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International Guide on Marine/ Maritime Spatial Planning

Volume 2 – Biodiversity Inclusive Principle

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MSPglobal

International Guide on Marine/ Maritime Spatial Planning

Volume 2 – Biodiversity Inclusive Principle

IOC Manuals and Guides No. 89, Volume 2

UNESCO 2025

Executive Summary

The **"MSPglobal International Guide on Marine/Maritime Spatial Planning"**, published in 2021, aims to support the development of marine spatial planning (MSP) processes and plans, offering practical guidance structured around different planning phases. While the **"MSPglobal Guide"** remains comprehensive and valuable, it does not fully explore some topics that have gained significance and urgency due to new scientific advancements, practical experience, evolving environmental pressures and recent international commitments. Pursuing its mission to support MSP processes and plans, MSPglobal has developed this complementary Volume 2 that expand the Guide's content to include biodiversity considerations further.

This volume emphasises the central role of biodiversity in ocean health and its contribution to ecosystem services and sustainable livelihoods. It also aims to support countries in answering the call from the Kunming-Montreal Global Biodiversity Framework to implement participatory, integrated and biodiversity inclusive spatial planning.

Developing biodiversity inclusive MSP processes requires recognising biodiversity as the foundation of sustainable development, setting specific objectives to achieve nature positive outcomes and integrating biodiversity conservation and resilience as a concern across all maritime activities. To assist governments, Indigenous Peoples and local communities, stakeholders and all relevant parties involved in MSP in bringing biodiversity to the forefront of the process, this volume summarises the reasons why this is crucial (**Chapter 2**), elaborates on the definition and key elements of biodiversity inclusive MSP (**Chapter 3**) and presents a set of 20 recommendations (**Chapter 4**).

These recommendations are organised by planning phase and are intended to complement those presented in the main Guide. Each specific recommendation includes its rationale and a set of suggested actions to support implementation. The volume is the result of expert contributions from around the world and shares insights from practical experiences and research.

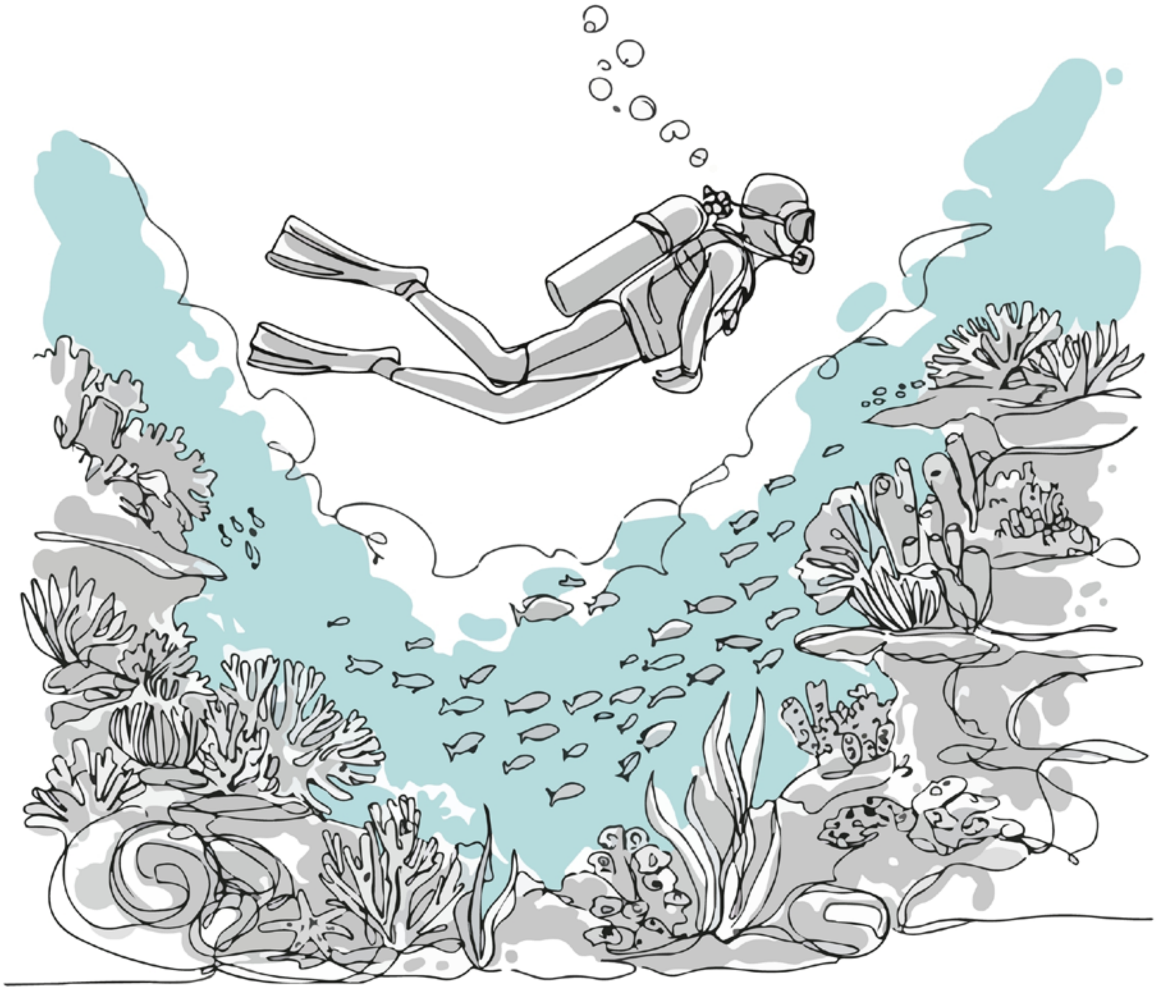
Rights-holder and stakeholder engagement is a fundamental aspect throughout the MSP process, and this is reinforced in several of the specific recommendations for biodiversity inclusive MSP.

Acknowledgements

UNESCO's Intergovernmental Oceanographic Commission (UNESCO-IOC) and the European Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE) express their gratitude to all participants of the online workshops organised in the scope of this publication for their enthusiastic discussions and valuable contributions.

In addition, we are grateful for the support of Arend Kolhoff from the Netherlands Commission for Environmental Assessment, who provided important insights on the subject of Strategic Environmental Assessment.

The editor, leading author, contributors and reviewers hope this publication will support marine spatial planning initiatives in becoming more biodiversity inclusive.



List of acronyms and abbreviations

ABNJ	Areas beyond National Jurisdiction
AM MSP	Assistance Mechanism of Maritime Spatial Planning
AZTI	Centro de Investigación Marina y Alimentaria (Research Centre in Marine Environment and Food), Spain
CARE	Collective benefit, Authority to control, Responsibility, and Ethics principles for Indigenous data governance
CBD	Convention on Biological Diversity
CBCS, UQ	Centre for Biodiversity and Conservation Science, The University of Queensland, Australia
DCC-CR	Decade Collaborative Centre for Coastal Resilience
DFFE	Department of Forestry, Fisheries and the Environment, South Africa
DFO	Fisheries and Oceans Canada
DG MARE	Directorate-General for Maritime Affairs and Fisheries of the European Commission
DTO	Digital Twin of the Ocean
EBA	Ecosystem-Based Approach
EBSA	Ecologically or Biologically Significant Area
EC	European Commission
eDNA	Environmental DNA (Deoxyribonucleic acid)
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMMA	Ecologically Significant Underwater Marine Area
EMODnet	European Marine Observation and Data Network
ES	Ecosystem Services
EU	European Union
FAO	Food and Agriculture Organization
FIO	First Institute of Oceanography, Ministry of Natural Resources, China
FPIC	Free, Prior and Informed Consent
GBIF	Global Biodiversity Information Facility
GBRMP	Great Barrier Reef Marine Park
GIS	Geographic Information System
GIZ GmbH	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Cooperation)
GOOS	Global Ocean Observing System
GPS	Global Positioning System
IEO (CSIC)	Instituto Español de Oceanografía, Consejo Superior de Investigaciones Científicas (Spanish Institute of Oceanography, Spanish National Research Council)
ICZM	Integrated Coastal Zone Management
ILK	Indigenous and Local Knowledge
IMCAM	Integrated Marine and Coastal Area Management
INDEFOR	Institut national de Développement forestier et de Gestion du Système national des Aires protégées, Guinée Équatoriale (National Institute for Forestry Development and Management of the National System of Protected Areas, Equatorial Guinea)
IOC	Intergovernmental Oceanographic Commission of UNESCO

IODE	International Oceanographic Data and Information Exchange
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IPLCs	Indigenous Peoples and local communities
IUCN	International Union for the Conservation of Nature
KMFRI	Kenya Marine and Fisheries Research Institute
KMGBF	Kunming-Montreal Global Biodiversity Framework
LAC	Limits of Acceptable Change
MPA	Marine Protected Area
MSP	Marine/Maritime Spatial Planning
NbS	Nature-based solutions
NCP	Nature's Contributions to People
NGO	Non-Governmental Organization
NU-LETG	Nantes Université, Littoral – Environnement – Télédétection – Géomatique (Nantes University, Littoral, Environment, Remote Sensing, Geomatics Laboratory)
OBIS	Ocean Biodiversity Information System
ODIS	IOC Ocean Data and Information System
OECM	Other Effective Area-Based Conservation Measure
PAP/RAC	Priority Actions Programme/Regional Activity Centre
PML	Plymouth Marine Laboratory, England
PPPs	Policies, Plans and Programmes
RAP	Representative Areas Program
SDG	Sustainable Development Goal
SDI	Spatial Data Infrastructure
SEA	Strategic Environmental Assessment
SESA	Strategic Environmental and Social Assessment
SeyCCAT	Seychelles Conservation and Climate Adaptation Trust
SMA	Special Management Area
SMARTIE	Specific, Measurable, Achievable, Relevant, Time-Bound, Inclusive and Equitable
SMSP	Seychelles Marine Spatial Plan
SOS	Samoa Ocean Strategy 2020–2030
Syke	Finnish Environment Institute
TNC	The Nature Conservancy
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
USD	United States dollar
UTARTU	University of Tartu, Estonia
WCS	Wildlife Conservation Society
WIO	Western Indian Ocean
WWF	World Wildlife Fund
WWF EPO	WWF European Policy Office

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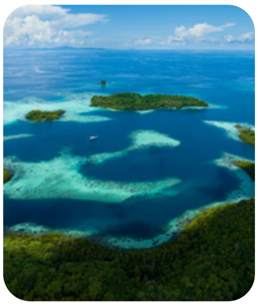

Glossary[1]

Adaptive management:
a systematic approach for improving management through learning by monitoring and evaluating management outcomes. Simply put, it is 'learning by doing' and adapting what one does based on what is learned.

Area-based management:
the regulations of human activity in a specified area to achieve conservation or sustainable resource management objectives.

Areas beyond national jurisdiction:
those areas of the ocean (water column and seabed) for which no one nation has sole responsibility for management.

Biological diversity:
the variability among living resources from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species and of ecosystems.

Blue carbon:
all biologically-driven carbon fluxes and storage in marine systems that are amenable to management. It includes mangroves, tidal marshes, and seagrasses, for which recognised carbon accounting methodologies exist. Other ecosystems, such as macroalgae, benthic sediments and mudflats, may also contribute to blue carbon storage, though their long-term carbon sequestration capacity is still being studied.

Blue/Green infrastructure:
a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services.

Bright spots:
areas where species may find improved habitat conditions in the medium term and where there may be new opportunities for sustainable blue growth and conservation.

Carrying capacity:
the level of use, at a given level of management, at which a natural or human-made resource can sustain itself over a long period of time.

Climate change:
a change in the state of the climate that can be identified, using statistical tests, by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.

Climate refugia:
areas where environmental conditions are projected to remain stable over time.

Connectivity:
directness of links and density of connections within and amongst ecosystems and uses. It may also refer to the exchange of individuals among marine populations.

Cost-benefit analysis:
a technique designed to determine the feasibility of a project or plan by quantifying its costs and benefits.

Cumulative impact:
the impacts (positive or negative, direct and indirect, long-term and short-term) arising from a range of activities throughout an area or region, where each individual effect may not be significant if taken in isolation, but collectively may impact and damage the environment.

Ecological risk:
summarises the probability and consequences of undesired events in a particular ecosystem.

1 This glossary is based on definitions from the MSPglobal International Guide on Marine/Maritime Spatial Planning, as well as other publications by UNESCO-IOC, the CBD Secretariat, IPBES, IPCC, UNEP, and other relevant authors.

Ecological sensitivity:
the degree of sensitivity of an ecosystem to human interference and environmental changes.

Ecosystem:
a community or group of living organisms that live in and interact with each other in a specific environment.

Ecosystem-based approach:
a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It is based on the application of appropriate scientific methodologies focused on levels of biological organisation, which encompass the essential processes, functions and interactions among organisms and their environment. It recognises that humans, with their cultural diversity, are an integral component of ecosystems.

Ecosystem services:
the benefits provided by ecosystems that contribute to making human life both possible and worth living. Coastal and marine ecosystem services include provisioning services (e.g., fisheries, building materials); supporting services (e.g., life-cycle maintenance for both fauna and local communities, element and nutrient cycling); regulating services (e.g., carbon sequestration and storage, erosion prevention, waste-water treatment, moderation of extreme events); and cultural services (i.e. tourism, recreational, aesthetic, and spiritual benefits).

Eukaryotic species:
single-celled or multicelled organisms that possess a clearly defined nucleus.

Eutrophication:
nutrient enrichment, typically in the form of nitrates and phosphates, and often from human sources such as agriculture, sewage and urban runoff. When this happens, usually due to pollution from land, plant life – such as phytoplankton or algae – proliferates.

Evaluation:
a management activity that assesses achievement against some predetermined criteria, usually a set of standards or management objectives.

Indicator:
information based on measured data used to represent a particular attribute, characteristic or property of a system. An indicator is a measure, quantitative or qualitative, of how close we are to achieving what we set out to achieve, i.e. our objectives or outcomes.

Indigenous and local knowledge:
holistic, territorialised, diversified, and evolving knowledge (ILK in short) that can flourish within all kinds of long-established communities experiencing histories of interaction with their natural surroundings.

Indigenous Peoples and local communities:
distinct and diverse groups that maintain close ties to their territories and traditions, playing a crucial role in environmental management. They are holders of ILK and the advantage of using the IPLCs term relates to its inclusive and nuanced nature, allowing for the inclusion of traditional knowledge from communities that may not assert an Indigenous status or identity.

Integrated marine and coastal area management:
participatory process for decision-making to prevent, control, or mitigate adverse impacts from human activities in the marine and coastal environment and to contribute to the restoration of degraded coastal areas.

Marine protected area:
a geographically defined marine area that is designated and managed to achieve specific (long-term biodiversity) conservation and sustainable use objectives (and that affords higher protection than the surrounding areas).

Marine (or maritime) spatial planning:
a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that have been specified through a political process.

Modelling:
the construction of physical, conceptual or mathematical simulations of the real world.

Monitoring:
the observation and recording of changes for the purpose of assessment of the progress and success of a plan.

Natural capital:
the stocks of living and non-living resources that provide benefits and services needed by people and all life on Earth.

Nature-based solutions:
actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively while simultaneously providing human well-being and ecosystem services and resilience and biodiversity benefits.

Ocean acidification:
a term used to describe significant changes to the chemistry of the ocean. It occurs when carbon dioxide gas (or CO2) is absorbed by the ocean and reacts with seawater to produce acid. Although CO2 gas naturally moves between the atmosphere and the oceans, the increased amounts of CO2 gas emitted into the atmosphere, mainly as a result of human activities (e.g., burning fossil fuels), has been increasing the amount of CO2 absorbed by the ocean, which results in seawater that is more acidic.

Ocean governance:
the way in which ocean affairs are governed, not only by governments but also by local communities, industries and other stakeholders, which includes national and international law, public and private law, as well as custom, tradition and culture, and the institutions and processes created by them.

Pollution:
the introduction of substances or energy into the environment, resulting in deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems, and impair or interfere with amenities and other legitimate uses of the environment.

Precautionary principle:
applies when there are threats of serious or irreversible environmental damage and provides that a lack of scientific certainty shall not be a reason to postpone cost-effective measures to prevent environmental degradation. There are several interpretations of the precautionary principle/ approach, with some defending that a policy or action that might cause harm should not be carried out, even if the risk is uncertain or there is no scientific agreement on the issue.

Resilience:
the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

Restoration:
any intentional activity that initiates or accelerates the recovery of an ecosystem from a degraded state. Active restoration includes a range of human interventions aimed at influencing and accelerating natural successional processes to recover biodiversity ecosystem service provision. Restoration activities that move a site towards a natural state baseline in a limited number of components (i.e. soil, water, and/or biodiversity) can be referred to as rehabilitation.

Rights-holder:
a group of people (a community and its individual members), with a common identity and a shared set of rules, who rightfully has title over their territory and the natural resources belonging to it. Being a rights-holder implies that the group's wellbeing is promoted by the rights, and that the group (and its individual members) have the capacity to exercise their self-determination related to the given territory.

Scenario:
a plausible and often simplified description of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces.

Sea use regulation:
the rules enacted for the regulation of any aspect of sea use, including zoning, use permits or area regulation, or any other regulation that prescribes the appropriate use or the scale, location or intensity of human activity.

Stakeholders:
the individuals, groups or organisations that are (or will be) affected, involved or interested (positively or negatively) by marine spatial planning management actions in various ways.

Suitability analysis/maps:
the identification of the best location for a particular use according to multiple criteria.

Sustainable blue (or ocean) economy:
the sustainable use of ocean resources for economic growth and improved livelihoods and jobs while preserving the health of ocean ecosystems.

Threshold:
the level of magnitude of a system process at which sudden or rapid change occurs. A point or level at which new properties emerge in an ecological, economic or other system, invalidating predictions based on mathematical relationships that apply at lower levels.

Tipping point:
The critical point in an evolving situation that leads to a new and sometimes irreversible development.

Trade-offs:
management choices that intentionally or otherwise change the type, magnitude and relative mix of services provided by ecosystems.

Vision:
a desired or preferred future.

1 About this volume

Why has this Volume 2 been developed?

UNESCO's Intergovernmental Oceanographic Commission (UNESCO-IOC) and the European Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE) have a longstanding partnership in the scope of the global ocean agenda, particularly in relation to Sustainable Development Goal (SDG) 14 of the 2030 Agenda. Their Joint Roadmap to accelerate Marine/Maritime Spatial Planning processes worldwide (MSProadmap)[2] has contributed to the promotion and capacity development on MSP through several activities, including training, workshops, technical reports and guidelines. The **"MSPglobal International Guide on Marine/Maritime Spatial Planning"**[3], published in 2021, was designed to support governments, stakeholders, communities, civil society networks and all relevant parties in conceptualising, developing and implementing marine/maritime spatial planning (MSP)[4], while drawing on insights from diverse experiences around the world. The **"MSPglobal Guide"** is intended to support the development of MSP processes and plans, offering comprehensive and practical guidance structured around different planning phases and key topics.

By the end of 2023, 126 countries/territories were reported to have engaged in MSP initiatives (UNESCO-IOC, 2024). Some of these countries/territories are in the very early stages of the process, with current initiatives focused mainly on empowerment, developing capacities and conducting preliminary assessments. Others are moving into second or third planning cycles, particularly within the European Union (EU) under the Directive establishing a framework for maritime spatial planning (Directive 2014/89/EU) (Zaucha *et al.,* 2025). The accumulated practice and experience with MSP processes have increased the level of awareness and improvements. At the same time, new challenges and ambitions continue to arise due to the growing impacts of threats such as climate change, pollution, biodiversity degradation, and the simultaneous pursuit of coastal and offshore climate action, food security, and sustainable blue/ocean economy[5].

