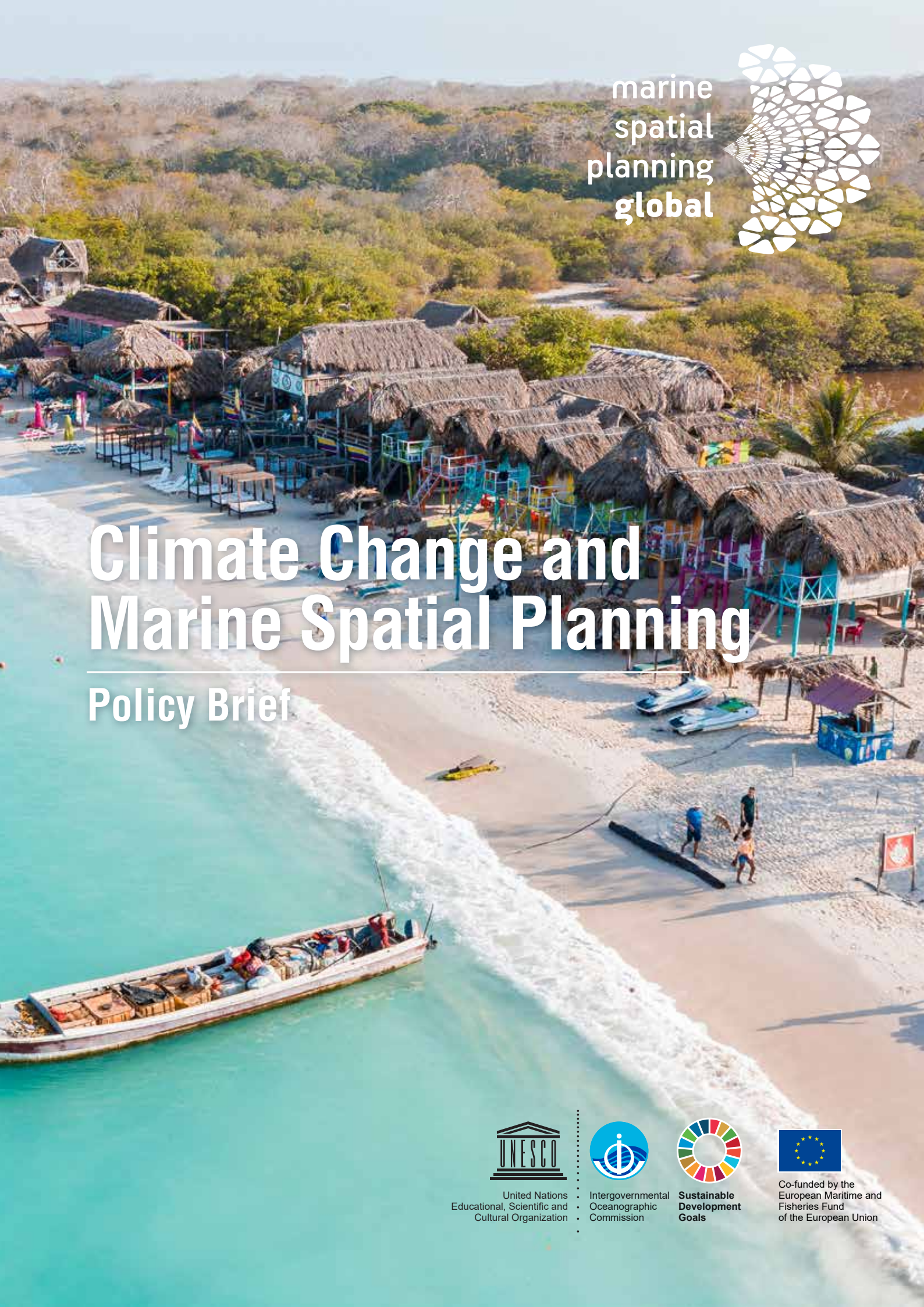

marine
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Climate Change and Marine Spatial Planning

Policy Brief

United Nations
Educational, Scientific and
Cultural Organization

Intergovernmental
Oceanographic
Commission

**Sustainable
Development
Goals**

Co-funded by the
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Executive Summary

As a changing climate alters ocean conditions, the redistribution of marine ecosystem services and benefits will affect maritime activities and societal value chains. While the magnitude of the effects will be diverse and region-specific and vary across sectors, both humans and nature will be subjected to increasing and intense negative impacts. Furthermore, the impacts of a changing climate on maritime economies are yet largely unknown and there are uncertainties and limitations of climate and ocean management options, which are at a very early or experimental stage. Significant gaps in technical, institutional and financial capacities for climate change adaptation between developed and developing countries exist, pointing to an imbalanced response to the global climate crisis.

