](https://www.un.org/africarenewal/sites/www.un.org.africarenewal/files/Africa%27s_Blue_Economy_A_policy_handbook.pdf)
- Wangai, P. W., Burkhard, B. & Müller, F. (2016) A review of studies on ecosystem services in Africa, *International Journal of Sustainable Built Environment*, 2 (5), 225–245. <https://doi.org/10.1016/j.ijbsbe.2016.08.005>
- Willcock, S., Hooftman, D., Sitas, N., O'Farrell, P., Hudson, M.D., Reyers, B., (2016). Do ecosystem service maps and models meet stakeholders' needs? A preliminary survey across sub-Saharan Africa, *Ecosystem Services*, 18, 110–117. <https://doi.org/10.1016/j.ecoser.2016.02.038>



Yetunde, E. A. (2017) Marine protected area: Prospective tool for ecosystem-based fisheries management in Nigeria, *International Journal of Biodiversity and Conservation*, 6(9), 158–166. <https://doi.org/10.5897/ijbc2016.1062>

## Chapter 9 - Marine protected areas and fisheries in West Africa

Bailey, R., Bahuchet, S. & Hewlett, B. (1992). Development in the Central African Rainforest: Concern for Forest People. In Cleaver, K. et al., *Conservation of west and central African rainforest*. (202-211) Banco Mundial, California, Washington: IUCN.

Banque Centrale de la République de Guinée (BCRG) (2021). *Rapport annuel*. BCRG.

Boubacar Sene, Y.I. (2013). *Impact de l'aire marine protégée de Bamboung sur les activités de pêche artisanale*, [Mémoire de diplôme de Master II en Biologie Animale], Université de Dakar.

Brêthes, J.C. & Fontana, A. (1992). *Recherches interdisciplinaires et gestion des pêcheries. Projet CIEO-890276*, Centre international d'exploitation des océans, Halifax, Nouvelle-Écosse, Canada.

Breton, Y. (1994). Liens entre pêche industrielle et pêche artisanale : Changements et conséquences pour la recherche, *Anthropologie et Sociétés*. 1 (18), 93-107.

*Bulletin statistique*, (2021). Centre National des Sciences Halieutiques de Boussoira.

Catanzano, J. & Thébaud O. (1995). *Le Littoral : pour une approche de la régulation des conflits d'usage*. Coll. Propos, (Ed. Paris). France. Institut Océanographique et IFREMER.

Cazalet, B. (2004). Les aires marines protégées à l'épreuve du sous-développement en Afrique de l'Ouest. *Vertigo* 3 (5). <https://doi.org/10.4000/vertigo.3274>

CERTIF, (2010). *Enquête des ménages du PNBA*: CERTIF.

CSE, (2021). *Atlas des sites critiques des petits pélagiques. Projet "Appui à la Gestion Durable des populations de Petits Pélagiques dans la zone de la CSRPA"*.

Diadiou, H.D., Ecoutin, J.M. & Sene, Y. *Impacts de l'Aire marine Protégée du Bamboung sur les activités de pêche artisanale. Atelier de restitution des résultats du projet CEPIA*.

Doumbouya A., & Magassouba B. (2014). *Consultation nationale (études-analyses) sur les systèmes de cogestion au sein des AMP de la Guinée*. Rome, Italie: FAO.

Doumbouya, A. (2020). *Détermination des zones d'intérêt biologique, sensibles et vulnérables à l'implantation des infrastructures en Guinée : cas du Delta du Kapatchez*. RAMPAO.

Doumbouya A, Camara, O.T., Mamie, J., Intchama, J.F., Jarra, A., Ceesay, S., ... Belhabib, D. (2017). Assessing the Effectiveness of Monitoring Control and Surveillance of Illegal Fishing: The Case of West Africa, *Frontiers in Marine Science*. 50 (4). 1 – 10. <https://doi.org/10.3389/fmars.2017.00050>

Doumbouya, A., Guilavogui, A. & Lefur J. (2006). *Accès à l'espace et à la ressource halieutique dans la ZEE guinéenne : compétitions et conflits*, Bull. Centr. Halieut. Boussoira 1(1).

Diop, M. & Dia, A. D. (2000). Pêcheries mauritaniennes : quelle régulation pour une gestion durable ? In *Les espaces halieutiques : Collection Colloques et Séminaires 4ème Forum halieumétrique*. (583 – 587).

Ecoutin J.M., Béhagle, N., Brochier, T., Guillard, J., ... Laë, R. (2013). *L'Aire Marine Protégée communautaire de Bamboung (Sine Saloum) : Synthèse 2003 – 2011*. [Rapport de recherche] IRD. <https://hal.science/hal-01483073v2>

Failler, P. & de Battisti, A.B. (1996). La cogestion : Quel avenir pour nos pêcheries ? *Actes des journées d'étude en socio-économie des pêches*. Université du Québec à Rimouski, Rimouski -Université McGill, Montréal.

Failler P. & Hosch, G. (2012). *Présentation du contexte global des pêches et de l'aquaculture des 22 pays africains bordant l'océan Atlantique. Conférence Ministérielle sur la Coopération Halieutique entre les États Africains Riverains de l'océan Atlantique (COMHAFAT). Code de conduite pour une pêche responsable*. ONU/FAO, Rome.