As science[6], technology innovation and efforts to engage with holders of Indigenous and local knowledge (ILK) deepen our knowledge about the ocean and coasts, new uses and activities also emerge (shaped by societal needs, economic drivers and policy frameworks), intensifying the demand for marine space. While new maritime developments increase (such as offshore renewable energy, offshore aquaculture, carbon capture and storage, seabed mining, etc.), traditional uses and activities continue to compete for space, making it difficult to balance pressures from the growth of maritime sectors with the protection of biodiversity. Climate change poses new challenges to human activities and exacerbates the mounting pressures threatening marine and coastal biodiversity as well as coastal societies. MSP practitioners are faced with the growing need to incorporate flexibility and adaptive approaches into the process. The role of MSP in achieving ocean sustainability is increasingly acknowledged and so are the rising expectations for it to contribute to meeting global targets regarding biodiversity protection and restoration, climate change and the sustainable blue economy. MSP is an integrated and holistic approach to ocean and coastal planning and management, but it also involves significant complexity and meeting specific priorities may require more tailored guidance.

A portfolio of specialised and targeted publications offers countries, practitioners, Indigenous Peoples and local communities (IPLCs), and stakeholders resources to assist in addressing a particular combination of needs determined by their unique characteristics and context. The updated MSProadmap (2022-2027) foresees the development of additional guidance and recommendations in thematic areas such as climate-smart MSP, marine protection and restoration, and sustainable blue economy.

The Kunming-Montreal Global Biodiversity Framework (KMGBF) emphasises the urgency of halting and reversing biodiversity loss and highlights the role of participatory, integrated and biodiversity inclusive spatial planning. Further developing the concept of **biodiversity inclusive MSP**[7] and providing guidance is, therefore, both a need and an opportunity to deepen the contribution of MSP to marine conservation.

2 https://www.mspglobal2030.org/msp-roadmap/
3 https://unesdoc.unesco.org/ark:/48223/pf0000379196
4 'Marine spatial planning' and 'maritime spatial planning' will be used interchangeably.
5 'Sustainable blue economy' and 'sustainable ocean economy' will be used interchangeably.
6 In this document the term science is applied following the definition of 'ocean science' provided by the Ocean Decade Implementation Plan (UNESCO-IOC, 2021), therefore encompassing natural and social science disciplines and embracing ILK as a fundamental source of knowledge.
7 More on the definition of biodiversity inclusive MSP and its key elements can be found in **Chapter 3**.

What is the purpose of this Volume 2?

This is a complementary volume of the **"MSPglobal International Guide on Marine/Maritime Spatial Planning"** that aims to reinforce biodiversity as a key to ocean health and functions, which underpins life on Earth and sustains livelihoods. Particularly, it supports countries in achieving the core objective of the KMGBF to implement participatory, integrated and biodiversity inclusive spatial planning (target 1, see **Box 1)**. It elaborates on the concept of biodiversity inclusive in the specific context of MSP (**Chapter 3**) within the wider framework of the ecosystem-based approach.

The purpose of this volume is to provide additional and specific recommendations on how to further include biodiversity considerations into MSP processes and plans (**Chapter 4**) and strengthen MSP's contribution to overall marine conservation and resilience.

This volume is structured around the same phases of the planning cycle described in the **"MSPglobal Guide"**. It is not meant to be prescriptive but to be used in a flexible way, where users can decide how to combine and integrate the recommendations according to their own needs and contexts.

Who is this Volume 2 for?

This publication is developed to assist governments, IPLCs, stakeholders and all relevant parties involved in the design, implementation, monitoring and evaluation of ecosystem-based marine spatial plans, bringing biodiversity to the forefront of the process. It will be useful to those with authority and decision-making roles, including policy-makers, planners, managers, and government officials at the local, national, regional and global levels, as well as IPLCs managing their customary coastal-maritime territories. It can also be of interest to academics, students and researchers of MSP. This guide can be used as a reference for capacity development activities on MSP, as well as to develop or advance good practices. It might also be relevant when considering and implementing other marine area-based management tools, including Marine Protected Areas (MPAs), Special Management Areas (SMA), Areas beyond National Jurisdiction (ABNJ), Other Effective Area-Based Conservation Measures (OECMs), and Integrated Coastal Zone Management (ICZM).

How was this Volume 2 developed?

This volume builds on the experience and expertise of professionals and researchers from different parts of the world. These experts were brought together during online workshops to discuss the concept of biodiversity inclusive MSP, challenges and recommendations on how to advance it. Workshops included presentations by experts and interactive discussions using a collaborative and whiteboarding platform. These sessions allowed for the identification of key elements of biodiversity inclusive MSP (**Chapter 3**). Further contributions were collected through an online form, and later interactions with the experts allowed for a better integration of the content by the MSPglobal team. A total of 33 experts from four continents attended the workshops, and 26 are included as contributors to this publication. Additional contributors were invited to share case studies that illustrate some of the recommendations, which can be found in text boxes. Experts from relevant international organisations and/or with specialised expertise on the topic who were not involved as contributors were invited to review the document, providing independent feedback and contributing to improve the quality of the publication. Reviewers included five experts from three continents.

2 Why do we need to emphasise biodiversity considerations in MSP?

2.1 Marine and coastal biodiversity as the foundation of ocean health and human livelihoods

The **term 'biodiversity'** or **'biological diversity' refers to the heterogeneity of living organisms on Earth and the ecological complexes of which they are part** (Convention on Biological Diversity, 1992, Article 2). This includes diversity at the genetic level (genetic differences within each species, important for its adaptability), species level (variety of species) and ecosystem level (variety of ecosystems in a particular area). In marine and coastal environments, biodiversity includes, for example, the different ecosystems that can be found, such as coral reefs, kelp forests or seagrass meadows, the variety of species, from tiny plankton to large fish and mammals, as well as the genetic diversity of populations, like the common kelp. The actual number of species in the ocean, which covers 71% of our planet's surface area and 99% of habitable space by volume, is difficult to determine due to its vastness. Scientists estimate that between one-third and two-thirds of ocean eukaryotic species remain undescribed (Appeltans *et al.*, 2012), and only a quarter of the ocean floor is mapped (Seabed 2030 Project, 2024).

The great diversity of species living in the ocean underpins food webs and biogeochemical cycles that **sustain marine ecosystems and provide numerous benefits to humankind.** The global ocean economy is valued in the billions to trillions of USD, and marine and coastal biodiversity contributes substantially to this value (UN DESA, 2017). While the precise relationship between biodiversity, ecosystem functions, and ecosystem services delivery is complex, it is widely accepted that biodiversity loss is degrading ecosystem functions, in turn affecting the delivery of ecosystem services. Biodiversity loss, therefore, diminishes the value of ecosystems as natural capital assets. However, when managed sustainably, it is possible to recover at least some of this value through biodiversity-driven ecosystem regeneration.

Critical **functions of the ocean** include producing half the world's oxygen and regulating climate through carbon sequestration and nutrient cycling (Cooley *et al.*, 2022). Mangroves, salt marshes and seagrasses are often referred to as 'blue carbon' ecosystems as they have the potential to capture carbon at rates that are more significant than those of terrestrial forests (although their combined global area is much smaller than that of forests). Mangroves, for example, are estimated to sequester up to 34 million tonnes of carbon per annum (Howard *et al.*, 2017). Carbon cycling is also connected to the movement and transformation of other essential nutrients, such as nitrogen and phosphorus, necessary for primary production and support diverse food webs.

Marine coastal ecosystems act as **natural coastal defence infrastructure**, offering substantial shoreline protection against natural disasters by acting as barriers that absorb and dissipate wave energy. For example, the existence of coral reefs, oyster reefs, mangroves, and other coastal wetlands can reduce wave energy by up to 97% (Ferrario *et al.*, 2014). Such ecosystems, therefore, provide essential protection to coastal populations and human infrastructure from storm surges, flooding, and erosion. As climate change increases the frequency, intensity, and magnitude of extreme weather events, ecosystem-based disaster risk reduction will become increasingly important. Marine Green Infrastructure and marine and coastal nature-based solutions (NbS) are rooted in this ability of ecosystems to provide a variety of services that address societal and ecological challenges (Lecerf *et al.*, 2023; O'Leary *et al.*, 2023; Ruskule *et al.*, 2023).

Coastal IPLCs and marine-based industries are heavily dependent on marine biodiversity, using marine resources for food security, in industries like fishing and tourism, and as raw materials in, for example, biotechnology with marine-derived compounds (e.g., alginates produced from kelps used in pill coats and dental moulds (Abka-khajouei *et al.*, 2022)) promising new treatments for cancer and other diseases (e.g., coral exoskeletons used as bone graft substitute (Demers *et al.*, 2002)). The filtration capacity of marine and coastal ecosystems also means they contribute to water security by absorbing land-based nutrients, reducing pollution run-off from land, and decreasing turbidity, thereby improving the quality of water that people rely on for drinking, irrigation, and recreation. In addition to delivering direct benefits to users for physical health, biodiversity-rich ecosystems provide opportunities for recreation and hold great value to coastal communities and Indigenous Peoples in terms of culture, aesthetics, religion and spirituality. In many cultures, the ocean has an intrinsic value and represents life and a connection to nature. Coastal and underwater environments are also major tourist attractions that bring in millions of people annually, generating revenue and supporting local economies (Secretariat of the Convention on Biological Diversity, 2012).

Because biodiversity underpins the physical and intangible benefits derived from marine and coastal ecosystems, as well as the ability of ecosystems to function and, where necessary, recover, **its conservation and sustainable use are critical for protecting both ecosystems and human well-being**.

2.2 Current threats

Marine and coastal ecosystems are vital for planetary functioning and human health and wellbeing. However, despite their undeniable importance, marine and coastal biodiversity is under severe threat from human activities (United Nations, 2016). Among the most pressing issues are overexploitation and habitat destruction, pollution, and climate change (Jaureguiberry *et al.,* 2022).

Overexploitation (including overfishing) and habitat destruction have significantly decreased fish populations and reduced habitat extent and connectivity in many regions. Globally, rates of ocean defaunation have increased, and many fish populations have declined in abundance and range. Over 37% of fish stocks assessed by the Food and Agriculture Organisation are considered overfished (FAO, 2024). Overexploitation alters population dynamics and interferes with food webs and biogeochemical cycling, impacting entire ecosystems. In addition, some fishing methods using seabed contacting mobile gears, such as bottom trawling, also directly harm benthic habitats and, with regular use, can change complex structural habitats to habitats dominated by gravel, mud, and sand. Habitat destruction in coastal areas is also caused by unsustainable coastal development, for example, urbanisation or agri- or aquaculture, as well as sand extraction. Globally, approximately 60% of marine and coastal ecosystems are degraded or unsustainably used (Buonocore *et al.*, 2021). In the last 50 years, kelp forests, salt marshes, mangrove forests, coral reefs, and seagrass beds have significantly declined (Buonocore *et al.*, 2021; Vergés and Campbell, 2020; Mcowen *et al*., 2017).

Pollution, particularly from plastics and land-based wastewater and nutrient runoff, poses a critical problem for the health of marine and coastal ecosystems. Plastic waste, which is often improperly disposed of, enters oceanic systems where it can entangle marine life, be ingested by animals, and enter food webs. More than 14 million tons of plastic enter the ocean annually (IUCN, 2024). This makes the ocean one of, if not the largest, dumpsites in history. Once present in the ocean, pieces of plastic waste break down into microplastics that can now be found even in the most remote ocean areas as well as in marine life across food webs, raising concerns for the potential impacts on human health through ingestion.

Unsustainable land uses and management systems often result in **poor watershed management**, which increases land runoff and contaminates coastal and marine waters with chemicals ranging from pesticides and fertilisers to heavy metals, as well as additional sediment inputs. These increased nitrogen and phosphorus inputs cause eutrophication, which can lead to algal blooms that consume oxygen through growth and decomposition, thereby causing anoxia (UNESCO-IOC, 2024). This can create conditions where there is not enough oxygen for marine life to survive and can contaminate seafood and drinking water if the algal bloom is large and produces toxins, known as a harmful algal bloom (Hallegraeff *et al.*, 2021). Eutrophication may also generate competition for light and nutrients when dense algal blooms block the sunlight from reaching submerged aquatic plants, thus disrupting photosynthesis (Filbee-Dexter and Wernberg, 2018; UNEP, 2023).

A more invisible source of pollution is **underwater noise** from ship engines, wind turbines, sonar, and other industrial activities. Elevated levels of underwater noise can disorient animals, affect their social interactions, and cause profound disruption for entire ecosystems. Ocean-based noise pollution has been increasing over time, affecting marine soundscapes locally and further afield as noise pollution can propagate hundreds of kilometres in some cases (CMS, n.d.). The exact distance of noise propagation is affected by factors such as seafloor morphology and type, noise composition and characteristics, and source level, and the impacts on marine life depend on their degree of sensitivity and exposure (Peng *et al.,* 2015).

Climate change poses a multifaceted and far-reaching threat to marine biodiversity, driving extensive changes in ocean conditions and reshaping marine and coastal ecosystems. Changing patterns in sea temperatures and ocean acidification, combined with falling oxygen levels, especially in deep waters, will lead to smaller fish, altered species distributions, species loss, and declining productivity (EEA, 2023a). Rising sea temperatures can result in heat stress, weakening species' reproductive and survival rates. Sea level rise represents a particular threat to coastal ecosystems, with low-lying areas increasingly vulnerable to inundation, which can lead to habitat loss. Ocean acidification, a related outcome of the increase of carbon dioxide concentration in the ocean (UNESCO-IOC, 2022), compromises the ability to grow calcium carbonate structures in organisms like corals, molluscs and some plankton, which may destabilise food webs that rely on them (Mollica *et al.*, 2018). Oxygen depletion affects species growth, reproduction and behaviour (IUCN, 2019) —with hypoxic zones predicted to increase in the future, biodiversity in affected areas will likely decline. These impacts are expected to have serious implications for the global blue economy, though effects will vary depending on local and regional factors.

In addition to all these threats, the advancements in marine technology leading to new uses and activities, such as deep-sea mining and marine carbon dioxide removal, might generate additional and, so far, **unknown impacts**.

The individual and cumulative impacts of pressures experienced by marine and coastal ecosystems require immediate and **coordinated management and governance actions**. International cooperation is essential to address the transboundary challenges posed by the fluid nature of the ocean.

2.3 New international objectives and targets

In response to the diversity of threats and in recognition of the significance of the ocean for planetary health and human development, the international community has agreed on ambitious goals and targets for the protection and restoration of ecosystems.

The adoption of the **Kunming-Montreal Global Biodiversity Framework (KMGBF)** (CBD, 2022) marks a significant step by the UN Convention on Biological Diversity, urging Parties to commit to halting and reversing nature loss. Under the KMGBF, by 2030, 30% of land, waters and seas should be conserved (target 3) and 30% of all degraded ecosystems restored (target 2). In the marine realm, this means expanding the coverage of MPAs and OECMs, restoring degraded marine and coastal ecosystems (such as coral reefs, mangroves, seagrasses and nursing areas) and depleted fisheries species/stocks. The KMGBF also recognises the importance of spatial planning and effective management in reducing biodiversity loss, calling for participatory, integrated and biodiversity inclusive spatial planning (and/or effective management processes) in all areas (target 1 (**Box 1**)).

Box 1

KMGBF target 1: Plan and manage all areas to reduce biodiversity loss

This target aims to "ensure that all areas are under participatory, integrated, and biodiversity inclusive spatial planning and/or effective management processes addressing land and sea use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030 while respecting the rights of Indigenous Peoples and local communities".

To accomplish this, spatial planning and management processes need to include different elements:

- ***"Participatory:*** *it is important that these processes consider how space and resources are being used by different actors, including IPLCs, how these uses align with biodiversity objectives and what possible conflicts could exist. Understanding and accounting for these different purposes necessitates a participatory approach".*
- ***"Integrated and biodiversity inclusive:*** *to be effective in achieving the goals of the KMGBF, these processes must integrate biodiversity considerations, along with other considerations".*
- ***"Respecting the rights of IPLCs:*** *the rights of IPLCs must be respected and preserved with their free, prior and informed consent, including their full and effective participation in decision-making, in accordance with relevant national legislation, international instruments, including the United Nations Declaration on the Rights of Indigenous Peoples, and human rights law".*

The KMGBF framework identifies the following **headline indicators** for this target to provide a high-level summary of its progress:

- *"Red List of Ecosystems";*
- *"Extend of natural ecosystems";*
- *"Percentage of land and seas covered by biodiversity-inclusive spatial plans";*
- *"Number of countries using participatory, integrated and biodiversity-inclusive spatial planning and/or effective management processes addressing land- and sea-use change to bring the loss of areas of high biodiversity importance close to zero by 2030".*

A set of component and complementary indicators is being developed to assist countries in gathering additional information on particular elements, trends and conditions.

Sources: https://www.cbd.int/gbf/targets/1 and CBD/COP/DEC/16/31

Other KMGBF targets contribute to addressing critical threats to ocean biodiversity. Ensuring the sustainable, safe and legal harvesting and trade of wild species (target 5) prevents overfishing and harmful fishing practices. Reducing the introduction of invasive alien species and minimising their impact (target 6) helps protect marine and coastal ecosystems. Reducing pollution (target 7) means less nutrient runoff, plastic pollution, and toxic chemicals entering the ocean. Minimising the impact of climate change on biodiversity and increasing its resilience (target 8) includes addressing ocean acidification and emphasising the potential of nature-based solutions for climate mitigation and adaptation and disaster risk reduction.

To translate the KMGBF into national action, Parties to the CBD agreed to revise and update their national biodiversity strategies and action plans, including the development of national targets reflecting, as applicable, all the goals and targets of the KMGBF.

The **United Nations' 2030 Agenda for Sustainable Development** also includes a specific goal for the conservation and sustainable use of the ocean, seas and marine resources (SDG 14). It seeks to *"sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans"* (target 14.2) as well as to expand conservation areas (target 14.5). SDG 14 also sets targets regarding the reduction of marine pollution, particularly from land-based activities (target 14.1), the prevention of overfishing (target 14.4) and the end of harmful fishing practices (target 14.6), among others.

Both **United Nations Decades of Ocean Science for Sustainable Development**[8] **(Ocean Decade) and on Ecosystem Restoration**[9] have been promoting important actions linked to SDG 14, paving the way for countries to have better access to data, knowledge, partnerships and funding that can contribute to marine and coastal protection and restoration. Some examples are the OBIS 2030 (the biodiversity data hub for the Ocean Decade Actions), SMARTNET (a global knowledge network for ocean science), Marine Life 2030 (a global, interoperable network and community of practice for observation and forecasting of marine life), as well as several projects restoring mangroves and underwater ecosystems.

At the **regional level**, other biodiversity frameworks have been adopted. In the European Union, for instance, Member States are additionally pushed forward by the **EU Biodiversity Strategy for 2030** (COM/2020/380 final). It reinforces the need to protect 30% of the sea in the EU by 2030, calling for strict protection of one-third of the protected areas. Commitments towards restoration were also included and later detailed in the **EU Nature Restoration Law** (Regulation (EU) 2024/1991). This regulation mandates the implementation of restoration measures for several habitat types, including marine and coastal habitats, and emphasises the need for the protection and enhancement of nature-based carbon removals (including blue carbon ecosystems).

At the **national level**, governments have established commitments to implement global frameworks. Meeting all the global and regional targets regarding the protection and restoration of nature is as challenging as it is imperative. Countries need to embed these goals across their policies and plans, design and put in place measures to protect and restore vulnerable marine ecosystems, reduce pollution and manage fisheries sustainably. One of the challenges is the fact that marine and coastal ecosystems are interconnected, spanning through a variety of spatial scales and jurisdictions. The land-sea interface, in particular, highlights the need for more integrated and holistic management approaches that consider the interdependence of terrestrial and marine environments, processes, uses and activities (Bocci *et al.*, 2024). Achieving the biodiversity targets might require a multi-scale approach, combining bottom-up strategies with stronger cooperation and concerted action between countries. This entails more than simply expanding the global coverage of areas under protection; it also means guaranteeing effective management of conservation areas and incorporating users into decision-making processes.

2.4 The role of MSP

MSP is a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas[10] to achieve ecological, economic, and social objectives that are usually specified through a political process (UNESCO-IOC, 2009). As a process, it can also be used to facilitate a comprehensive marine governance system and enhance overall marine management by **helping to minimise conflict and implement marine policies in a coordinated manner**.