Marine/Maritime Spatial Planning (MSP) is being developed and implemented worldwide as a way to foster sustainable ocean use and management. The spatial and temporal distribution of human uses in marine spaces through MSP aims to minimise conflicts and promote synergies among uses, as well as between uses and the environment. In addition to the many environmental and socio-economic challenges which MSP seeks to address, a changing climate must now be included. **Mainstreaming climate change into MSP will allow for improved preparedness and response, as well as reduced vulnerability of marine systems**.

"Climate-smart MSP" refers to planning initiatives in the ocean space which integrate and may adapt to the effects of a changing climate. For MSP to become "climate-smart", data and knowledge on the pathways through which climate change impacts marine ecosystems and human uses are needed at appropriate spatial scales. These should address the inherent uncertainties in planning scenarios themselves with regard to climate change, particularly in relation to their ability to adapt to changing ocean conditions. In this regard, the **United Nations Decade of Ocean Science for Sustainable Development (2021-2030)** will play a key role, as one of its main objectives is filling the significant remaining gaps in marine knowledge, including the effects of climate change. Marine Protected Areas (MPAs) and other spatial marine management tools can also be used to promote specific adaptation-relevant features, while **climate literacy** can help build capacities and facilitate behavioural change to better cope with climate-related challenges.

Increasing the **knowledge** base on the impacts of a changing climate is necessary. This includes building evidence on the uses most vulnerable to the effects of climate change and integrating their possible spatial relocation in MSP; knowledge on conservation priority species and keystone ecosystem components and including them in impact analysis assessments to promote their sustainability and resilience; and an understanding of the social and economic implications of climate change, particularly in communities highly dependent on marine resources for their livelihoods.

It is also necessary to **raise awareness** on the effects of a changing climate on marine ecosystems and maritime activities, and fostering new behaviours and social norms in local communities to improve knowledge and skills on opportunities for sustainable mitigation and adaptation options, for enhancing climate literacy and promoting sustainable actions at the local level.

This involves integrating strategic climate objectives into overall sustainable development and environmental policies using **climate-smart, nature-inclusive MSP** as a common framework for setting up meaningful and effective actions across regions, which may be achieved through establishing interdisciplinary MSP networks. Practical adaptation and mitigation strategies at appropriate scales, using fit-for-purpose, spatially explicit and operationally mature nature-based solutions, as well as strategic investments to achieve long-term visions reflected in climate-smart, nature-inclusive spatial plans, are also required.

1. Introduction

The ocean plays an essential role in moderating Earth's climate, absorbing between 20 to 30% of human-induced carbon dioxide emissions since the 1980s. This contributes to warming, deoxygenation and acidification, which alter ocean conditions, affecting the structure and functioning of ecosystems and the provision of goods and services. The rates and magnitudes of these changes will be significantly smaller if greenhouse gas (GHG) emissions are drastically reduced (IPCC, 2019).

It has been five years since the Paris Agreement, and although there are promising signs with ambitious targets from around the world, overall progress is still far-off in limiting global temperature rise to below +2 °C by 2100 (Temperatures, 2020). Bolder decisions need to be taken by all countries in their climate plans, focusing on both land and ocean-based actions. Spatial planning is vital to balancing multiple human demands and facilitating climate change mitigation and adaptation (Frazao-Santos et al., 2020).

Marine/Maritime Spatial Planning (MSP) is the process of analysing and allocating the spatial and temporal distribution of human activities in marine spaces to achieve ecological, economic, and social objectives that are usually specified through a political process (IOC-UNESCO, 2009). In this regard, MSP, including coordinated transboundary efforts, can play a crucial role in linking across sectors and sea basins, effectively allocating the marine space to accommodate appropriate mitigation and adaptation measures. Together with the Decade of Ocean Science – which aims for a healthy and resilient ocean, with marine ecosystems mapped and protected and climate change and other impacts measured and reduced (IOC-UNESCO, 2017) – this can contribute to achieving global ocean governance goals, particularly Sustainable Development Goals 13 ("Climate Action") and 14 ("Life Below Water") of the 2030 Agenda for Sustainable Development (UN/DESA, 2017).