Failler P., Touron-Gardic G., Drakeford B., Sadio, O., & Traore, M. S. (2020). Perception of threats and related management measures: The case of 32 marine protected areas in West Africa. *Marine Policy* 117 (2020) 103936. <https://doi.org/10.1016/j.marpol.2020.103936>

Failler, P., Touron-Gardic, G., Sadio, O., & Traore M. S. (2019). Menaces sur les aires marines protégées en Afrique de l'Ouest : de la pêche non contrôlée aux changements climatiques. *Mondes en développement*, 2019/3 (187), (133 – 152). <http://dx.doi.org/10.3917/med.187.0133>

FAO, (2003). *Fisheries management. 2. The ecosystem approach to fisheries. FAO Technical Guidelines for Responsible Fisheries*. FAO

FAO, (2020). *La situation mondiale des pêches et de l'aquaculture*. FAO. <https://www.fao.org/documents/card/en/c/CA9229FR>

- Grafton, Q.R. (2010). Adaptation to climate change in marine capture fisheries. *Marine Policy*, 34: 606–615. <https://doi.org/10.1016/j.marpol.2009.11.011>
- Greenpeace, (2017). *Le cout de la destruction des océans*: Greepeace.
- Guénette, S., Meissa, B. & Gascuel, D. (2014). Assessing the Contribution of Marine Protected Areas to the Trophic Functioning of Ecosystems: A Model for the Banc d'Arguin and the Mauritanian Shelf. *PLoS ONE* 9(4): e94742. <https://doi.org/10.1371/journal.pone.0094742>
- Leurs, G., van der Reijden, K.J., Cheikhna Lemrabott, S.Y., Barry, I., Nonque, D.M., Olf, H., ... Govers, L.L. (2021). Industrial Fishing Near West African Marine Protected Areas and Its Potential Effects on Mobile Marine Predators, *Frontiers in Marine Science*,(8). <https://doi.org/10.3389/fmars.2021.602917>
- Marie, B., , R. & Behnassi, M. (2015). , Marseille, France: IRD Editions.
- Michel, G.S., Gascuel, D., Laura, Henichart, M., Boncoeur, J.,Alban, F., ... De Monbrison, D. (2013). *Les aires marines protégées dans la gestion des pêches : Synthèse de l'état de l'art*. hal-011103270.
- Mohamed, L. A. H., (2018). *Evaluation économique des services écosystémiques rendus par les aires marines protégées en Afrique de l'Ouest, exemple Parc National du Banc d'Arguin*. [Thèse de doctorat], Université de Montpellier- France.
- Platteau, J. P. (1988). Les problèmes de la pêche artisanale en Afrique vus par les acteurs eux-mêmes. *Cahiers de la Faculté des Sciences Economiques et Sociales de Namur*, Série documents et points de vue, (23).
- Projet BioCos: *Gestion de la biodiversité marine et côtière ouest-africaine par le renforcement des initiatives de conservation et de suivi dans les AMP*, (n.d.).
- Sadio, O. (2015). *Evaluation de l'efficacité des Aires Marines Protégées comme outil de restauration des ressources marines et de gestion des stocks halieutiques : l'expérience ouest africaine*. [Thèse de doctorat en économie halieutique], Université de Bretagne Occidentale, Brest.
- Tempier, E., (2018). La gestion collective de droits d'usage par les Prud'homies méditerranéennes de patrons pêcheurs, un modèle pour l'avenir. fhal-03407555.
- Thiao, D., Diop, M., Bienvenue Sène, J.H. & Traoré, M.S. (2018). *Atelier régional sur l'identification des sites critiques pour les petits pélagiques en Afrique de l'Ouest – rapport Final*.
- Thiaw, M., Mbengue, B.A., Mbaye, A., Diadiou, H.D., Kantoussan, J., Sow, B.A., Goudiaby, K.D., ... Brehmer, P. (eds) (2016). Synthèse des informations sur les Aires Marines Protégées (AMP): cas des AMPs en Afrique de l'Ouest. Projet: Efficacité des Aires de Pêche Protégées (AMP & ZPP) dans la restauration des ressources halieutiques et de leurs habitats au Sénégal. Synthèse bibliographique – Série Etudes et Documents ISRA. Vol. 10, N°3 - ISSN 0850-9933.
- Roost, T. (2022). *Les aires marines protégées comme outils de protection de la biodiversité* <https://seaescape.fr/blog/2022/01/15/aires-marines-protegees/>
- Tregarot E., Meissa, B., Gascuel, D., Sarr, O., El Valy, Y., Wagne, O.H., ... Failler, P. (2020). The role of marine protected areas in sustaining fisheries: The case of the National Park of Banc d'Arguin, Mauritania, *Aquaculture and Fisheries*, 5(5), 253-264. <https://doi.org/10.1016/j.aaf.2020.08.004>
- Troadec, J. P. (1994). *Le nouvel enjeu de la pêche : l'ajustement des institutions aux nouvelles conditions de rareté des ressources*. *Comptes rendus de l'Académie d'agriculture de France*, n° 3.
- Weber, J. (1995). L'occupation humaine des aires protégées à Madagascar : Diagnostic et éléments pour une gestion viable. *Nature-Sciences-Sociétés*, N°3 (2), 57-163. <https://doi.org/10.1051/nss/19950302157>
- Weigel, Y-Y., Féral, F., & Cazalet, C. (Éds.) (2007). *Les aires marines protégées d'Afrique de l'Ouest : gouvernance et politiques publiques*. PUP. [https://horizon.documentation.ird.fr/exl-doc/pleins\\_textes/divers11-03/010041112.pdf](https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers11-03/010041112.pdf)
- Yves, R. & Oussouby, O. (2014). *Itinéraires de création d'aires marines protégées (AMP) en Afrique de l'Ouest - Expériences et leçons apprises*. Dakar, Sénégal: FIBA/RAMPAO/PRCM.



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