By addressing many sectors (such as fisheries, shipping, tourism and energy production), their interrelationships and cumulative impacts, MSP can play a significant role in **managing the pressures on marine and coastal ecosystems, especially if applying an ecosystem-based approach (EBA)**. This ecosystem-wide view helps to reduce threats such as pollution and habitat loss associated with resource use. For

8 https://oceandecade.org/

9 https://www.decadeonrestoration.org/

10 In many cases, coastal and marine areas can be difficult to distinguish due to different reasons. On one hand, the discrete physical dimensions of the coastal zone are not universally defined, often varying by context and jurisdiction. On the other hand, coastal and marine ecosystems are interconnected, with strong land-sea interactions that need to be accounted for. Thus, coastal and marine planning actions need to be aligned and, in some cases, can be integrated into a single process.

instance, the contribution of MSP in identifying pressures, reducing adverse impacts and achieving the good environmental status of marine ecosystems is notably recognised by the EU Biodiversity Strategy for 2030.

In the allocation of spaces for particular uses, marine protection and restoration need to be increasingly and adequately considered. MSP can contribute to the protection of biodiversity outside of designated protected areas by **steering human activities away from vulnerable habitats or reducing their impacts on habitats**. An MSP process can thus provide a broader perspective and, in some cases, contribute to the identification of (additional) areas with high potential for protection and connectivity based on the best available knowledge, ecological models, as well as rights-holders and stakeholders' input. Similarly, it can help identify degraded areas where restoration efforts are needed, integrating suitability analysis. The potential contribution of MSP in achieving biodiversity targets was recognised by the CBD (CBD/COP/DEC/XIII/9), as well as the need to better integrate area-based conservation measures into MSP (CBD/COP/DEC/14/8).

The potential of MSP to support biodiversity mainstreaming is increasingly acknowledged (Winther *et al.*, 2020; Haapasaari *et al.*, 2024), and MSP legislation and plans frequently determine **biodiversity-related objectives**. Yet, practical implementation and operationalisation remain limited as economic considerations often take precedence over biodiversity when it comes to decision-making (Haapasaari *et al.*, 2024). However, prioritising biodiversity conservation to ensure healthy ecosystems is the cornerstone of sustainable ocean use, delivering long-term societal benefits.

MSP has the potential to **combine diverse forms of knowledge, engagement and ecosystem-based management principles**, which can be used to inform decision-making processes that promote balanced use of marine resources, where considerations about biodiversity and ecological health are at the forefront, recognising their foundational role in a sustainable blue economy. A biodiversity inclusive MSP process presents an opportunity to harmonise human activities in a consistent manner to reduce pressures and protect biodiversity. Depending on the particular context and the legal and governance frameworks in place, the role of MSP in integrating different policies for biodiversity conservation might vary greatly. Nevertheless, **biodiversity should always be duly considered at the several phases of the MSP process**.

3 What is biodiversity inclusive MSP?

3.1 Definition

The **term 'biodiversity inclusive'** emerged to emphasise the need for projects, plans and policies to not simply acknowledge biodiversity considerations (e.g., number of species, specific habitats, etc.) but rather **take a proactive stance and embed biodiversity conservation at the core of decision-making** processes and practices. It aims to reinforce that healthy biodiversity is crucial for long-term social-ecological resilience and prosperity, encouraging all sectors to assess, prevent and mitigate their impacts on biodiversity.

The **Convention on Biological Diversity (CBD) has been leading the way** in bringing biodiversity to the forefront of policies and assessments, namely in sectors such as agriculture, fisheries, climate or Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) (Runhaar *et al.*, 2024). The endorsement of the ***"Voluntary Guidelines on Biodiversity-Inclusive Impact Assessment"*** (UNEP/CBD/COP/DEC/VIII/28) by CBD Parties in 2006 contributed to the wider adoption of the terminology. Today, the designation 'biodiversity inclusive' or 'nature inclusive' can be found in areas such as natural capital assessments (Capitals Coalition and Cambridge Conservation Initiative, 2020), circular economy (EEA, 2023b), design (Hernandez-Santin *et al.*, 2022), urbanism (Monti, 2020) and spatial planning (Landry and Rankovic, 2021).

Land and sea-use changes are a main driver of biodiversity loss, and spatial planning has the responsibility to tackle this threat adequately. However, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) ***"Global Assessment Report on Biodiversity and Ecosystem Services"*** shows the need for spatial planning approaches to better address ecological and biological concerns (Landy and Rankovic, 2021). The KMGBF reinforces this in its call for *"participatory, integrated, and biodiversity inclusive spatial planning"*. In this scope, the biodiversity inclusive approach is defined as *"taking into account all relevant information to safeguard biodiversity in spatial planning processes"* (UNEP-WCMC, 2024). It must be highlighted that **the goal is to halt and reverse the loss of areas of high biodiversity importance**, and therefore, it is outcome-driven. Biodiversity inclusive spatial planning is seen as an approach to guide the **long-term conservation and sustainable use** of land, freshwater and sea areas that lead to nature positive outcomes for the benefit of nature and people (Grantham *et al.*, 2024). It is recognised as relevant to many of the other KMGBF targets, namely by providing information on areas of high biodiversity, strategic information on where to conserve and restore degraded ecosystems and by contributing to the management of human-wildlife conflicts.

When applied to the marine space, this means that **biodiversity conservation is not merely a layer of information** to be considered but rather needs to be integrated across all maritime activities through a comprehensive spatial planning process, resulting in nature positive outcomes for the marine environment. To achieve this, MSP needs to consider trade-offs between multiple objectives that are clearly defined, contributing to achieving or maintaining ocean health and lowering the risk of environmental impacts.

Developing a biodiversity inclusive MSP process means recognising that biodiversity (in its various dimensions) supports **ecosystem multifunctionality across scales** (Correia and Lopes, 2023) and is indispensable to a healthy ocean that underpins sustainability. It is crucial that MSP processes and resulting plans include clear and specific objectives to achieve measurable, biodiversity positive outcomes. To ensure that biodiversity is truly recognized as the foundation of sustainable development, MSP needs to be necessarily developed under an ecosystem-based approach. This will help guarantee that the process includes appropriately detailed information about biodiversity and conservation action.

3.2 Foundational framework of MSP: Ecosystem-based approach

The CBD Secretariat defines the 'ecosystem approach' as *"a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way"* (Secretariat of the Convention on Biological Diversity, 2004). The **ecosystem-based approach provides a framework, guided by a series of principles** (Malawi principles UNEP/CBD/COP/4/Inf.9 (**Box 2**)), to ensure that ecosystems and their multiple connections with human activities are given due consideration in the implementation of strategies and policies (CINEA, 2021a). It considers the ecosystem as a whole, analysing all the drivers, their impacts and effects on ecosystem functioning, health and integrity (Curtin and Prezello, 2010).

Box 2

Malawi Principles for the Ecosystem Approach

A set of complementary and interlinked principles that characterise the ecosystem approach:

1. *"Management objectives are a matter of societal choice".*
2. *"Management should be decentralised to the lowest appropriate level".*
3. *"Ecosystem managers should consider the effects of their activities on adjacent and other ecosystems".*
4. *"Recognizing potential gains from management, there is a need to understand the ecosystem in an economic context, considering, e.g., mitigating market distortions, aligning incentives to promote sustainable use, and internalising costs and benefits".*
5. *"A key feature of the ecosystem approach includes conservation of ecosystem structure and functioning".*
6. *"Ecosystems must be managed within the limits to their functioning".*
7. *"The ecosystem approach should be undertaken at the appropriate scale".*
8. *"Recognizing the varying temporal scales and lag effects which characterise ecosystem processes, objectives for ecosystem management should be set for the long term".*
9. *"Management must recognise that change is inevitable".*
10. *"The ecosystem approach should seek the appropriate balance between conservation and use of biodiversity".*
11. *"The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices".*
12. *"The ecosystem approach should involve all relevant sectors of society and scientific disciplines".*

Source: UNEP/CBD/ COP/4/Inf.9

Considering that marine and coastal ecosystems are highly interconnected, with complex links between species, habitats and processes, adopting an EBA is particularly important for their effective and integrated management (UNEP, 2011). MSP is regarded a central marine policy to operationalise EBA principles. Indeed, in its early origins, MSP was proposed as a process to move towards ecosystem-based management of the marine environment (UNESCO-IOC, 2009).

In the European Union, for instance, the MSP Directive calls explicitly for the application of EBA in order to maintain the cumulative effects of human activities within the limits of marine ecosystems, preserving their resilience and ability to sustain goods and services for present and future generations. This approach acknowledges that the **carrying capacity of marine ecosystems against human pressures is limited** (WWF, 2020). In other regions of the world, countries such as Brazil[11] and South Africa[12] also recognise the importance of EBA in the development of their MSP.

Applying EBA in MSP is expected to deliver multiple benefits, including a deeper understanding of the functioning of marine ecosystems and the consideration of cumulative impacts and trade-offs. It encourages the planning process to look beyond national jurisdictional boundaries, be adaptive and apply the precautionary principle (Ansong *et al.*, 2017). This holistic approach improves the understanding of the state of marine ecosystems, which should guide the planning of uses and activities and contribute to a broader strategy for nature conservation.

The implementation of EBA in the marine realm is, however, perceived as slow, and some assessments indicate little practical evidence of the application of EBA principles within MSP processes (CINEA, 2021b). The World Wildlife Fund (WWF) has endeavoured to assess the integration of EBA in MSP in different European Sea Regions, using a set of indicators derived from the requirements of the MSP Directive and taking into account other EU environmental legislation. Inclusion of nature is one of the categories assessed with the lowest scores, namely in indicators such as the use of the precautionary principle in the absence of data, identification of blue corridors and protection of blue carbon ecosystems.

Though there are challenges to implementing EBA in MSP, there is also progress. A recent study shows that the **ecosystem-based approach has become more operational over the last decade**, and there is an increased understanding and interdisciplinary collaboration (Haugen *et al*., 2024). It also highlights the advantages of an incremental approach to integrate EBA in existing frameworks. Several projects and organisations have produced guidance on incorporating EBA in MSP and identified specific methods and tools that can help with implementation, namely cumulative impacts/effects analyses, sensitivity analysis, risk assessment, economic and social valuation of ecosystem services, fuzzy cognitive mapping, scenarios, multi-criteria analysis, cost-benefit analysis, among others. SEA is particularly mentioned as an important process or tool for implementing EBA in MSP, as it identifies, describes and assesses the likely significant effects on the ecosystem (HELCOM-VASAB, 2016; Pinkau and Schiele, 2021).

The present publication reinforces that EBA is the foundational framework that should guide MSP processes and resulting plans, and aims to strengthen the focus on biodiversity and ecological elements.

It is essential to apply EBA in MSP through a process perspective (Frank-Kamenetsky *et al.*, 2023), recognising its relevance in each of the different phases of the planning cycle. This means integrating EBA principles (**Box 2**) from the

11 https://cooperacaobrasil-alemanha.com/TerraMar/VisionMSP.pdf
12 https://www.gov.za/sites/default/files/gcis_document/201905/42444gon641marinespatialplanningact16of2018.pdf

definition of spatial and temporal planning scales, definition of objectives, assessments of ecosystem conditions, and cumulative impacts to the identification and participation of rights-holders and stakeholders, among others (**Figure 1**).

Aspects related to the inclusion of nature, namely biodiversity, restoration, ecosystems' capacity limits and cumulative impacts, are particularly relevant for a biodiversity inclusive MSP process.

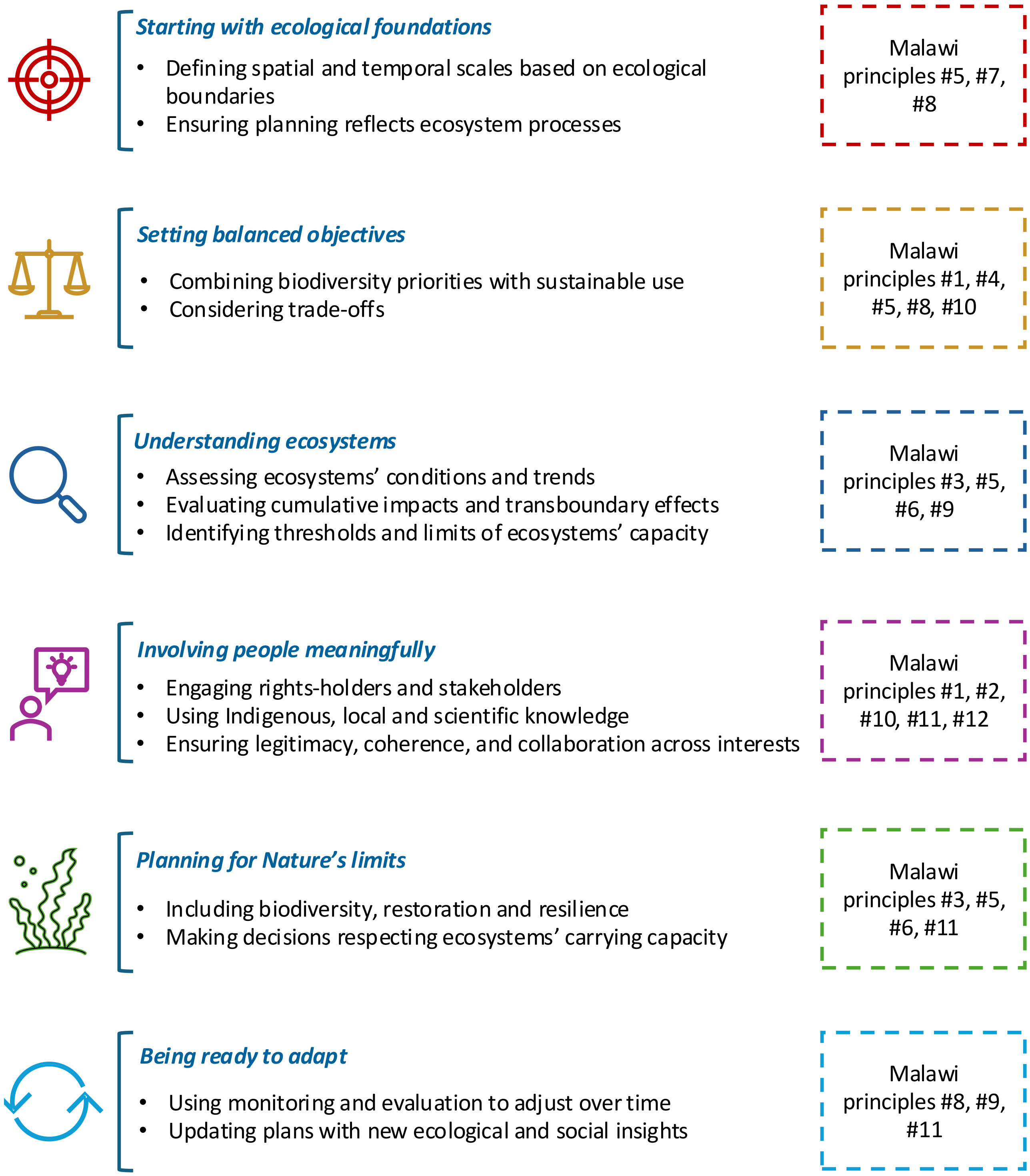

Figure 1
Embedding the ecosystem-based approach in MSP, guided by the Malawi principles.

Further reading sources:

Galparsoro, I., Menchaca, I., Pouso, S., Katsanevakis, S., Fraschetti, S., Giakoumi, S., Borja, Á. and Stelzenmüller, V., 2023. *Framing and operationalising ecosystem-based maritime spatial planning (EB-MSP): Concepts and definitions.* MarinePlan Project. https://www.marineplan.eu/fileadmin/marineplan/Publications/ConceptsDefinitions20230216.pdf

CINEA. 2021. *Guidelines for implementing an ecosystem-based approach in maritime spatial planning: including a method for the evaluation, monitoring and review of EBA in MSP.* European Climate, Infrastructure and Environment Executive Agency. DOI 10.2926/84261. https://op.europa.eu/en/publication-detail/-/publication/a8ee2988-4693-11ec-89db-01aa75ed71a1

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HELCOM-VASAB. 2016. *Guideline for the implementation of ecosystem-based approach in maritime spatial planning (MSP) in the Baltic Sea area.* https://www.helcom.fi/wp-content/uploads/2019/08/Guideline-for-the-implementation-of-ecosystem-based-approach-in-MSP-in-the-Baltic-Sea-area_June-2016.pdf

3.3 Key elements of biodiversity inclusive MSP

While exploring and discussing the concept of biodiversity inclusive MSP during the online workshops with experts, four main elements emerged as key in its development. First, **knowledge-based approaches** can provide a deeper understanding of biodiversity, ecosystem elements and functions (**Section 3.3.1**). This foundational knowledge is crucial for a better comprehension of the ecological capacity and limits of ecosystems and for determining the degrees of human uses and activities that do not put ecosystems' health at risk. This is the cornerstone of **ocean resilience and sustainable blue economies** that should guide the vision of biodiversity inclusive MSP (**Section 3.3.2**). To guarantee biodiversity and ecosystem health in the present and for the future, **marine protection and restoration** efforts are an essential element (**Section 3.3.3**) that can be boosted by knowledge-based approaches. The overall success of biodiversity inclusive MSP process depends on the **engagement of rights-holders and stakeholders** from the start, particularly those that are strongly reliant on marine biodiversity (**Section 3.3.4**). Their engagement allows the consideration of their needs and concerns, as well as the integration of their knowledge systems. Together, these interconnected elements form the fundamentals of biodiversity inclusive MSP (**Figure 2**).

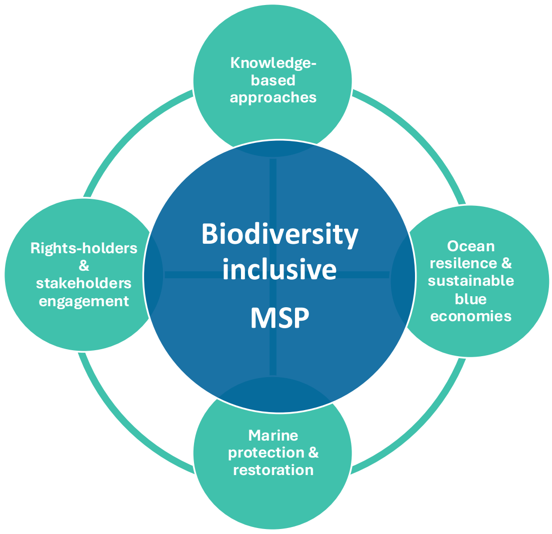

Figure 2
Key elements of biodiversity inclusive MSP.

3.3.1 Knowledge-based approaches for better understanding of biodiversity, ecosystem elements and functions

In biodiversity inclusive MSP, the **best available science, including ILK and evidence**, is used to understand the complex relationships among biodiversity, ecosystem functions and services and identify ecosystems' thresholds and tipping points. Information on threatened biodiversity (populations, species and ecosystems), as well as ecosystem processes, ecological integrity, connectivity and social-cultural values associated with these elements are extremely important. Examples of valuable data and information might be the **distribution of species and habitats, ecosystem extent and condition, threats and risk status** to species and ecosystems (Borja *et al.*, 2024), vulnerability and sensitivity. Biodiversity inclusive MSP should integrate as many levels of biodiversity as possible when data and information are available (Grantham *et al.*, 2024).

MSP is expected to embrace a holistic, **three-dimensional vision of marine ecosystems that considers the depth, structure, and interconnectivity** of marine life and environmental conditions. As far as possible, it should include updated data and information about the complex interactions among species and their habitats, as well as understand how climate change will spatially and temporally alter marine ecosystems (Trégarot *et al.*, 2024). Another critical aspect is studying **how marine ecosystems provide essential ecosystem services** (Galparsoro *et al.*, 2021) and assessing **how human activities might negatively affect that** ability in order to avoid crossing the resilience tipping points where ecosystems might be unable to bounce back or continue delivering important services.

Effective planning and management need to be based on understanding when and how ecosystems change over spatial and temporal scales.