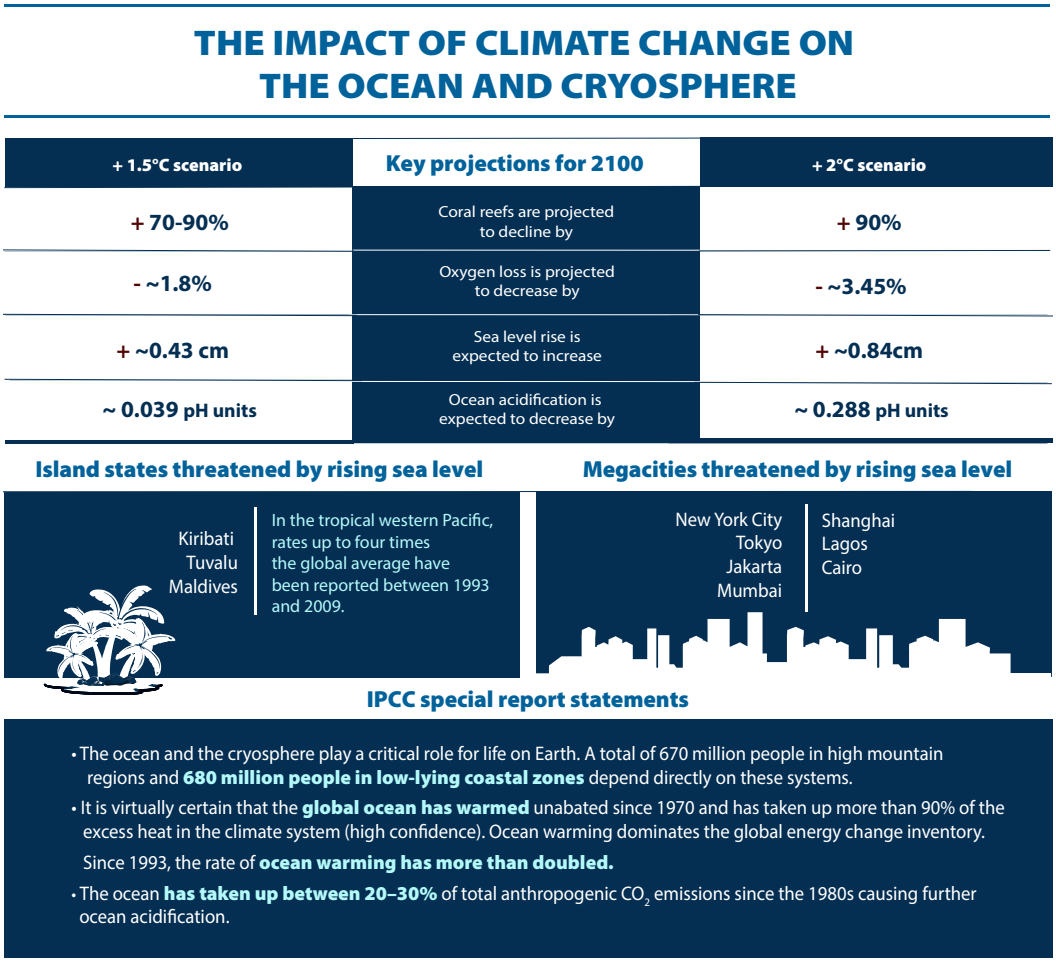

Figure 1
The impacts of a changing climate on our ocean, © IOC-UNESCO, 2019.

2. Challenges to mainstreaming climate change impacts in MSP

Variable impacts on sectors, in different geographies and at different scales

Climate change presents an additional, growing and evolving challenge, requiring flexible and adaptive ocean planning and management. As a changing climate alters ocean conditions, the redistribution of marine ecosystem services and benefits will affect maritime activities and societal value chains. While the magnitude of the effects will be diverse and region-specific and vary across sectors, both humans and nature will be subjected to increasing and intense negative impacts (IUCN, 2020). For example, both maritime shipping activities and commercial fisheries will be impacted by climate change, the latter even more so (Frazao Santos et al, 2020). In particular, near the Equator, fisheries will be more affected due to shifts in species distribution at higher latitudes, and although there may be a gain in terms of biomass and potential catches (COACCH, 2019), this may not translate into increases in revenue because of the likely higher dominance of lower value species (Lam et al., 2016).

Wild polar bear in the Arctic Sea.
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Furthermore, the impacts on marine ecosystems are expected to be cumulative with other human-induced changes, such as overexploitation of living resources, habitat destruction and pollution. Indeed, climate change functions as another stressor on the marine environment, increasing vulnerability to human pressures and reducing resilience (Qiang and Silliman, 2019). Projections of vulnerability to climate stressors and their effects on resilience are critical in providing high quality scientific information for adaptive management. Moreover, using MSP as a framework for action can help safeguard ecosystem functions in climate change hotspots (Rilov et al., 2020).

As mentioned before, the effects of a changing climate are not expected to affect all places uniformly, and so differences in socio-ecological vulnerabilities should be spatialised and considered in planning scenarios. The health of ecosystems which provide coastal protection (e.g. coral reefs, mangroves, sea grass meadows), particularly in low-lying areas where the risk of flooding is severe, as well as the effects on essential habitat and fishing grounds, should be prioritised in the MSP process and be linked to suitable adaptiveness and responsiveness strategies. Coastal zones, often characterised as socio-economically important areas, have a relatively high climate-related vulnerability (Nicholls et al., 2007). This is particularly the case in Small Island Developing States (SIDS) (UNDP, 2017) and "hotspots", mainly in north-western Europe and Asia, where episodic flooding is projected to occur at the end of the century (Kirezci, et al., 2020). The high seas are also on the front line of climate change-related stress, both in relation to their mitigation capacity and vulnerabilities (Nereus, 2016).

Limited knowledge of processes and impacts

Although considerable efforts are being made towards integrating climate change in spatial-use scenarios and visioning processes (Frazao-Santos et al. 2020), there is still limited knowledge on the complexity of the processes underlying the impacts. This is a major obstacle for reducing uncertainty in spatial planning decision-making (Rilov et al., 2019), jeopardising the success of management efforts, even at the local scale. Furthermore, the impacts of climate change on maritime economies, including insurance burdens, as well as the social impacts, are also expected to be significant, but are yet largely unknown (Yiannakou and Salata, 2017). Additionally, uncertainties and limitations of many of the currently available climate and ocean management options must be acknowledged, as certain potential ocean solutions are at a very early or experimental stage (Gatusso et al. 2018).

Variable national responses

Another important consideration is the tremendous difference in technical, institutional and financial capacities for climate change adaptation between developed and developing countries (FIG, 2010). At the same time, linking adaptation efforts with sustainable development initiatives in the latter has promising potential for reducing climate risks (Mertz, et al., 2009).

Soft corals in Indonesia.

3. Enablers and opportunities

What is "climate-smart MSP" and how can it contribute to climate change mitigation and adaptation?

A climate-smart planning process takes into account whether and how climate change might affect the different steps of planning (Fig. 2). The aim is to create a dynamic plan which adequately balances and sustains the planning objectives (EcoAdapt, n.d.). Climate-smart planning concepts and approaches are well established in terrestrial/urban systems, with web-platforms supporting the development of planning options offering low-emission, climate-resilient growth (CSPP, n.d.).

"Climate-smart MSP", however, is a novel process, referring to the planning initiatives in the ocean space which integrate and may adapt to the effects of a changing climate (Frazao-Santos et al., 2020). For MSP to become "climate-smart", data and knowledge on the pathways through which climate change impacts marine ecosystems and human uses are needed at appropriate spatial scales. These should address the inherited uncertainties in the planning scenarios, particularly in relation to their ability to adapt to changing ocean conditions.

It has been suggested that spatial planning may function as a switchboard for mitigation, adaptation and sustainable development objectives, enhancing effective mitigation and adaptation options in an integrated manner (Biesbroek, et al., 2009). In this regard, climate-smart MSP may contribute to a more robust analysis and allocation of human activities in marine areas that effectively restores our ocean's health, supporting resilience to the impacts of a changing climate. Well-organised local and regional scale planning strategies can influence global conditions and confront climate risks, as the most important relevant advances are accomplished at the local and regional levels (Carson, 2015).