Importantly, data needs not just to be collected and analysed but also to be effectively **translated into actionable insights that can inform policy decisions**. Complex information must be distilled into straightforward, usable formats that communicate the trade-offs, risks and implications of management alternatives to decision-makers.

While relying on data and information is vital, the absence of sufficient data cannot be a reason to postpone planning or implementation of interventions where it is most needed. Although comprehensive and detailed data is undoubtedly useful, MSP can still effectively move forward based on **adaptive and precautionary approaches that use the best existing data and information** while simultaneously enhancing collection and analysis. This precautionary strategy helps to maintain ecosystem resilience and diversity.

3.3.2 Biodiversity and ecosystem health for ocean resilience and sustainable blue economies

Biodiversity inclusive MSP recognises that the health of marine biodiversity and ecosystems is intrinsically crucial for supporting sustainable blue economies, which depend on the **ability of the ocean to deliver natural resources and ecosystem services** such as food production, carbon sequestration, and climate regulation and protection. Protecting biodiversity and **maintaining ecosystem integrity strengthens the ocean's resilience** to climate change and minimises environmental risks, while enabling economic benefits. Biodiversity protection and restoration is not only essential for several economic activities but **also presents new economic opportunities and generates many social benefits** (EU COM/2021/240 final).

In biodiversity inclusive MSP, ecosystems and their conservation are acknowledged as the **basis for sustainable use, rather than just another sector and a constraint** to economic development (Frazão Santos *et al.*, 2024; Reimer *et al.*, 2023). This requires making decisions grounded in an understanding of ecosystem functions and ecological capacity and limits, ensuring that human activities remain within sustainable use and limited environmental impacts.

Economic development, including the creation of jobs and livelihood enhancement, needs to be rooted in the sustainable use of the ocean, seas and coastal resources to ensure the long-term health and resilience of the ocean. Sustainable blue economy integrates economic, social, and environmental dimensions by promoting *inter* alia low-pollution, resource-efficient, and circular economy practices. **Economic decision-making needs to consider a natural capital approach** (Voora and Venema, 2008) that captures and calculates the economic values of marine ecosystem services and highlights the benefits to people who are put at risk by losing biodiversity and a healthy marine environment. Integrating data on the environmental, economic, social and cultural benefits derived from the ocean (namely through ocean accounting (Loureiro *et al*., 2023)) can ensure that any trade-offs considered represent a more complete picture of the overall social and economic gains and losses potentially arising from planning decisions. Holistic and integrated approaches that protects ocean health while enabling sustainable and equitable use of ocean resources for human well-being are essential to unlock and deliver an impactful and lasting transition to sustainable blue economies (UNEP, 2025).

3.3.3 Emphasis on marine protection and restoration

In biodiversity inclusive MSP, the importance of marine protection and restoration as a cornerstone for ocean health is emphasised. This means, first of all, clearly integrating biodiversity conservation into MSP objectives. In addition, MSP can enable the incorporation of area-based conservation measures across broader governance of marine spaces.

Area-based conservation measures like MPAs, OECMs and restoration actions are essential to halt biodiversity loss. MPAs maintain a vital function in biodiversity conservation by limiting human uses and destructive processes and allowing ecosystems and species better conditions to flourish (Ward *et al.*, 2022). OECMs complement MPAs, helping to maintain biodiversity across a broader patchwork of marine environments. Understood as geographically defined areas (other than a protected area), *"governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity"* (CBD/COP/DEC/14/8), they can include, for example, fisheries-management areas by IPLCs.

Although conservation is crucial, it is not sufficient to address the extensive damage already suffered by ecosystems. Degraded habitats need to be restored so that biodiversity can recover to a healthier state that ensures ecosystem functions and the provision of essential services. However, restoration can be an expensive and challenging process, and its outcomes may not always be fully effective. Sometimes, ecosystems cannot be recovered, and **restoration should not be seen as a simple compensatory measure or a commercial opportunity**. It is also important to avoid isolated or disconnected protection and restoration areas and instead embed them within a larger spatial context, **ensuring ecological coherence and connectivity**.

A system that embraces both MPAs and OECMs is needed for the world to meet the KMGBF conservation targets (Maini *et al.*, 2023) and other multilateral environmental agreements

(UNDP, SCBD and UNEP-WCMC, 2021). As a multisectoral and integrated process, **MSP can play a role in this**.

MSP not only considers existing area-based conservation measures but can contribute to the identification of key biodiversity areas and areas in need of restoration, incorporating considerations about pressures, cumulative impacts and trade-offs, following the principles of EBA. It can also include a wide range of actions to avoid biodiversity loss (Grantham *et al.*, 2024).

Besides, MSP has a complementary role to the area-based conservation measures and **provides an opportunity to minimise pressures on biodiversity outside of those areas and contribute to connectivity**. MSP can be a vehicle for **facilitating biodiversity mainstreaming across maritime activities** by integrating biodiversity-specific regulations (for example, temporal closures or spatial restrictions) into sectoral activities, such as fisheries.

Biodiversity inclusive MSP, by intentionally embedding conservation and restoration objectives and regulations, can contribute in different degrees to the achievement of KMGBF targets 2 and 3, with positive outcomes for nature and human well-being.

3.3.4 Engagement of rights-holders and stakeholders from the start

In biodiversity inclusive MSP, rights-holders and stakeholders are included along the process. For a successful MSP process, it is crucial that these groups and their needs (including biodiversity needs) are recognised, they are included in decision-making processes and the **distribution of benefits and harms among the groups are accounted for**.

It is crucial to take care of Indigenous Peoples, communities and sectors that are dependent on biodiversity. These include, but are not limited to, Indigenous Peoples, local fishers and those whose cultural, social and economic needs are dependent on marine resources. Not only do they have a wealth of ILK about marine ecosystems, but they often experience the effects of biodiversity degradation first-hand. These **knowledge systems are based on centuries-old relationships with the environment** and preserve lessons about sustainability, ecological balance in marine systems and adaptation to changes (UNESCO-IOC and UNESCO-LINKS, 2024b). They can significantly enhance MSP processes by anchoring them in a systems perspective of the ecosystems they seek to protect and sustainably manage.

Additionally, including rights-holders into the planning process can help respond to questions of **justice, equity and social responsibility**. Making sure these groups are part of the decision-making processes is a good practice to address ownership in conservation and management action and to ensure that policies do not negatively affect people who depend on marine ecosystems for their livelihoods. This is also consistent with the **Free, Prior and Informed Consent (FPIC) principle to engage with IPLCs**, which is an essential aspect of a human rights-based approach to conservation and sustainable resource management (UNESCO-IOC and UNESCO-LINKS, 2024b).

Effective engagement can lead to successful management outcomes because it builds collaborative relationships among decision-makers and those involved in the use of resources and biodiversity conservation (Said and Trouillet, 2020). Meaningful **biodiversity mainstreaming requires not only the engagement of small-scale users but also the active involvement of other stakeholders, including the large industrial sectors** whose activities are dependent on healthy marine ecosystems. MSP processes can facilitate the recognition from these sectors of their reliance on biodiversity and improve their commitment to positive change, helping align long-term economic interests with ecological sustainability.

An important portion of this engagement process is to make sure that it is meaningful and ongoing. Engaging rights-holders and stakeholders is essential during the early stages of MSP but cannot end there. Consultation and collaboration need to be maintained through **two-way channels that can build trust, minimise conflicts and develop more effective plans**.

4 How to develop biodiversity inclusive MSP?

4.1 The MSP process

The ***"MSPglobal Guide"*** proposes six phases to organise the MSP process; these are: 1) Setting the scene; 2) Designing the planning process; 3) Conducting assessments for planning; 4) Developing the marine spatial plan; 5) Enabling implementation of the marine spatial plan; 6) Monitoring, evaluation, and adaptation of the process and the marine spatial plan (UNESCO-IOC and European Commission, 2021). For each of the six phases, general key tasks are suggested (**Figure 3**). Some of these phases of the MSP process may occur in parallel, and key tasks may extend beyond a specific phase. The content provided by the ***"MSPglobal Guide"*** aims to support the development of diverse MSP processes and plans at various stages without being prescriptive.

This volume highlights ways to strengthen biodiversity considerations throughout the MSP process, contributing to the development and implementation of plans that generate biodiversity positive outcomes. To that end, it provides a cross-cutting recommendation (**Section 4.2**) to guide the entire process, as well as specific recommendations for each phase (**Section 4.3**). Some recommendations may (partially) coincide with key tasks presented in the ***"MSPglobal Guide"***, but emphasising their importance in the context of biodiversity inclusive MSP. The recommendations presented in this volume should not be viewed in isolation but rather as a complement to those outlined in the ***"MSPglobal Guide"***.

Each recommendation includes its rationale and a set of suggested actions that may facilitate implementation. Some also mention potential useful tools, while others present additional sources for further exploration. Although specific recommendations are presented per phase and arranged in a logical sequence, users might combine them according to their specific context and needs.

The recommendations presented in this chapter are intended to be used by MSP processes at different stages of development, serving as guidance for new planning initiatives as well as for ongoing ones.

4.2 Cross-cutting recommendation for biodiversity inclusive MSP

▶ *Enhancing biodiversity inclusive MSP through Strategic Environmental Assessment*

SEA is most commonly known as a process for assessing the environmental and social risks and impacts of development-related policies, plans and programmes (PPPs), allowing decision-makers to ensure that a proposed PPP is compatible with sustainable environmental and social management (IAIA, 2024). Although the term SEA does not explicitly mention the social dimension, this is an integral focus of the process, which has a growing relevance, and some organisations use the term Strategic Environmental and Social Assessment (SESA).

SEA can be seen as a design tool to facilitate a debate amongst stakeholders, developing a shared vision and co-creating integrated and alternative development pathways. An objectives-led approach of SEA can be beneficial to evaluate whether the PPP will help or hinder achieving a range of broader environmental and policy objectives or Environmental and Social Quality Objectives (ESQO) (IAIA, 2024). ESQO can be established to guide the SEA process, ensuring that important issues are not left out in the process and to provide a framework for the assessment of the PPP and its alternatives or scenarios (IAIA, 2024).

SEA can support a more environmentally-oriented MSP practice by strengthening stakeholder engagement and by providing a structured approach to assess potential environmental effects (using a wide range of indicators) of different planning options (Kusters *et al.*, 2024). Applying SEA early in the MSP process can significantly enhance the ecological sustainability of maritime decisions and help safeguard marine biodiversity. Biodiversity can also be particularly addressed in SEA, as highlighted by the CBD draft guidance on biodiversity-inclusive SEA (UNEP/CBD/COP/8/27/Add.2), namely through the assessment of important ecosystem services and direct and indirect drivers of change.

Although SEA has been traditionally used as a tool to evaluate the potential impacts of the draft marine spatial plan (through an impact-led approach), there are several advantages to using it earlier in the planning process as a design tool. It is therefore recommended that MSP processes embrace SEA through an objectives-led approach that can help evaluate the policy and planning proposals against desired biodiversity outcomes, consider alternatives and trade-offs and design a monitoring strategy.

Figure 3
Planning phases of the MSP process and related key tasks according to the "MSPglobal Guide".

Setting the scene

- Looking at previous and existing (planning, legal, governance and institutional) frameworks.
- Establishing cross-sectoral coordination.
- Promoting rights-holders and stakeholders' engagement.
- Leveraging funding and resources.

Designing the planning process

- Including a long-term vision for sustainable blue economy.
- Integrating biodiversity conservation objectives and targets in MSP.

Conducting assessments for planning

- Enhancing data and information collection and sharing.
- Mapping and analysing.
- Determining ecological limits.
- Incorporating climate change considerations.
- Incorporating natural capital considerations.

Developing the marine spatial plan

- Defining important areas for protection and restoration.
- Considering OECMs.
- Integrating nature-based solutions.
- Integrating socio-economic and cultural considerations.
- Planning for the future.

Enabling implementation of the marine spatial plan

- Strengthening legal and policy frameworks.
- Building capacity and promoting public awareness.

Monitoring, evaluation and adaptation of the process & the plan

- Enhancing monitoring and evaluation.

Figure 4
Recommendations for biodiversity inclusive MSP per planning phase of the "MSPglobal Guide".

4.3 Specific recommendations for biodiversity inclusive MSP per phase

The complete set of specific recommendations for biodiversity inclusive MSP per phase of the planning process is summarised in **Figure 4** and explained below. These recommendations should be considered in conjunction with those presented in the main ***"MSPglobal Guide"*** (**Figure 3**) rather than in isolation.

Phase 1 - Setting the scene

Looking at previous and existing (planning, legal, governance and institutional) frameworks

When starting any MSP process, it is necessary to understand the existing frameworks affecting the marine environment and its users at local, national and regional levels. This involves the examination of relevant planning, legal, governance and institutional frameworks that directly or indirectly affect the marine space. Particular attention should be paid to the frameworks associated with biodiversity conservation (including frameworks related to areas managed by IPLCs) to identify current efforts, existing strengths and gaps, providing a base of knowledge on which the MSP process can build. Any potential conflicting, overlapping or synergic policies need to be identified so that coherence can be improved and duplication avoided. Aligning MSP with existing frameworks promotes integrated governance and increases the likelihood of a more effective implementation. For biodiversity inclusive MSP, the regional scale is extremely relevant to considering the transboundary or cross-border context and how it may affect biodiversity.

Suggested actions:

- Ensure comprehensive inclusion of frameworks that target biodiversity conservation when gathering and reviewing current frameworks. Incorporate plans, policies, governance, and institutional structures that are pertinent to OECMs, MPAs and MPA networks, restoration, NbS, environmental evaluations, and other related topics. Identify and review previous biodiversity related initiatives to identify planning gaps and needs.
- Identify biodiversity policy targets, commitments and timelines for delivery to inform subsequent planning options.
- Take into consideration policies, plans and projects linked with the environmental pilar of the sustainable blue economy.
- Where existing, take into consideration the different sub-national governance levels that are interested in MSP implementation and the possibility of a multi-scale approach to the plan.
- Include in the review process pertinent organisations and institutions with jurisdiction over the marine area, as well as other rights-holders and stakeholders, so that they may identify and agree on key environmental impacts and biodiversity opportunities that the new MSP process can address.
- Convert the conclusions of the reviews above into a guiding document that specifies any legal or governance adjustments required to ensure long-term ecosystem health. This document can also be used as a tool to assist in coordinating MSP efforts with pre-existing governance frameworks.

Establishing cross-sectoral coordination

MSP and marine biodiversity conservation frequently involve various governmental organisations with overlapping mandates but different goals. For example, while biodiversity protection is often the responsibility of ministries of environment, MSP can be under the maritime or fisheries ministries that deal primarily with resource utilisation. During MSP processes, this disparity may lead to fragmented or even contradictory practices that pay little attention to biodiversity management and conservation. Integrated planning is made even more difficult by the possibility that other marine public and private actors are not involved in determining biodiversity priorities or aware of their needs.

Biodiversity inclusive MSP requires efficient cross-sectoral coordination that strengthens collaboration and ensures alignment within and between public and private entities so that integrated and sustainable outcomes can be achieved. It is therefore important to establish clear and dedicated communication channels for MSP coordination (at the sub-national, national and transboundary levels) that can include thematic forums or dialogues bringing together responsible organisations and entities, fostering a shared understanding of priorities and coordination of initiatives. This includes also involving entities responsible for coastal and terrestrial planning and management so that land-sea interactions can be duly considered (Yue *et al.*, 2023). Cross-sectoral coordination will also be essential to improve data sharing.

Suggested actions:

- Ensure that the MSP lead entity has a strong mandate to oversee cross-sectoral coordination also for the purpose of guaranteeing that MSP is biodiversity inclusive.
- Organize collaborative meetings to establish a clear understanding and shared vision of biodiversity inclusive MSP. To ensure impartiality and credibility, consider hiring a third party for the practical organisation of the discussions.
- Create ad hoc working groups for specific 'hot topics' related to biodiversity if relevant.

- Procure sufficient resources to cover all stages of the planning cycle and ensure cross-sectoral cooperation continues in the long-term.

Promoting rights-holders and stakeholders' engagement

Biodiversity inclusive MSP requires the engagement of rights-holders and stakeholders that have a wide array of perspectives, knowledge and interests. It needs to be co-developed with the appropriate groups to help reduce conflicts, improve buy-in and ensure social license for the implementation of the plan. Participatory engagement is also key to promoting an ecosystem-based approach that acknowledges ILK (**Box 3**), improving the understanding of biodiversity patterns, seasonal cycles and interactions among species in coastal marine ecosystems. On the other hand, MSP needs to safeguard the rights and needs of those who are dependent on marine ecosystems and biodiversity.

IPLCs (**Box 3**), environmental NGOs and other stakeholders should be engaged in the process as early as possible and in a collaborative and transparent manner. A participatory engagement process can generate a shared perspective on ecosystem services, sustainable resource management, conservation priorities and objectives. A structured and iterative stakeholder engagement process needs to be planned and established in the early stages to include formal and informal platforms for dialogue, multi-stakeholder networks, and collaborative mapping tools (**Box 4**). This will build trust among rights-holders and stakeholders to exchange knowledge, share good practices and align multiple interests.

Suggested actions:

- Identify all groups who might depend, impact or have knowledge of the marine environment. This might include stakeholders involved in conservation, fisheries, tourism, coastal industries, etc., as well as IPLCs that may have unique links with biodiversity elements.
- Work with Indigenous Peoples groups, local organisations and councils to identify knowledge holders, particularly around ILK, cultural values and local resource management practices. While doing this, follow the Collective benefit, Authority to control, Responsibility, and Ethics (CARE) principles for Indigenous data governance.
- Create platforms, such as forums and advisory groups, that facilitate ongoing dialogue among multiple rights-holders and stakeholders. Organize multisector workshops and consultations to address specific concerns and 'hot topics' related to biodiversity and co-develop objectives and operational actions. These should be carried out during the several phases of the planning cycle.
- Provide resources and capacity for marginalised groups to engage in the process (e.g., organise meetings at times and locations that are conducive for them to attend, fund their attendance to meetings, provide training for them to collect data and report new data, etc.).
- Follow an iterative and adaptive approach by incorporating new and updated data and information about rights-holders and stakeholders when needed.
- Procure sufficient resources to enable long-term partnerships and ongoing engagement.

Further reading sources:

UNESCO-IOC and UNESCO-LINKS. 2024b. *Engaging Indigenous Peoples and Local Communities, and Embracing Indigenous and Local Knowledge in Marine Spatial Planning: Volume 2 – Good Practices.* Paris, UNESCO. (IOC Technical Series No. 189, Volume 2). https://unesdoc.unesco.org/ark:/48223/pf0000390615

Giacometti, A., Morf, A., Gee, K., Kull, M., Luhtala, H., Eliasen, S. Q. and Cedergren, E. 2020. *Handbook: Process, Methods and Tools for Stakeholder Involvement in MSP.* BONUS BASMATI Deliverable 2.3. https://nordregio.org/publications/bonus-basmati-handbook/

Leveraging funding and resources

Biodiversity inclusive MSP processes might require specific resources for their development, implementation and monitoring. Leveraging different governmental initiatives and diverse funding sources can help ensure adequate resources and the long-term sustainability of the process. Biodiversity inclusive MSP provides a comprehensive framework for attracting finance by reducing investment risks and increasing investor certainty. It also helps balance the needs of various sectors, promoting sustainable use of marine biodiversity and resources and attracting investment for both economic development and conservation.

The Sustainable Blue Economy Finance Principles are a global guiding framework for banks, insurers and investors to finance a sustainable blue economy transition and associated activities, such like biodiversity inclusive MSP to protect natural assets. It promotes *inter alia* systemic and precautionary objectives in sustainable blue economy investments. The Sustainable Blue Economy Finance Principles are primarily directed towards private financial institutions (banks, investors and insurers), but are also supportive of public finance. Public finance is particularly important and influential to the development of a sustainable blue economy as many enabling activities, such like biodiversity inclusive MSP, are determined during the planning stage, well before private financial institutions are involved with financing. Relevant guidance on the application of the

Box 3

Engaging Indigenous Peoples and Local Communities, and Embracing Indigenous and Local Knowledge in Marine Spatial Planning

UNESCO-IOC and the Local and Indigenous Knowledge Systems programme of UNESCO (LINKS) worked together with experts on IPLCs and marine policies to create two volumes of a publication to assist MSP practitioners in effectively involving IPLCs and including ILK in MSP processes while considering universal human rights and internationally recognised ethical principles. Volume 2 offers practical guidance for developing inclusive and equitable MSP processes and presents a range of case studies that showcase IPLC-led and co-management initiatives, integration of customary laws, and ILK-based strategies.