The role of Marine Protected Areas and nature-based solutions

Without a doubt, better conserved and restored coastal and marine ecosystems may provide coastal communities with direct adaptation benefits, such as coastal protection, while supporting global mitigation activities (BTO, 2019). In this context, Marine Protected Areas (MPAs) and other spatial marine management tools can be used to promote specific adaptation-relevant features. Kelp and seagrass meadows for example, can help decrease ocean acidification locally and provide refuge for vulnerable shell-forming organisms. At the same time, MPAs protecting blue carbon ecosystems constitute nature-based mitigation tools with clearly quantifiable carbon sequestration benefits (IUCN, 2016). Nature-based solutions (NbSs) such as these, which are spatially explicit and operationally mature (Gatusso et al., 2018), may be easily incorporated into countries' climate strategies (IUCN, 2016). NbSs are considered an umbrella framework for ecosystem-based approaches such as MSP, and may be used to address major societal challenges such as climate change (IUCN, 2020).

Figure 2
A Climate-Smart Planning Process (Source: Sawyer et.al, 2017).

Stakeholder engagement and ocean literacy

The engagement of key stakeholders, as well as the wider public, has long been recognised as essential but challenging in the MSP process. The addition of climate change to the planning puzzle may further complicate interactions. However, raising awareness on climate change issues and relevant NbSs will develop capacities and facilitate behavioural change to better cope with related challenges. Stakeholders may also provide valuable insight into how a specific region has changed over time and how the system functions overall. These are important ingredients of climate-smart MSP promoting "Nature Inclusive Design" approaches (Tennet, 2019) and constitute a truly dynamic and adaptive strategic ocean governance framework, which will effectively contribute to enhancing sustainability and resilience of the ocean.

Hawksbill sea turtle *(Eretmochelys imbricate)* in Maldives.

4. Key recommendations for action

As a changing climate alters the conditions of our ocean and changes the distribution of marine ecosystem services and the maritime activities dependent on those services, the need for flexible, adaptive, climate-smart MSP approaches is evident. Well-organised local and regional scale planning strategies can influence global conditions and confront climate risks. The integrative ocean governance process of MSP may effectively support the '*think globally, act locally*' slogan, which is an integral part of climate action, and may function as a switchboard for mitigation, adaptation and sustainable development objectives. Recommendations to address the challenges through specific measures by key stakeholder groups including decision-makers, scientists and economic sectors linked with the MSP process include:

Knowledge generation and use

Increasing the knowledge base on the impacts of a changing climate is necessary. This includes building solid evidence on the uses most vulnerable to the effects of climate change and which are valuable for a specific region's socio-economy, and integrating their possible spatial relocation in the development of MSP scenarios. Also required is knowledge on conservation priority species and keystone ecosystem components expected to be significantly affected by a changing climate, and including them in impact analysis assessments to promote their sustainability and resilience. Increased knowledge on environmental impacts must be coupled with an understanding of the social and economic implications of climate change, particularly in communities highly dependent on marine resources for their livelihoods.

Climate literacy

Raising awareness of stakeholders on the effects of a changing climate on marine ecosystems and maritime activities may contribute to developing a better-informed participatory planning process. Additionally, fostering new behaviours and social norms in local communities can improve knowledge and skills on opportunities for sustainable mitigation and adaptation options, intensify sharing of good practice approaches and contribute to more active involvement in co-management actions.

Policy actions

Integrating strategic climate objectives into overall sustainable development and environmental policies dealing with the marine domain may be accomplished by using climate-smart, nature-inclusive MSP as a common framework for setting up meaningful and effective actions across regions. This may be facilitated through the establishment of interdisciplinary MSP networks to develop climate-smart, nature inclusive design frameworks for ocean planning. Also required are practical adaptation and mitigation strategies at appropriate scales, which may be developed by using fit-for-purpose, spatially explicit and operationally mature nature-based solutions. Strategic investments are necessary to achieve long-term visions reflected in climate-smart, nature-inclusive spatial plans.

The integrative ocean governance process of MSP may effectively support the **'think globally, act locally'** slogan, which is an integral part of climate action, and may function as a switchboard for mitigation, adaptation and sustainable development objectives.

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