The main overarching recommendations presented in the publication include:

- *"Recognize and implement Indigenous Peoples' rights frameworks and protocols, extending these principles to local communities whose livelihoods depend on customary management practices, especially small-scale fishers";*
- *"Ensure equity and equality for women, youth, elderly, vulnerable and minority groups";*
- *"Take into account IPLCs' rights as stated in human-rights frameworks";*
- *"Recognize the diverse scales and systems of management within a territory, particularly embracing self-governance systems of IPLCs in the MSP process, and adjust the MSP governance scheme accordingly (IPLC-led, co-management or government-led)";*
- *"Adopt comprehensive and holistic participatory approaches (community-based and/or Indigenous-led) in knowledge co-production and co-creation methodology, placing ILK as equally important and relevant as mainstream scientific knowledge";*
- *"Recognize and embrace an adaptive management approach based on ILK";*
- *"Build transparent and trustworthy MSP processes based on strong and long-lasting relationships";*
- *"Build capacity and competencies in MSP processes for government representatives, MSP practitioners and IPLCs".*

The publication also includes specific recommendations per phase of the MSP process. Ensuring that ILK and IPLCs' sustainable practices are included in MSP and foster biodiversity positive outcomes while safeguarding the needs and rights of these communities.

Source: UNESCO-IOC and UNESCO-LINKS, 2024b

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Case Study

Box 4

Marine Spatial Planning in Equatorial Guinea

Contributed by Erick Ross Salazar (MigraMar), Christian Barrientos (WCS) and Gaspar Lutero Mangue (INDEFOR)

Overview:

The participatory process was central to the development of a marine spatial plan for the Exclusive Economic Zone (EEZ) of Equatorial Guinea. In the face of limited data, participatory mapping was crucial to understanding the distribution of endangered, migratory, and commercially important species, as well as fishing zones, economic activities, areas of possible conflict between stakeholders and the presence of other marine users.

Description:

The Republic of Equatorial Guinea, located in the Gulf of Guinea, boasts a vast marine territory of 314,000 km^2 —over 91% of its total area— thanks in part to the offshore island of *Annobón*. Despite its small terrestrial footprint (28,051.5 km^2), the country is home to thirteen protected areas, seven of which have coastal components.

Recognising the importance of marine conservation, the government partnered with the Wildlife Conservation Society (WCS) to develop a marine spatial plan for its EEZ. Although authorities strongly supported the initiative, a major challenge was the scarcity of scientific data, a common issue in developing nations. The process began with a Blue Planning in Practice workshop to build local MSP capacity among stakeholders.

The next phase focused on gathering data. While conservation efforts existed —mainly protecting sea turtle nesting beaches on Bioko and the continental coast— comprehensive marine data was lacking. To address this, WCS collaborated with artisanal fishers, the country's largest group of marine resource users. GPS trackers on their vessels provided insights into spatial fishing practices. Additional data sources included:

- International databases on oceanography, bathymetry, and industrial fishing pressure;
- Governmental records on oil concessions, platforms, and coastal infrastructure;
- Scientific studies from neighbouring countries on migratory marine species within Equatorial Guinea's EEZ.

To further support research, WCS facilitated marine biodiversity studies, including satellite tagging nesting leatherback turtles on southern *Bioko* and conducting the first marine mammal survey around the island.

Given the limited available data, workshops were held with coastal communities on the mainland and the islands of *Bioko*, *Annobón*, and *Corisco*. Artisanal fishers, with their deep knowledge of marine ecosystems, played a key role in participatory mapping. Moderators guided participants in marking maps with the distribution of endangered, migratory, and commercially important species, as well as fishing zones, economic activities, areas of possible conflict between stakeholders and the presence of other marine users.

Participatory mapping with stakeholders in Equatorial Guinea.

This participatory process, which included eight workshops with coastal communities, generated 52 species distribution maps, 12 human activities distribution maps and three sea turtle nesting beach maps; all of this was completely new information for Equatorial Guinea. The collected data was analysed and synthesised into maps covering oceanography, ecosystems, infrastructure, habitat sustainability, species distribution, and human activities. Using this information, five MSP scenarios were developed and presented to authorities and stakeholders for feedback. Based on recommendations, final maps were refined and presented to the authorities, leading to the selection of an ideal MSP scenario. The entire process was compiled into the publication ***"Atlas Marino de Guinea Ecuatorial para una Planificación Espacial Marina"*.**

For more information:

Ross Salazar, E., Barrientos Contreras, C., Grantham, H. and Jones, K., 2020. *Atlas marino de Guinea Ecuatorial para una planificación espacial marina*. Bata, Guinea Ecuatorial: Wildlife Conservation Society. https://library.wcs.org/Scientific-Research/Research-Publications/Publications-Library/ctl/view/mid/40093/pubid/DMX4044300000.aspx

Sustainable Blue Economy Finance Principles includes **"Turning the Tide: How to finance a sustainable ocean recovery—A practical guide for financial institutions"** (UNEP FI, 2021) and **"Diving Deep: Finance, Ocean Pollution and Coastal Resilience. A practical guide for financial institutions"** (UNEP, 2022). The guide **"Setting Sail: Target setting in the Sustainable Blue Economy"** (UNEP FI, 2024) supports financial institutions in setting targets for a sustainable blue economy.

Suggested actions:

- Consider working with conservationist philanthropists and NGOs to raise funds to develop the marine spatial plan.
- Explore opportunities for government-funded international cooperation (e.g., Official development assistance) to support capacity building and joint initiatives on marine spatial planning and biodiversity protection.
- Consider EU funding (e.g., the European Maritime, Fisheries and Aquaculture Fund, Horizon Europe, Interreg, LIFE) and other international sources to support cross-border cooperation on maritime spatial planning and biodiversity protection at the sea-basin level.

Phase 2 - Designing the planning process

Including a long-term vision for a sustainable blue economy

A long-term vision for a sustainable blue economy aligns multiple rights-holders and stakeholders around common objectives and achieves low-impact growth that respects ecosystem health and balances the economic and social needs of the present without compromising the ability to meet future needs (**Box 5**). Biodiversity inclusive MSP is meant to be guided by a holistic vision that preserves marine biodiversity, reduces ecological footprints, encourages low-carbon and circular economies and supports renewable energy transitions. This type of vision helps to attract sustainable investments and foster local livelihoods that respect biodiversity. Further guidance on setting vision and enabling a practical transition to sustainable, regenerative and equitable blue economies is available in UNEP (2025).

Suggested actions:

- When analysing existing frameworks (phase 1), include policies, plans, governance and institutional structures relevant to sustainable blue economy.
- Identify existing positive and negative incentives for a sustainable blue economy (namely policy and regulation gaps, subsidies, etc.) (phase 1).
- Co-develop the vision with rights-holders, stakeholders and responsible agencies, ensuring there is a clear commitment to marine biodiversity conservation.

Integrating biodiversity conservation objectives and targets in MSP

The integration of explicit objectives that promote biodiversity conservation in MSP is essential to ensure that ecosystem health is prioritised, the subsistence of IPLCs is ensured and that economic goals are aligned and compatible. When developing objectives, international, regional, national and local commitments and targets should be considered, particularly those related to protection and restoration, as well as other existing policies and governance structures (including those linked to the land-sea interface).

Biodiversity cannot be compartmentalised as a separate topic from maritime sectors but formulated as a central and cross-cutting theme for the MSP process.

To meaningfully guide decision-making, objectives cannot be generic statements. They must be clear, relevant and achievable, improving conditions for implementation. To allow for monitoring and evaluation, they also need to be specific, measurable and time-bound. Another crucial aspect is that the objectives are co-developed with rights-holders and stakeholders and in coordination with governmental agencies. In this way, the objectives established can be more inclusive and equitable. In short, objectives need to be SMARTIE (Specific, Measurable, Achievable, Relevant, Time-Bound, Inclusive and Equitable) (UNESCO-IOC and European Commission, 2021) and conducive to positive outcomes for biodiversity (**Box 6**).

Suggested actions:

- Start from the review of existing frameworks and the identification of international, regional, national and local conservation commitments and targets (phase 1).
- Discuss with responsible agencies, rights-holders and stakeholders how MSP can contribute to achieving existing objectives and targets and develop clear, coherent and specific conservation objectives (SMARTIE if possible).
- Analyse the compatibility of other MSP objectives (e.g., objectives for renewable energy development, objectives for fisheries management) with biodiversity, analysing the potential positive and negative outcomes for biodiversity.
- Document and communicate the objectives, rationales, expected outcomes and possible trade-offs to increase transparency amongst rights-holders and stakeholders.
- Identify indicators for each objective that can help establish the baseline and track progress (e.g., towards achieving biodiversity objectives and percentage of waters designated as protected areas).

Case Study

Box 5

Strengthening the blue economy through ecosystem services and biodiversity conservation: A Case Study on Marine Spatial Planning in Tanzania

Contributed by Emmanuel M. Mpina (TNC)

Overview:

The MSP initiative in Tanzania aims to sustainably manage 241,500 km^2 of coastal and marine ecosystems, addressing climate change and resource demands through integrated management. It seeks to protect at least 30% of critical habitats by 2030, informed by over 314 stakeholders and 23 recommendations. The National Biodiversity Strategy and Action Plan emphasises marine biodiversity conservation, with targets for integrating biodiversity into freshwater and marine spatial planning, restoring degraded ecosystems, and expanding marine protected areas in biodiversity hotspots. This approach supports ecological integrity and the sustainable use of marine resources.

Description:

The implementation of MSP serves as a tool for strengthening the blue economy and enhancing biodiversity conservation. This case study illustrates how MSP addresses ecological and economic challenges while promoting sustainable resource management.

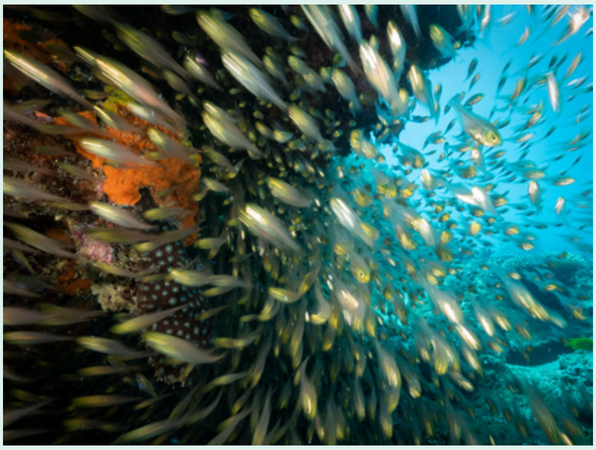
Main Features:

- Tanzania's coastal and marine ecosystems cover 241,500 km^2, providing essential goods and services that support local livelihoods and cultural practices;
- Aim to protect at least 30% of critical habitats by 2030, with 33.5% of terrestrial areas and 6.5% of ocean areas currently under protection;
- Facilitates sustainable allocation of human activities, addressing climate change impacts and resource demands through a collaborative approach;
- Involvement of over 314 stakeholders during the scoping study ensures input and collaboration in the MSP process;
- The process has led to the creation of National Marine Spatial Planning Guidelines and a Blue Economy Policy, providing a strategic framework for sustainable development;
- The National Biodiversity Strategy and Action Plan emphasises integrating biodiversity into spatial planning, restoring degraded ecosystems, and expanding marine protected areas.

Key Recommendations:

- Effective marine conservation requires a systematic approach that aligns existing spatial designations with broader biodiversity goals.
- Strong government leadership is vital for successful MSP implementation, supported by technical assistance and stakeholder collaboration.
- Recognizing the importance of freshwater resources, the guidelines emphasise integrating freshwater spatial planning into the overall strategy.

Surge from the swells pushing a school of fish through the reef channels in Zanzibar.



© Michael Markovina/TNC Photo Contest 2022 (*)

The MSP process in Tanzania tries to integrate biodiversity considerations, focusing on ecosystem health and emphasising restoration of degraded ecosystems to promote resilience against climate change. In this process, stakeholder engagement and collaboration of coastal communities and stakeholders is essential to enhance awareness and ensure support for conservation efforts.

Case Study

Box 6

SMART objectives for the Seychelles Marine Spatial Plan Initiative

Contributed by Joanna Smith (TNC), Helena Sims (TNC), Rabia Somers (Marine Spatial Plan Unit Seychelles)

Overview:

The Seychelles Marine Spatial Plan (SMSP) Initiative is focused on planning for and the management of the sustainable and long-term use and health of the Seychelles Ocean. It is government-led, with planning and facilitation by The Nature Conservancy (TNC) and support from the Seychelles Conservation and Climate Adaptation Trust (SeyCCAT) and other partners. The SMSP engages more than 12 marine sectors, including fishing, tourism, biodiversity conservation, maritime infrastructure and security agencies, energy, and non-renewable resources, to develop a comprehensive marine plan with stakeholder input. The high-level objectives are: (1) expand marine protections, (2) address climate change adaptation, and (3) support the Blue Economy and other national strategies.

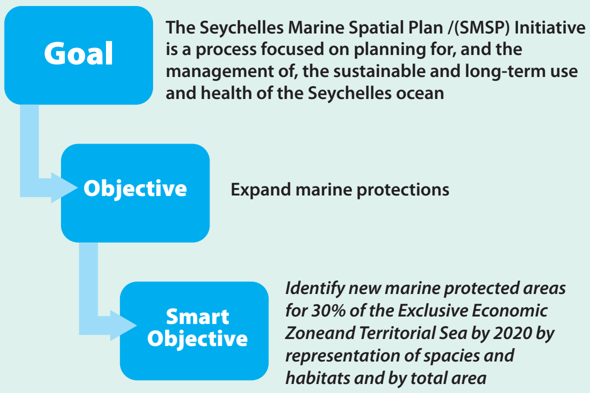
Description:

Starting in 2014, the SMSP developed SMART objectives for each of the three high-level objectives. Using guidance from the UNESCO-IOC 2009 guidebook, MSP is best achieved and most successful when conducted on the basis of an 'objective-based' approach. A SMART objective approach to MSP is organised around a hierarchy of goals, objectives, and activities, with indicators that evaluate activities in achieving the goals and objectives. Ideally, goals and objectives are derived from specific issues in the marine area and reflect a set of MSP principles. Clear goals and objectives are a cornerstone of MSP global best practices.

SMART objective framework:

- **Goal:** a statement of general action or intent. Goals are high-level statements of the desired outcomes that you hope to achieve. They provide the umbrella for the development of all other objectives and reflect the principles upon which subsequent objectives are based.
- **Objective**: a statement of desired outcomes or observable behavioural changes that represent the achievement of a goal.
- **SMART:** an acronym to quantify objectives: Specific, Measurable, Achievable, Relevant, Time-bound.

The SMSP's SMART objective for a biodiversity protection goal centred on the government's ambition to expand marine protections to 30% of its ocean by 2020. This ambition was three times the global goal from the Aichi targets and Sustainable Development Goals (10% by 2020). The government made this commitment in 2012 at Rio+20 because a healthy ocean plays a critical role in the national economy. The SMSP's SMART objective was approved by the SMSP Steering Committee in 2014, and 14 activities and indicators were developed for all three SMART objectives.



Framework to develop SMART Objectives from MSP goals and objectives.

© Government of Seychelles (*)

The marine environment is extremely important to the culture and national economy of Seychelles. More than 60% of the national GDP comes from tourism and fisheries; both depend upon a healthy marine and coastal environment. Marine biodiversity protections for representative species and habitats protect spawning grounds for commercially valuable fish species, protect coral reefs and larval dispersal sites, and protect foraging habitats for seabirds and regionally significant species. Marine protections that allow conditional economic uses that are compatible with the protection objectives can provide for improved sustainability and best practices in these marine sectors.

For more information:

www.seymsp.com

Tools that can help:

When developing objectives and desired outcomes, scenarios can be useful to help rights-holders and stakeholders envision possible futures. Some guidance can be found here: https://mspguide.org/2022/03/18/scenario-planning/

For analysing compatibility between objectives, a compatibility matrix can help visualise relationships. Additional information can be found here: https://maritime-spatial-planning.ec.europa.eu/media/document/12474

Phase 3 – Conducting assessments for planning

Enhancing data and information collection and sharing

Biodiversity inclusive MSP is by essence knowledge-based so that decisions can be made with the best available information. However, in many countries, there are some challenges in terms of data availability, accessibility and harmonisation (**Box 7**). For example, data on marine ecosystems, associated species and environmental conditions might be particularly sparse for offshore areas. Other data might not be publicly available (e.g., fisheries data, maritime infrastructure), creating accessibility issues. Nevertheless, data, or lack thereof, cannot be a barrier to developing MSP processes as data gaps can be filled in the following MSP cycle, following an adaptive approach.

When evaluating data availability, spatial and temporal data coverage of the required data should be assessed. It is recommended to first consult existing data from a broad range of sources before initiating the creation of new data. Generally, data collection requires significant investment in time and resources, whilst much of the required data may already be available. Therefore, it is important to carry out extensive scans for available data from local, national, regional and international sources to help save resources.

For collecting additional data, a well-structured data collection plan needs to be established, defining key elements such as study area and sampling plan, habitats to be mapped, environmental, biological or human activities parameters to be monitored, and data collection and management methods[13].

One way to enrich data collection is to combine scientific and ILK as appropriate, gathering a more holistic view of ecosystems and processes occurring at various scales (**Box 8**). This might require a combination of fine-scale and coarse data, as well as quantitative and qualitative data, for example, from participatory mapping and experts' consultation (Trouillet *et al.*, 2019). It is also important to encourage an open exchange of data among government agencies and institutions. Connectivity and interoperability of data and data infrastructures are key requirements for data exchange. Data harmonisation and the use of standardised data formats and coordinate reference systems in the case of spatial data are of key importance for interoperability. In the context of transboundary MSP initiatives, data connectivity and interoperability are essential for ensuring dataset integration with neighbouring countries in order to establish seamless data coverage across borders.

In general, developing biodiversity inclusive MSP may require enhanced data and information collection, along with the establishment of data-sharing frameworks.

Suggested actions:

- Identify existing biodiversity databases and key data gaps and establish a strategy for targeted data collection efforts.
- Identify and apply, to the extent possible, standard methodologies for biodiversity data collection and analysis to ensure uniformity across regions/agencies and facilitate integration in MSP.
- Establish data sharing and protection protocols, ensuring secure handling of stakeholder personal data and sensitive biodiversity-related information.
- Engage public agencies, research institutions and IPLCs for collecting relevant ecosystem, biodiversity and other spatial data using harmonised data formats that can facilitate exchange and interoperability.
- Negotiate the disclosure of data that is not publicly available, particularly when it has been collected using public resources.
- Use citizen science, remote sensing, and historical records to help fill data gaps in biodiversity knowledge, especially for less documented species, habitats and regions.
- Use existing or create, if necessary, accessible data portals that consolidate local, national and regional data on ecosystem health, environmental conditions and human activity that enable comprehensive assessments, enhance transparency and facilitate communication. In doing so, avoid duplication of efforts and strengthen harmonisation.
- Establish a protocol for updating data at regular intervals to ensure MSP adapts to new data and changing environmental conditions throughout the different stages of the planning cycle.

13 **For more detailed information** on data collection in the MSP context, please refer to Chapters 2 and 3 of the ***"MSPglobal Data Toolbox: Volume 1 – How to develop a Spatial Data Infrastructure for Marine Spatial Planning"***.

Tools that can help:

Global data platforms provide open access to global marine datasets, which can be easily shared and integrated across platforms. Some examples are:

- The **Ocean Biodiversity Information System** (OBIS): a global network of over 1,000 institutions connected through national, regional and thematic nodes which standardise, quality control and publish marine biodiversity data through an integrated global data platform, focussing on marine species distribution, biomass and abundance as well as ecosystem habitat extent and condition;
- The **Global Ocean Observing System** (GOOS): an international programme that coordinates and supports global ocean observation to monitor ocean conditions, ecosystems and climate;
- The **IOC Ocean Data Information System** (ODIS): offers discovery services to standardised, real-time and delayed mode ocean data from multiple sources, which can be shared and integrated. It is maintained by The International Oceanographic Data and Information Exchange (IODE);
- The **Global Biodiversity Information Facility** (GBIF): an international network and data infrastructure about all types of life on Earth.

At the regional level, there are also data platforms compiling relevant data. Some examples are:

- The **European Marine Observation and Data Network** (EMODnet): an European Commission marine data service offering pan-European in situ data and products on the marine environment and human activities at sea (e.g., including bathymetry, geology, biology, chemistry, human activities, seabed habitats, and physics);
- The **EU Digital Twin of the Ocean** (DTO): combines ocean observations, artificial intelligence and advanced modelling to provide a multidimensional virtual representation of the ocean;
- The **Western Indian Ocean Symphony** (WIO Symphony): a tool based on more than 80 ecology and human activity maps that support ecosystem-based Marine Spatial Planning. The tool was developed through a partnership between the Nairobi Convention Secretariat and the Swedish Agency for Marine and Water Management.

To complement the data available with more detailed information on habitats and species distribution and condition, satellites, aerial imaging, and uncrewed aerial vehicles might be useful and combined at different scales.

Box 7

The importance of ocean observation, data and spatial data infrastructure for MSP

Data and spatial data infrastructure are of key importance for MSP as they provide the foundation for informed decision-making and sustainable management of marine resources.

High-quality, comprehensive data on ecological, social and economic aspects enable planners to understand the spatial distribution of marine habitats, species, human activities and potential conflicts or synergies. Comprehensive ecological data are essential to map and monitor species and habitats distribution, and ecosystem health. Ocean observation, including in situ monitoring, satellite remote sensing and autonomous platforms can be particularly useful to provide real-time and long-term data.

Reliable spatial data infrastructure ensures that this information is accessible, standardized, and interoperable, facilitating collaboration among stakeholders and across jurisdictions. Moreover, robust data systems support the integration of temporal trends, such as climate change impacts, allowing MSP to adapt to evolving conditions.

Data analysis, visualisation and access rely on robust data architecture, comprehensive metadata, and adherence to standards to ensure seamless integration with databases. A **well-structured data architecture** facilitates efficient data storage, retrieval, and management, enabling visualisation and analysis tools to interact with the database smoothly. **Comprehensive metadata** provides context and details about the data, enhancing its usability and interpretability across different applications. Adhering to established **data standards** ensures consistency and interoperability, allowing diverse tools and systems to work together effectively.

Without adequate data and infrastructure, MSP efforts risk being fragmented, less effective, and unable to achieve long-term conservation and development goals. Strengthening ocean observation networks and biodiversity and ecological monitoring is particularly important to support biodiversity inclusive MSP.

For more detailed information about data for MSP please see the "***MSPglobal Data Toolbox: Volume 1 – How to develop a Spatial Data Infrastructure for Marine Spatial Planning***" and the "***MSPglobal Data Toolbox: Volume 2 – How to use Ocean Observation for Marine Spatial Planning***".

Box 8

Contribution of Indigenous and Local Knowledge to biodiversity and ecosystem assessments

IPLCs' **knowledge, innovations, practices, institutions, and values** play a crucial role in safeguarding nature and Nature's Contributions to People14*. Their contributions can be strengthened by ensuring land, access, and resource rights, applying the FPIC principle, ensuring fair and equitable benefit-sharing, and adopting co-management solutions.

Given that IPLCs sustainably manage over 25% of the world's land, incorporating ILK into global biodiversity and ecosystem service assessments is essential. Their involvement in National Ecosystem Assessments (NEAs) enrich scientific knowledge, align conservation and sustainability policies with IPLC livelihoods, cultures, worldviews, and rights.

According to the National Ecosystem Assessment Initiative (UNESCO and UNEP-WCMC, 2023a), integrating IPLCs and ILK in NEAs has many positive aspects:

- *"Their capacity to provide detailed knowledge of ecosystem and biodiversity status, trends, drivers and impacts".*
- *"Their stewardship of the environment through their long-term protection, sustainable use, management and governance systems".*
- *"Strengthen current knowledge of threats to biodiversity and work collaboratively with IPLCs to counter these threats".*
- *"To better inform policies and support collaborative governance that favours both people and nature".*
- *"To develop international norms and standards around the inclusion of ILK in biodiversity and ecosystem assessments while being consistent with a human rights-based approach".*
- *"To better understand and account for ecosystem goods and services and their cultural values".*
- *"To mobilise community-based research on biodiversity and ecosystem services, enabling them to build their own research and governance capacities in the process, which can further promote conservation, restoration, and sustainable use of natural resources".*

The ***"Practical Guide on Working with ILK in National Ecosystem Assessments"*** (UNESCO and UNEP-WCMC, 2023b) provides detailed steps for engaging IPLCs and incorporating ILK in NEAs.

Source: UNESCO-IOC and UNESCO-LINKS, 2024a

Mapping and analysing

Biodiversity inclusive MSP requires as much spatial information as possible regarding biodiversity, ecological and environmental conditions that can then be used for different types of analyses. It needs, at least, the mapping of ecosystems (extent and condition), species occurrence, threats and uses (Grantham *et al.*, 2024). The marine space is tri-dimensional, and mapping should include, as far as possible, the seabed, water column, and surface. Geomorphological and geological elements might also be helpful as they influence biodiversity distribution and condition. The different levels of biodiversity should be included when data is available. Species distribution models can help overcome data limitations. The main drivers of biodiversity loss should also be mapped, including (but not limited to) harmful uses and activities, sources of pollution and distribution of invasive species. It is also important to consider not only present threats but also future (potential) ones, including climate change.

Individual layers of information must then be combined in different ways, allowing, for example, the analysis of cumulative impacts, the identification of areas with high levels of ecological integrity, threatened and degraded ecosystems, areas of importance for ecological connectivity, areas nurtured by IPLCs and so on. Different scales of analysis might be required, from a local, more detailed scale to a transboundary one. For example, connectivity requires extending the analysis to adjacent areas on land and sea.

The assessment of ecosystem services is equally relevant and needs to integrate the functional dimension of biodiversity, as well as social and cultural values.

The results of mapping and analysis should then be made available in an easily accessible and understandable format so that they can genuinely inform decision-making.

14 Nature's Contributions to People (NCP) is a term introduced by IPBES that includes all the contributions, both positive and negative, of living nature (i.e. all organisms, ecosystems, and their associated ecological and evolutionary processes) to people's quality of life.

Suggested actions:

- Use gathered data to map biodiversity and ecosystem distribution and condition, biophysical and ecological characteristics and threats. Include projection of future risks.
- Gather individual spatial data layers and combine them within a geographic information system (GIS) to perform multi-faceted analyses (**Box 9**).
- Combine different scales of analysis as required.
- Present findings to rights-holders and stakeholders and validate them, making use of visual tools such as collaborative mapping tools (**Box 9**).

Determining ecological limits

A critical element of biodiversity inclusive MSP is identifying the capacity and limits of ecosystems within which human uses and activities can operate without harming ecosystems' health and function. Different methodologies can be used to determine the carrying capacity for specific human activities at sea, establishing the maximum volume of the activity that is supported by the marine environment in a given area without suffering damage (Borja *et al.*, 2022). Studies on carrying capacity can explore different dimensions, i.e., social, economic, resource and ecological, and have been applied to various contexts, from aquaculture (Byron and Costa-Pierce, 2013) to tourism management in marine protected areas (Llausàs *et al.*, 2019). For tourism management, for example, the Limits of Acceptable Change (LAC) framework has been vastly used and linked to spatial zoning (Bentz *et al.*, 2016).

Whatever the methodologies used, they should consider climate-induced changes which exacerbate the challenges to ecosystem resilience. Cumulative impact assessments are critical in studying how human activities, and when combined with climate stressors, can compromise the carrying capacity of ecosystems. Other useful concepts are ecological sensitivity and ecological risk.

MSP needs to base decisions on the sustainable use limits determined by the ecological thresholds to ensure that the ecosystem does not suffer irreversible changes.

Suggested actions:

- Identify the specific attributes of ecosystems and related indicators that are needed to assess the carrying capacity of each activity in different areas.
- Assess the vulnerability of different ecosystems to human activities.
- Consider the cumulative effects of multiple human activities occurring in the same area via cumulative impact assessment methodologies. This can help identify areas where human use is close to or exceeds the ecological limits and where activity levels might need to be adjusted.

Box 9

Analysis and visualisation of spatial data for MSP

Data analysis refers to the processing and interpreting of datasets to identify and visualise patterns, trends and relationships that are often not immediately apparent, providing deeper insights into spatio-temporal dynamics and underlying processes of the data.

Visualisation is a key component in communicating MSP-relevant data findings in an accessible way. Visualisation tools transform raw spatial data, or complex analysis results into comprehensible and interactive maps and 3D models.

GIS software provides robust and accessible tools for spatial analysis and visualisation, allowing users to perform complex queries, overlay analyses and geostatistical operations. Commercial options such as ArcGIS, QGIS, and GRASS GIS provide powerful capabilities, while open-source GIS solutions like QGIS offer cost-effective, flexible alternatives without the cost of proprietary software. A further advantage of open-source solutions lies in their flexibility and active community support, which continually adds new features and plugins to the software. QGIS compatibility with Python and R allows users to access libraries such as Matplotlib, Plotly, and ggplot2 for advanced data visualisation and the option of tailoring visual outputs to specific needs.

Web-based GIS platforms, such as GeoServer, ArcGIS Online and QGIS Server, offer comprehensive solutions for data storage, management, and dissemination. These platforms provide robust solutions for publishing and accessing spatial data online. They support various data formats and standards, ensuring interoperability and ease of access.

Alternative tools such as Mapbox, Google Earth Engine and Tableau provide a range of capabilities for data visualisation.

For more detailed information about spatial data analysis and visualisation, please see Chapters 3.2.5 and 4.4.2 of the ***"MSPglobal Data Toolbox: Volume 1 – How to develop a Spatial Data Infrastructure for Marine Spatial Planning".***

Incorporating climate change considerations

Biodiversity inclusive MSP also needs to incorporate climate change projections to understand how it will affect ecological conditions, species distribution and migration patterns over time. It needs to use scientific data and modelling tools to predict the impacts of climate change, not only on biodiversity but also on ecosystems' capacity and limits. This information will also enable the identification of areas of climate refugia (Ban *et al.*, 2016) and 'bright spots' (Queirós *et al.*, 2021) (**Box 10**), as well as predict impacts on the provision of other essential ecosystem services.

Potential responses to mitigate and/or adapt to climate change can then be considered through scenarios to ensure long-term biodiversity conservation and resilience. Analysis of potential impacts of climate change also needs to be extended to pre-existing management measures to inform the need for adjustments and adaptation (for example, existing MPAs boundaries that might need adaptation strategies). Integrating climate-related knowledge is also one of the requirements of climate-smart MSP[15].

Suggested actions:

- Analyse scientific data on climate change effects in the marine and coastal areas under scope, including but not limited to projections on sea temperature, sea level rise, acidification and storm frequency.
- Use ecological modelling tools to predict the impact of climate change on species distribution, migration and habitat use.
- Identify species, ecosystems, and areas most susceptible to climate impacts and evaluate how climate-related changes might need adaptation measures.

Tools that can help:

Bio-ORACLE provides comprehensive marine environmental data layers for modelling the distribution of marine biodiversity globally under all IPCC climate change scenarios.

Incorporating natural capital considerations

Natural capital considerations might also be useful for biodiversity inclusive MSP as the approach considers a diverse range of values and tries to quantify benefits provided by nature (Dowdall *et al.*, 2022). It addresses the critical need to communicate the benefits of marine conservation in terms that are relevant and relatable for a range of rights-holders, stakeholders and decision-makers by recognising marine biodiversity and ecosystems as assets with direct economic and social value.

Natural capital can be integrated into MSP (Gacutan *et al.*, 2019) to improve decisions by providing a more evident way to consider trade-offs between ecological, economic and social benefits. Natural capital accounting can help in this regard by assessing the total value generated by marine and coastal ecosystems, as well as potential losses due to development activities (Gacutan *et al.*, 2022). Enhancing insights into the economic values of marine and coastal ecosystems can support better decisions related to specific measures and investments needed to conserve and restore biodiversity (WAVES, 2016). Through this approach, it can be possible to assess how plan and management measures interact, both positively and negatively, and whether the delivery of management measures would result in the achievement of a broader plan vision.

Although the biophysical value of natural capital in monetary units supports communication and a better understanding of the value of nature, it is necessary to remark that non-market monetary values are still key in decision-making. Natural capital also needs to be part of a broader sustainability analysis that considers other types of capital (e.g., the five capitals approach applied in the UK (MMO, 2023)). Several countries are developing Ocean Accounts, which combine marine natural capital assessments with other capital assessments. Ocean accounting can support the MSP process, providing evidence of how well natural capital is being maintained or restored (Gacutan et al., 2022).

Suggested actions:

- Map and assess marine natural capital assets (biodiversity, habitats and areas providing key ecosystem services).
- Co-define and prioritise marine natural capital assets with local rights-holders and stakeholders via workshops according to their relative values.
- Establish quantitative and qualitative metrics that can translate the biophysical value of natural capital into accessible information. Market and non-market approaches can be used.
- Adopt weighted indicators reflecting the relative importance of different marine natural capital assets.
- Conduct trade-off analyses to assess how different planning options may affect ecosystem services and the social and economic benefits they provide, both in the short- and long-term.

15 **For more detailed information** on climate-smart MSP please consult the ***"MSPglobal International Guide on Marine/Maritime Spatial Planning: Volume 3 – Climate-smart Principle"***.

Case Study

Box 10

Consideration of evidence on climate change refugia and bright spots as a climate-smart MSP approach for biodiversity conservation in the UK

Contributed by Ana M. Queirós (PML), Elizabeth Talbot (PML), Dawn Ashby (PML) and Jonathan White (PML)

Overview:

MSP can support biodiversity adaptation to climate change through the consideration of evidence on the location of biologically meaningful climate change refugia and biodiversity bright spots in policy development. Ocean modelling has been used to identify such areas in the United Kingdom, enabling their further use in plan development across the UK nations, thus advising subsequent licensing. This approach is now being considered in the review of the East Marine Plan (England) and the preparation of the Orkney Islands Marine Plan (Scotland) and Marine Plan for Northern Ireland, demonstrating how MSP processes can apply climate-smart spatial planning to enhance biodiversity resilience and long-term conservation outcomes.

Description:

Delivering biodiversity targets through MSP requires climate-smart approaches that consider the long-term impacts of climate change on marine ecosystems. As an evidence-based framework, MSP can consider spatial data on the location of climate change refugia and bright spots for biodiversity -biologically meaningful areas (e.g., key seabed habitats) where climate change is less pronounced or where habitat conditions improve, respectively, despite impacts elsewhere (Queirós et al., 2021). Using ocean modelling, these areas can be mapped and made available within data resources (e.g., planning tools) and data formats usable in MSP.

Consideration of this data from the early evidence-gathering stages of MSP allows for the biodiversity climate-resilience enhancement to be considered as a theme throughout plan preparation. This may then guide the development of zoning elements of plans and guide human activity management objectives, affecting subsequent licensing and consenting decisions, as well as affecting the siting of future conservation areas. By considering such evidence, it is therefore more likely that MSP is able to contribute to limit human impacts on those areas less affected by climate change, which may form the seed banks of future marine biodiversity, and thus support the climate resilience potential of wild species and habitats (Queirós *et al*., 2023).

Through the UK-based MSPACE project, climate scientists, planners, and industry representatives co-developed an Early Warning System that provides such modelling-based data products usable for MSP (Queirós et al., 2023, plus ref to datasets). These datasets, delivered as technical reports, shape files, and policy summaries, identify long-term climate change refugia and bright spots in key seabed and water column habitats, habitats explored by megafauna, and those delivering vital climate regulation services. This evidence is now informing the review of the East Marine Plan (England), Orkney Islands Marine Plan (Scotland), and Marine Plan for Northern Ireland, ensuring that biodiversity climate resilience is factored into future marine planning decisions.

MSP evidence gathering, plan preparation, and review provide key opportunities to integrate climate change refugia and biodiversity bright spots evidence into decision-making. This ensures:

- Plans provide clear guidance on managing human activities in these areas, supporting species and habitats in adapting to climate change.
- Licensing and consenting processes can incorporate this evidence, further reducing impacts on critical areas.

Strong science-policy collaboration is essential to address data gaps and develop usable science products supporting planners, ensuring biodiversity climate-resilience is embedded in MSP for the long-term.

For more information:

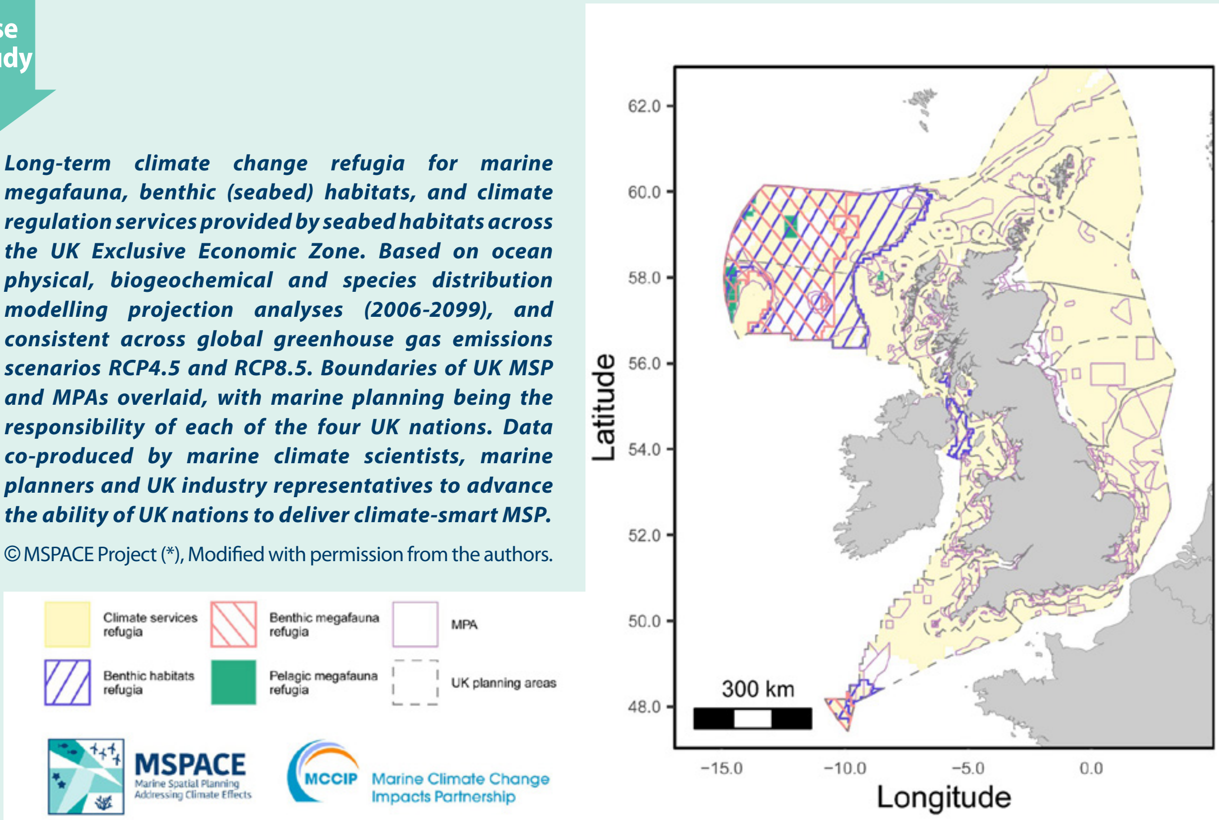
Queirós, A.M., Kay, S., Sciberras, M., Talbot, E., Kaiser, M., Wilson, R.J., Sailley, S., Marra, S., Matear, L., Fernandes, J., Aldridge, J., McEwan, R., Morris, K., McNeill, C.L., Nunes, J., Woodcock, K., Duncombe-Smith, S., Smith, A., Lynam, C., Vina-Herbon, C., Boulcott, P., Hunter, B., Parker, R., Robinson, K., Trappe, F., Mackinson, S., Sweeting, C., Frost, M. and Somerfield, P.J., 2023. *Early-warning system: Climate-smart spatial management of UK fisheries, aquaculture and conservation.* A report of the NERC/ESRC Marine Spatial Planning Addressing Climate Effects project. 58 pp. doi:10.14465/2023.msp02.tec

Associated data products: https://doi.mba.ac.uk/data/3113/1

https://pml.ac.uk/projects/mspace-marine-spatial-planning-addressing-climate/

Case Study

Long-term climate change refugia for marine megafauna, benthic (seabed) habitats, and climate regulation services provided by seabed habitats across the UK Exclusive Economic Zone. Based on ocean physical, biogeochemical and species distribution modelling projection analyses (2006-2099), and consistent across global greenhouse gas emissions scenarios RCP4.5 and RCP8.5. Boundaries of UK MSP and MPAs overlaid, with marine planning being the responsibility of each of the four UK nations. Data co-produced by marine climate scientists, marine planners and UK industry representatives to advance the ability of UK nations to deliver climate-smart MSP.



MSPACE Marine Spatial Planning Addressing Climate Effects

MCCIP Marine Climate Change Impacts Partnership

Phase 4 - Developing the marine spatial plan

Defining important areas for protection and restoration

Based on all the previous assessments, biodiversity inclusive MSP can spatially define key areas suitable for biodiversity protection and restoration measures (Holness *et al.*, 2022). A spatial data-driven approach (such as Systematic Conservation Planning (SCP)) can be applied to integrate information on biodiversity elements, ecological and biophysical conditions, existing and potential threats, risks and socio-economic factors to identify priority areas (**Box 11**), ensure spatial efficiency and reduce conflicts (Harris *et al.*, 2022). This approach needs to be combined with rights-holders and stakeholders' engagement, ensuring their inputs are also included (**Box 12**). The integration of socio-economic and governance considerations, as well as future projections, allows for a more comprehensive analysis of the suitability of the areas for protection and restoration measures. This can contribute to better integrating these actions into the wider seascape (**Box 13**), leverage efforts and assist responsible agencies in achieving the KMGBF targets.

Determining key areas for biodiversity (formally protected or not) is also important when considering the allocation of different uses and activities and the need for impact management measures. Even in cases where the classification of MPAs is outside the scope of the MSP process, zoning and regulation of other uses and activities need to safeguard those key areas.

Suggested actions:

- Establish clear and replicable criteria for defining important areas for conservation and restoration. Consider identifying different types of areas (e.g., areas in need of protection, areas where pressures need to be reduced, areas that require active restoration, areas that require further research, etc.).
- Conduct spatial biodiversity prioritisations using the most appropriate method/tool.
- Characterise priority areas in terms of their importance, e.g., for endemic, vulnerable or threatened species, both nationally and regionally, for context.
- Analyse management options for the identified areas.
- Present the outcomes to rights-holders, stakeholders and relevant government agencies and collect feedback.

Tools that can help:

Decision support tools, such as Marxan, Prioritizr, Zonation 5 and Prior3D, can help define priority areas for conservation and restoration. However, these tools can be complex and specialised technical expertise in GIS, modelling, and ecological data analysis might be needed, requiring capacity development and interdisciplinary collaboration.

Case Study

Box 11

MPA Europe Project - Systematic Conservation Planning for optimal designation of MPA networks and Biodiversity Inclusive MSP

Contributed by MPA Europe project

Overview:

The MPA Europe project is mapping the optimal locations for marine protected areas in European seas, to support science-based marine spatial planning. The project takes a data-driven Systematic Conservation Planning (SCP) approach to produce an online open-access atlas in 2025 identifying optimal MPA networks at various spatial scales, prioritised for biodiversity, organic carbon sediment stores, and both. Several case studies are being co-designed and co-produced.

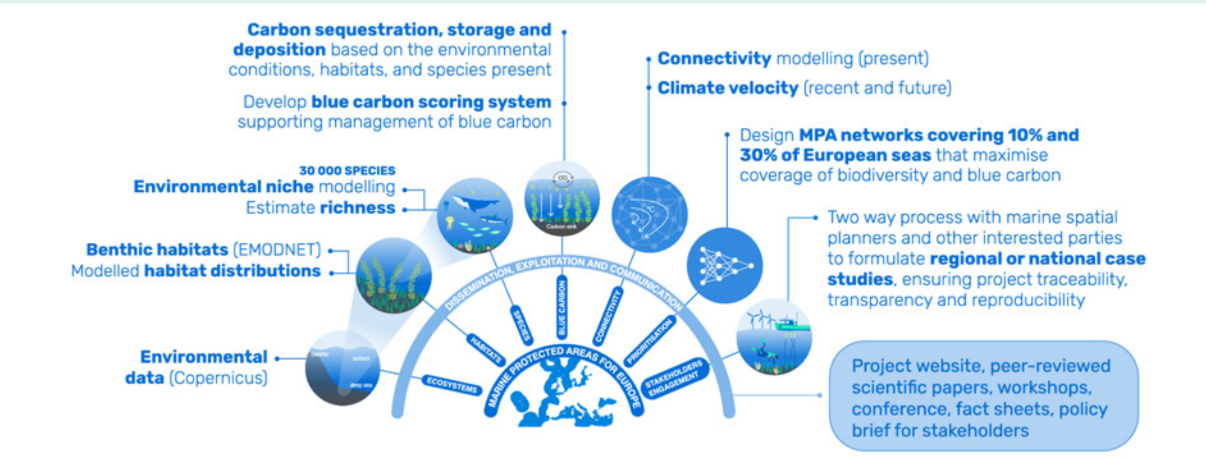
Description:

EMPA Europe has created species distribution models for over 12,000 species found in Europe, under the five IPCC climate change scenarios to 2050 and 2100, drawing from 36,000 marine species with occurrence records in OBIS and including all marine biodiversity groups except for the Viruses, Protozoa, Fungi, Bacteria, and Archaea kingdoms. Models use spatially complete standardised data layers and multiple environmental data parameters, working to a resolution of 5 km^2.

The project also created the first depth-integrated marine ecosystem classification for Europe's seas, drawing from multiple environmental datasets compiled in Bio-Oracle, and established a new EURO-CARBON database on seabed sedimentary carbon stores across habitat types, after issuing an open call for contributions.

These data layers can be used by marine spatial planners individually or in combination to support biodiversity inclusive MSP. The atlas identifying optimal locations for marine protected areas can be used as a base map for overlaying with data layers on current and planned blue economy activities, to explore scenarios for balancing economic and social goals with reserving areas important for biodiversity conservation and restoration and multi-use options which may qualify as OECMs. The EURO-CARBON database can be used within MSP to site human activities to avoid disturbance of important seabed carbon stores.

Including marine ecosystem information in developing marine spatial plans is necessary to deliver an ecosystem-based approach to MSP. MSP must adapt to reality, anticipating the changing ranges of species and conditions of habitats under climate change scenarios and developing planning scenarios to accommodate future change. The MPA Europe project marine ecosystems classification provides valuable baseline units for monitoring temporal change under the context of climate change or anthropogenic disturbances. By tracking shifts in environmental conditions within these ecosystems, researchers can assess the relative vulnerability of biodiversity to future changes, supporting proactive marine and conservation planning.



MPA Europe Project components

SCP is an efficient way within MSP to address marine conservation, since it can protect more biodiversity for a given spatial area than other approaches. This is particularly important in busy sea spaces such as those in Europe.

The approach taken by the MPA Europe project, which can be replicated to other ocean regions, supports identifying optimal networks of MPAs which are coherent, representative and adequate and which protect the maximum range of biodiversity, from ecosystems to habitats and species. MPA networks which encompass a range of ecosystems can potentially maximize the diversity of habitats and species protected, enhancing resilience.

For more information:

MPA Europe project, which is supported by Horizon Europe and UKRI, may be found here: https://mpa-europe.eu/

The MPA Europe map platform is open access and may be viewed here: https://shiny.obis.org/distmaps/

Associated documentation is provided here: https://iobis.github.io/mpaeu_docs/

A user tutorial is available at this link: https://www.youtube.com/watch?v=o0DwqXiZVe8&t=2s

All of the deliverables of MPA Europe are produced using FAIR principles and are available here: https://zenodo.org/communities/mpaeurope/records?q=&l=list&p=1&s=10&sort=newest

Case Study

Box 12

Great Barrier Reef Marine Park: using an integrated, inclusive, and participatory conservation planning process to facilitate rezoning

Contributed by Kristine Camille V. Buenafe (CBCS, UQ) and Hugh P. Possingham (CBCS, UQ)

Overview:

The Great Barrier Reef is one of the world's most ecologically rich and complex natural systems, supporting extensive animal and plant biodiversity, including threatened and vulnerable species. Prior to the Great Barrier Reef Marine Park (GBRMP) rezoning in 2003, only 4.5% of the marine park was in no-take zones and 80% of it protected mainly coral reefs despite the breadth of habitats. After rezoning, the GBRMP achieved representative protection, protecting at least 20% of all habitats and >33% of the GBRMP is now in no-take zones. The GBRMP process serves as a benchmark for the implementation of representative no-take networks around the world.

Description:

The GBRMP in northeast Australia covers 344,400 km^2 and has eight zones. Zones with the widest area coverage are the 'general use' (the least restrictive zone, allowing most reasonable uses) and 'marine national park' (one of the more restrictive zones, providing protection and is generally free of extractive activities) zones. The review of the 1981 zoning process of the GBRMP has resulted in one of the most successful equitable rezoning in the world. The rezoning process was called the 'Representative Areas Program' (RAP) and was developed around the following objectives: 1) maintain biological diversity; 2) provide refuge for species to evolve and function undisturbed; 3) provide a base for threatened species and habitats to recover; and 4) maintain ecological processes and systems.

The RAP process constitutes steps similar to published and robust Systematic Conservation Planning frameworks. Key steps include reviewing the existing network, identifying new potential areas to be included, extensively consulting with key stakeholders, and opening draft zoning for public comment. An independent and interdisciplinary Scientific Steering Committee with relevant knowledge on the GBR was established to navigate the process, with the best available knowledge. Operational principles were designated to make sure that the rezoning process quantitatively achieved the ecological objectives of the RAP. For example, ensuring representation across all bioregions and habitats, replicating to spread the risk against negative impacts, setting minimum amount of protection, and protecting uniqueness and rarity. A reserve-design software, Marxan, was used for decision-support, providing solutions that met representation goals, were clumped, and minimised impacts on other ocean uses.

Further, a Social, Economic, and Cultural Steering Committee was established to lead a participatory, balanced, open, and transparent consultation process with Indigenous People, Indigenous Knowledge-Holders, Traditional Owners, and other relevant stakeholders. Some key success factors of this process include using independent experts, early and sustained input from stakeholders, existing legislative power to push the process, and high-level support.

Intertidal zones in Heron Island, Great Barrier Reef

The GBR supports a wide range of habitats and thousands of species, including threatened and vulnerable species like dugongs and marine sea turtles and migratory species that span boundaries and jurisdictions like humpback whales and migratory seabirds and shorebirds. The sheer biodiversity value of the GBR makes it part of UNESCO's World Heritage List. Zoning the GBR results in not only conserving biodiversity and cultural value but also maximising the possible and reasonable activities and uses of the region. RAP led to the protection of at least 20% of the area for all habitats (in other words, representative protection).

For more information:

https://doi.org/10.1111/j.1523-1739.2005.00302.x

https://elibrary.gbrmpa.gov.au/jspui/bitstream/11017/382/1/GBRMP-zoning-plan-2003.pdf

https://outlookreport.gbrmpa.gov.au/

https://onlinelibrary.wiley.com/doi/10.1002/aqc.3115

https://www2.gbrmpa.gov.au/our-work

https://www2.gbrmpa.gov.au/access/zoning/eye-on-the-reef-app

Case Study

Box 13

The Finnish EMMA Process for Identifying Ecologically Significant Marine Areas for Decision-Making

Contributed by Lauri Kuismanen (Syke), Markku Viitasalo (Syke) and Riku Varjopuro(Syke)

Overview:

- Nationally Identified EBSAs: 87 EBSAs were delineated across Finnish marine areas, uniquely tailored for national and local conservation needs.
- Robust Methodology: Data collection included 160,000 marine sites, with prioritisation analyses integrating ecological and anthropogenic factors.
- Participatory Approach: The process incorporated expert input and stakeholder engagement for comprehensive representation and local relevance.
- Policy Support: The EMMA process provides critical information for environmental decision-making, supporting biodiversity protection and sustainable resource use.
- Direct use in MSP: The EMMAs were readily adopted as areas demarcated as "Significant underwater natural values" in the Finnish MSP 2030, which implemented the EU MSP Directive.

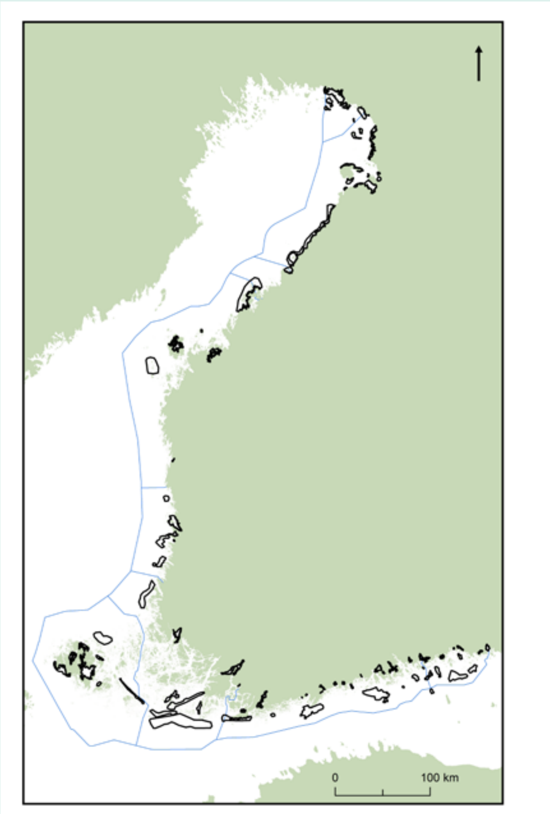
Description:

Finland has developed a national approach to identifying and conserving marine biodiversity through the delineation of Ecologically Significant Underwater Marine Areas (EMMA). The EMMA process is based on the UN Convention on Biological Diversity's Ecologically or Biologically Significant Marine Areas (EBSA) framework, which highlights areas with exceptional ecological or biological characteristics. While the EBSA concept is global, the Finnish EMMA process tailored the concept to the national scale, resulting in the description of 87 unique national EBSAs (called EMMAs) that meet the specific needs of Finland's marine environments and policy context.

The EMMA process included extensive data collection and spatial prioritisation analysis, supported by participatory approaches involving expert knowledge and stakeholder input. Using a spatially explicit dataset of marine species and habitats from 160,000 sites (collected by the national marine biodiversity inventory programme Velmu) and information on environmental drivers and human pressures, spatial prioritisation analyses (using the Systematic Conservation Planning tool Zonation) were applied to define these areas' boundaries. The EMMA sites are relevant and applicable to national and local decision-making on maritime spatial planning, environmental permitting, as well as the development of marine protected area (MPA) networks.

The Finnish EMMA process is an example of how the EBSA framework can be adapted to finer spatial scales, providing actionable insights for ecosystem-based MSP and conservation in varied marine environments.

The EMMAs are based on extensive data, additionally leveraging the knowledge of experts as well as the input of the end-users of the materials to identify and delineate ecologically significant areas in a processed and interpreted format, listing ecological features (e.g., Red Listed species or habitats, ecosystem services, exceptionally rich biodiversity) in relation to criteria of the EBSA process, and describing the area generally. The areas can be utilised in, e.g., spatial planning processes (directing activities), conservation (areas outside the current MPA network), or permitting processes (activity planned in or in the vicinity of ecologically valuable areas).



The 87 EMMA areas (black shapes) of Finland.
The blue lines delineate the borders of the coastal regions.
© Lappalainen et al. (2020) (*)

For more information:

Kuismanen, L.M.J., Virtanen, E.A., Lappalainen, J., Kurvinen, L., Blankett, P. and Viitasalo, M. 2023. Identifying ecologically valuable marine areas to support conservation and spatial planning at scales relevant for decision-making. *Marine Policy*, 158. doi:10.1016/j.marpol.2023.105890

Lappalainen, J., Kurvinen, L. and Kuismanen, L. 2020. Suomen ekologisesti merkittävät vedenalaiset meriluontoalueet (EMMA) – Finlands ekologiskt betydelsefulla marina undervattensmiljöer (EMMA). *Suomen ympäristökeskuksen raportteja*, 8|2020, pp. 294. http://hdl.handle.net/10138/312221 (In Finnish)

Considering OECMs

OECMs are a relatively new type of area-based conservation that presents several opportunities for MSP to achieve biodiversity targets beyond the scope of designated MPAs by safeguarding identified key habitats and species. OECMs can be integrated into biodiversity inclusive MSP by considering in the plan's proposal how areas such as military areas, sacred sites, coastal wetlands and fisheries areas can also be used for effective and long-term conservation purposes, regardless of their primary management objectives. CBD provides guiding principles, common characteristics, and criteria for identifying OECMs (CBD/COP/DEC/14/8) (**Box 14**).

Delivering OECMs through a biodiversity inclusive MSP requires their introduction into regulatory processes and legislative frameworks. It is important to clarify for rights-holders and stakeholders how OECMs and their implementation differ from MPAs and how their delivery contributes to biodiversity targets.

Suggested actions:

- Analyse the state of the marine environment within the potential OECM sites to understand if the area is valuable for conservation (phase 3).
- Analyse existing and proposed uses to understand how human activities impact biodiversity within the OECM sites.
- Identify and involve sectors and governing authorities that are linked in the management of the OECM sites.
- Identify and discuss the appropriate OECMs needed to address the conservation goal and policy levers for successful application.

Further reading sources:

Jonas, H. D., Wood, P. & Woodley, S., Volume Editors. 2024. *Guidance on other effective area-based conservation measures (OECMs)*. IUCN WCPA Good Practice Series, No.36. Gland, Switzerland: IUCN. https://doi.org/10.2305/LAAW4624

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FAO. 2022. *A handbook for identifying, evaluating and reporting other effective area-based conservation measures in marine fisheries*. Rome. https://doi.org/10.4060/cc3307en

Box 14

Other effective area-based conservation measures

Other effective area-based conservation measure means *"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/COP/DEC/14/8).

For the identification of OECMs, CBD established the following criteria:

- **Criterion A:** Area is not currently recognized as a protected area.
  - Not a protected area.
- **Criterion B:** Area is governed and managed.
  - Geographically defined space.
  - Legitimate governance authorities.
  - Managed.
- **Criterion C:** Achieves sustained and effective contribution to in situ conservation of biodiversity.
  - Effective.
  - Long-term.
  - In situ conservation of biological diversity.
  - Information and monitoring.
- **Criterion D:** Associated ecosystem functions and services and cultural, spiritual, socio-economic and other locally relevant values.
  - Ecosystem functions and services.
  - Cultural, spiritual, socio-economic and other locally relevant values.

Source: CBD/COP/DEC/14/8

Integrating nature-based solutions

Protection, restoration (active and passive) and other sustainable management measures can be further considered under the umbrella concept of nature-based solutions (O'Leary *et al.*, 2023). In addition to the benefits to biodiversity, NbS actions also improve human well-being by addressing social, economic, and environmental challenges. Biodiversity inclusive MSP can apply this broader integrated perspective by considering where specific protection and restoration actions would help address issues such as coastal protection, coastal erosion, carbon storage, food security, etc. This requires integrating the identification of areas of high ecological value, the potential supply of ecosystem services, and the demand/need for such services, allowing for the strategic planning of a spatial network of areas that is simultaneously important for biodiversity and human well-being.

When considering the design and implementation of NbS, it is essential to contemplate the need for a set of enabling conditions at the socio-cultural, economic, and governance levels, such as the existence of collaborative relationships among stakeholders, adequate resources, and a political mandate for NbS (Martin *et al.*, 2021).

Suggested actions:

- Consider the various assessments available (ecosystems distribution and condition, climate considerations, natural capital, cumulative impacts, etc.) and overlap with areas with specific needs (e.g., coastal protection).
- Identify potential NbS actions to be implemented and define appropriate and feasible objectives.
- Evaluate the existence of suitable conditions for implementing NbS actions, including but not limited to funding.
- Encourage the active involvement of rights-holders and stakeholders in designing and implementing NbS actions.

Integrating socio-economic and cultural considerations

Although identifying ecosystem services and assessing natural capital might integrate some socio-economic and cultural considerations, other concerns need to be incorporated. Biodiversity inclusive MSP aims to bring biodiversity to the forefront of decision-making, including socio-economic and cultural aspects (Said and Trouillet, 2019). The rights, needs and vulnerabilities of Indigenous Peoples, small-scale fishers and other local communities highly dependent on marine and coastal biodiversity should also be duly considered in the process. Cultural and customary uses of the space need to be accounted for when considering planning options.

Other national and local socio-economic and cultural issues may affect the success of MSP strategies and require consideration, for example, in the temporal planning for the implementation of measures and actions (such as the need for phased or incremental decommissioning of harmful practices). It is important to account for the distribution of benefits and harms of biodiversity inclusive planning decisions across different groups, and consider possibilities to minimise or compensate for the harms.

Suggested actions:

- Assess the economic dependence of local communities and industries on marine biodiversity to determine the potential social and economic impacts of MSP and implemented management measures, recognising that official national statistics may not capture the full breadth of local community dependencies on marine resources.
- Include the cultural significance of marine areas, including sacred spaces and historical and traditional practices.
- Make use of social science methods (such as interviews, surveys, narrative analysis, etc.) to help assess socio-economic dependencies and cultural significance. Integrate

Further reading sources:

O'Leary, B.C., Krause, T., Espinoza Cordóva, F., N'Guetta, A., Fonseca, C., Frehen, L. and Boyd, E. (Eds). *2024. Deliverable 4.4 – Nature-based Solutions Policy Briefs* (pp. 14-18). MaCoBioS. https://macobios.eu/wp-content/uploads/2024/11/PolicyBrief_3_2024-09_v2.3.pdf

IUCN. 2020. *Global Standard for Nature-based Solutions: a User-Friendly Framework for the Verification, Design and Scaling Up of NbS*. IUCN, Gland, Switzerland. 10.2305/IUCN.CH.2020.08.en

Pérez-Cirera, V., Cornelius, S. and Zapata, J. 2021. *Powering Nature: Creating the Conditions to Enable Nature-based Solutions*. WWF. https://wwfint.awsassets.panda.org/downloads/wwf_powering_nature_report.pdf

Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis. S. 20216. *Nature-based Solutions to Address Global Societal Challenges*. IUCN, Gland, Switzerland. https://portals.iucn.org/library/sites/library/files/documents/2016-036.pdf

this in the engagement strategy.

- Assess the distribution of benefits and harms of biodiversity inclusive planning decisions.
- Make clear how the socio-economic and cultural factors are considered in decision-making and influence MSP outcomes.

Planning for the future

In biodiversity inclusive MSP, it is important to consider likely external changes that can occur in the future and threaten the plan's resilience and the long-term effectiveness of the proposed measures. To future-proof the marine spatial plan, it is necessary to foresee, to the extent possible, a diversity of plausible external changes and gain insight into how they can affect the implementation of the proposed plan. This includes using climate projections and different future scenarios (some already developed in the previous assessments phase) to anticipate risks and inform spatial planning options (Stelzenmüller *et al.*, 2024), ensuring that biodiversity conservation, resource use and human activities are resilient to changing conditions.

In this context, it is important to assess the uncertainties associated with such prediction data[16] of future scenarios and clearly communicate associated uncertainties in MSP analysis results, visualisations and recommendations. Engaging rights-holders and stakeholders in these discussions enhances transparency around climate-related changes and uncertainties and ensures that MSP strategies are locally relevant and more likely to gain support.

Planning for the future also means allowing for some flexibility within the plan and considering sufficient 'room' for adaptation to changing environmental, social and economic conditions. Adjusting to new knowledge and evidence is a key aspect of an adaptive management approach, but this requires robust and continuous monitoring that can inform on expected and unexpected changes. Based on the scenarios analysed and other considerations, a clear framework for updating and revising the plan needs to be established and linked with a monitoring plan.

Suggested actions:

- Identify potential external changes that can affect the implementation of the proposed plan.
- Involve rights-holders and stakeholders in the discussion of anticipated climate impacts and future scenarios.
- Analyse how planning options withstand the foreseen changes and how they can be adapted to guarantee biodiversity positive outcomes.

Phase 5 - Enabling implementation of the marine spatial plan

Strengthening legal and policy frameworks

In some contexts, existing legal and policy frameworks may need revision to facilitate the implementation of biodiversity inclusive MSP and resulting plans to ensure policy coherence. All available tools across sectors and regulatory authorities need to be activated to maximise conservation benefits. The implementation of legal tools, such as pollution restrictions, fishing limits and control of invasive species in MSP areas, should be coordinated with competent authorities and rights-holders within their territorial jurisdiction. Requirements from regional and international frameworks may also need to be articulated, especially regarding transboundary or cross-border issues.

Policy incentives for adopting biodiversity-friendly practices can be created across sectors and aligned with the provisions of the marine spatial plan. The degree of compliance with the plan may depend on the planning system in place (in some cases, plans are legally enforceable, while others are meant to be guiding policy instruments). It is essential to guarantee that appropriate enforcement and/or incentive mechanisms are in place, including the necessary resources.

Suggested actions:

- Assess the available policy and regulatory tools across sectors that can facilitate the implementation of the plan.
- Identify which policies and regulations would need to be amended or reinforced to better support biodiversity inclusive MSP and plan implementation.
- Facilitate collaboration with responsible authorities for policy harmonisation and joint enforcement.
- Stipulate in legislation, if needed, a mandate for a body to enforce blue economy policies.

Building capacity and promoting public awareness

For biodiversity inclusive MSP to be effective, government agencies, rights-holders and stakeholders must clearly understand and accept their roles and responsibilities in achieving the plan's desired outcomes. A shared understanding of the MSP objectives and requirements facilitates compliance and enables the application of available tools to balance biodiversity conservation with sustainable use of marine resources. This requires improved communication, training and collaboration between all those involved in the plan's implementation.

Suggested actions:

- Develop a guideline document that details different aspects of the biodiversity inclusive plan and the roles of

16 **For more detailed information** about spatial data uncertainties, please see Chapters 3.1.1 and 3.3.2 of the "***MSPglobal Data Toolbox: Volume 1 – How to develop a Spatial Data Infrastructure for Marine Spatial Planning***".

each governmental agency, rights-holder and stakeholder.
- Establish/maintain inter-agency coordination mechanisms.
- Conduct training sessions for relevant authorities, rights-holders and stakeholders to improve their understanding of biodiversity goals, management requirements and good practices.
- Develop specific guidelines of biodiversity inclusive planning for different sectors (e.g., fisheries, tourism, shipping), providing good practices, legal requirements and conservation expectations.
- Develop accountability mechanisms and standards to ensure established principles and goals for biodiversity inclusive planning are upheld.
- Build a public awareness program about the value of nature and biodiversity that can contribute to behavioural change.

Phase 6 - Monitoring, evaluation and adaptation of the MSP process and the marine spatial plan

Enhancing monitoring and evaluation

Monitoring and evaluation are key to assessing the effectiveness of biodiversity inclusive MSP and the success of the different measures. Monitoring should be regular and, as far as possible, based on standardised protocols and indicators (Stelzenmüller *et al.*, 2021). When appropriate, indicators established under other monitoring procedures might also be used to avoid duplication of efforts (**Box 15**). Specific indicators to monitor the achievement of the objectives established by the plan should be included, particularly the biodiversity positive outcomes. Sector-specific data (e.g., fisheries) should also be included. A combination of methods to collect monitoring data can be used (surveys, remote sensing, eDNA, among others).

Monitoring results will then be used in periodic evaluations to allow tracking of expected and unexpected outcomes, corrective actions or revision when needed, ensuring the plan remains relevant. This will support an adaptive management approach (**Box 16**). A specific timeframe (e.g., 5-10 years) or a set of criteria for a required plan revision (that is, the start of the next planning cycle) should also be clearly foreseen.

Rights-holders and stakeholders need to be involved in monitoring and evaluation processes to ensure transparency and accountability, but also because they are an important source of information on the effects and side-effects of marine spatial plans.

Suggested actions:

- Develop a standardised monitoring protocol with rights-holders and stakeholders, setting out data collection parameters and frequencies, stakeholder responsibilities and data sharing requirements. Ensure the protocol includes biodiversity indicators that can help track the achievement of targets and commitments.
- Coordinate with other agencies and institutions doing environmental monitoring (e.g., universities and research centres) to leverage existing protocols and technologies. As far as possible, ensure that data is comparable.
- Establish a schedule for periodic reviews, involve rights-holders and stakeholders, and provide feedback on what is learned in the biodiversity inclusive plan-making process.

Case Study

Box 15

Spanish Maritime Spatial Plans: Implementation, evaluation and monitoring of the plans

Contributed by Mónica Campillos-Llanos (IEO (CSIC))

Overview:

The Spanish Maritime Spatial Plans have a monitoring programme designed to detect the progress of maritime human uses and activities in the marine environment, the effectiveness and possible shortcomings of the plan itself, to facilitate adaptive management and to establish the steps towards revising and updating the plans in 2027.

Description:

In Spain, the processes related to both EU Marine Strategy Framework Directive and EU MSP Directive are connected by law in order to apply the ecosystem approach and to ensure that the combined pressure of all activities is maintained at levels compatible with the achievement of good environmental status and that the capacity of marine ecosystems to respond to human-induced changes is not compromised while contributing to the sustainable use of marine goods and services by present and future generations. That is why much of the information from the Marine Strategy process is used to develop maritime spatial plans.

The monitoring programme of the Spanish maritime spatial plans is designed to cover the four main aspects described below.

Aspects to cover in the Spanish monitoring of the Maritime Spatial Plans

Aspect	Source of information	Need to be complemented or new MSP monitoring
1.Environmental status of marine waters, including climate change	**Marine Strategy Monitoring Programmes**	**No**
2. Human uses and activities in the sea, including pressures and impacts	**Marine Strategy Monitoring Programmes**	**Yes, complement as needed**
3. Economic and social context and developments	**Economic and social evaluation of the 3'd cycle of Marine Strategies**	**Yes, complement as needed**
4. Management objectives and effectiveness of plans.	**Marine Strategy Monitoring Programmes Monitoring programmes for hydrological plans and other tools. Ad-hoc monitoring programme of the MSP plans**	**Yes, it collects indicators from different monitoring programmes and complements them with a new programme designed ad-hoc**

Source: Spanish Maritime Spatial Plans, Royal Decree 150/2023. Ministry for the Ecological Transition and the Demographic Challenge.

The Maritime Spatial Plan establishes its own indicators to be monitored during the implementation and update of the plan. In addition, it uses existing tools to facilitate the monitoring programme and avoids duplication in the design of indicators by using those indicators established in the Marine Strategy monitoring programmes. These indicators cover aspects 1, 2 and 3 in the table above, through 18 monitoring programmes. When any of these aspects is not sufficiently completed with Marine Strategy indicators, the MSP monitoring programme requires an *ad hoc* design of indicators that generate useful information for the evaluation and adaptation of the plans.

The use of indicators from these Marine Strategy monitoring programmes, in order to complement the indicators of the Maritime Spatial Plans, is of great importance in the context of biodiversity, in particular they provide the following information:

- Environmental status of the components of biodiversity, specifically:
  - the group of seabirds, marine turtles, marine mammals, fish and cephalopods.
  - benthic and pelagic habitats.
  - trophic networks.
- Environmental status of the marine environment concerning the presence, abundance, and impacts of non-native and invasive species.
- Spatial distribution and intensity of human activities in the marine environment through the monitoring programmes of human activities and their pressures.

For more information:

https://www.boe.es/boe/dias/2023/03/04/pdfs/BOE-A-2023-5704.pdf

Case Study

Box 16

Ecosystem-based marine spatial planning assessment tool

Contributed by Ibon Galparsoro (AZTI), Natalia Montero (AZTI), Gotzon Mandiola (AZTI) and Vanessa Stelzenmüller (Thünen Institute of Sea Fisheries)

Overview:

The EB-MSP assessment tool addresses the implementation challenges of ecosystem-based management principles in marine spatial planning processes. The tool considers specific actions that should be addressed through the planning process, providing a structured assessment method for practitioners and competent authorities and ensuring coherent and transparent planning. The tool is publicly available as a web app and includes a video tutorial for users.

Description:

The EB-MSP assessment tool is a valuable resource for ensuring the effective implementation of ecosystem-based management principles in marine spatial planning. It integrates fundamental principles of an ecosystem approach into specific actions for planning processes. The tool evaluates the conformity of marine spatial plans with ecosystem-based principles, assesses plans in progress, and examines plans in transboundary regions.

The EB-MSP assessment tool can significantly contribute to marine biodiversity protection and restoration by ensuring that ecosystem-based management principles are integrated into marine spatial planning processes. The tool helps assess if/how specific issues are considered in the planning process, such as ecological functioning, ecological connectivity, ecosystem services, ocean accounting and ecological carrying capacity. Therefore, it can also be used to guide the development of marine spatial plans that deliver biodiversity positive outcomes.

The practical implementation of the EB-MSP assessment tool is showcased through its use in the transboundary context of the Bay of Biscay, involving Spain and France. The tool was used to independently evaluate the marine spatial plans of both countries, highlighting the degree of implementation of the ecosystem-based management principles and identifying areas for improvement. This case study demonstrates the tool's applicability in real-world scenarios and its potential to enhance the effectiveness of MSP processes. Recently, the tool has been used to assess marine spatial plans of 10 EU countries and two regions (Western Baltic Sea and Western Mediterranean Sea).

Moreover, the tool's design as a web app, along with a dedicated video tutorial, makes it accessible and user-friendly for a wide range of stakeholders. This accessibility ensures that the tool can be widely adopted, promoting the consistent application of ecosystem-based management principles across different geographic contexts and planning stages.

The EB-MSP assessment tool can assist practitioners and authorities in promoting the sustainable use of marine space by seeking to balance human activities with the need for healthy ecosystems and evaluating if protection and restoration objectives have been adequately integrated into management plans. It also supports adaptive management by facilitating continuous improvement of marine spatial plans and encourages stakeholder engagement by outlining actions for effective communication and participation throughout the planning process. These features contribute to a well-informed and inclusive planning process that can protect and restore marine biodiversity.

For more information:

Scientific publication: https://doi.org/10.1038/s43247-024-01975-7
Access to the tool: https://aztidata.es/EB-MSP/
Video tutorial: https://www.youtube.com/watch?v=VIM0jrqoe4g&t=6s

5 Ways to move forward

As described in this specific volume of the ***"MSPglobal Guide"***, biodiversity inclusive MSP is not exactly a new approach to develop and implement marine spatial plans, but a lens to emphasize once more that the ecosystem-based approach (EBA) is the foundation of MSP and that a healthy ocean is the cornerstone of sustainable blue economies. As such, MSP processes can and must address conservation targets such as those of the Kunming-Montreal Global Biodiversity Framework (KMGBF), particularly the target 1 to implement participatory, integrated and biodiversity inclusive spatial planning.

The co-development of this volume on biodiversity inclusive MSP is a first step to support countries to develop and monitor their plans to ensure that conservation objectives are included and successfully achieved. The **wide dissemination of this guide** to planners, government officials, IPLCs managing their customary coastal-maritime territories, stakeholders and researchers will be a key task to immediately follow. In the next phase of MSPglobal, UNESCO-IOC and DG MARE will also focus on **developing and delivering trainings** on biodiversity inclusive MSP.

Collaborations with other organisations will be key in the next steps for developing capacities and supporting the implementation of this guide. For instance, by playing a major role in the protection, conservation, restoration and sustainable management of the world's marine and coastal areas, the United Nations Environment Programme (UNEP) will be an essential partner.

Within the framework of the Convention on Biological Diversity (CBD), there is ongoing work regarding **complementary indicators of the KMGBF target 1** in order to assist countries in gathering additional information on particular elements, trends and conditions. In parallel, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is also working on a **methodological assessment of integrated biodiversity-inclusive spatial planning and ecological connectivity**.

UNESCO-IOC and DG MARE hope that the **recommendations and respective suggested actions proposed in this guide can feed ongoing and future discussions** of these international processes as well as other individual initiatives from governments, researchers and NGOs **for MSP to become more biodiversity inclusive, adhering to its four key elements**: (i) knowledge-based approaches; (ii) ocean resilience and sustainable blue economies; (iii) marine protection and restoration; and (iv) rights-holders and stakeholders engagement.

Moving forward, the effective implementation of biodiversity-inclusive MSP will depend on the integration of scientific evidence, policy coherence, and robust monitoring frameworks. By operationalising the guidance provided in this volume, practitioners and decision-makers can contribute to the advancement of spatial planning processes that are ecologically sound, legally grounded, and aligned with international biodiversity targets.

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1 rev. 2	Guide to IGOSS Data Archives and Exchange (BATHY and TESAC). 1993. 27 pp. (English, French, Spanish, Russian)
2	International Catalogue of Ocean Data Station. 1976. *(Out of stock)*
3 rev. 3	Guide to Operational Procedures for the Collection and Exchange of JCOMM Oceanographic Data. Third Revised Edition, 1999. 38 pp. (English, French, Spanish, Russian)
4	Guide to Oceanographic and Marine Meteorological Instruments and Observing Practices. 1975. 54 pp. (English)
5 rev. 3	Guide for Establishing an IODE National Oceanographic Data Centre, IODE Associate Data Unit or IODE Associate Information Unit (3rd revised edition), 2022. 28 pp. (English) *(Electronic only)*
6 rev.	Wave Reporting Procedures for Tide Observers in the Tsunami Warning System. 1968. 30 pp. (English)
7	Guide to Operational Procedures for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring. 1976. 50 pp. (French, Spanish)
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9 rev.	Manual on International Oceanographic Data Exchange. (Fifth Edition). 1991. 82 pp. (French, Spanish, Russian)
9 Annex I	*(Superseded by IOC Manuals and Guides No. 17)*
9 Annex II	Guide for Responsible National Oceanographic Data Centres. 1982. 29 pp. (English, French, Spanish, Russian)
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16	Marine Environmental Data Information Referral Catalogue. Third Edition. 1993. 157 pp. (Composite English/French/Spanish/Russian)
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MSPglobal

International Guide on Marine/ Maritime Spatial Planning

Volume 2 – Biodiversity Inclusive Principle

More and more countries worldwide are moving away from isolated sectoral management to an integrated planning framework for their maritime jurisdiction, aiming to reduce conflicts and encourage coexistence and synergies among different stakeholders. In that respect, marine/maritime spatial planning (MSP) has emerged as an essential process for promoting a more inclusive, rational and sustainable use of the ocean, shaping the future of international ocean governance.

This Volume 2 of the MSPglobal Guide, co-developed by several experts and produced jointly by the Intergovernmental Oceanographic Commission of UNESCO and the Directorate-General for Maritime Affairs and Fisheries of the European Commission, emphasises the central role of biodiversity in ocean health and its contribution to ecosystem services and sustainable livelihoods. It also aims to support countries in answering the call from the Kunming-Montreal Global Biodiversity Framework to implement participatory, integrated and biodiversity inclusive spatial planning.

IOC Manuals and Guides No. 89, Volume 2