PROBLUE

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INTEGRATED SEASCAPE MANAGEMENT

Knowledge Factsheet Series | #2

Climate-Informed Marine Spatial Planning

Supporting Mitigation and Resilience

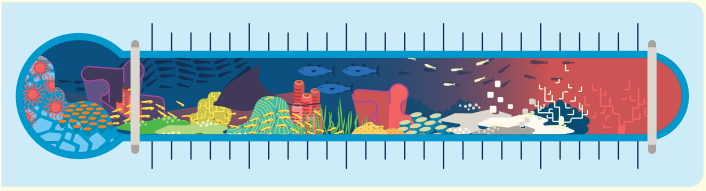
WHAT IS CLIMATE-INFORMED MSP?

Climate-informed marine spatial planning (MSP) is a participatory process that considers current and future climate risks and opportunities during design, planning, and implementation. While climate-informed MSP is key to realizing the Blue Economy, this process supports clients in meeting their national and international climate targets and enables the World Bank Group to implement its Climate Change Action Plan (CCAP). Climate considerations in MSP harness the economic opportunities of the decarbonization pathway, while responding to the growing challenges of climate change through adaptive and integrated ocean management.

Blue Economy is defined by the World Bank Group as the sustainable and integrated development of economic sectors in healthy oceans.[1]

Climate projections suggest that a warming ocean will decrease global marine biomass between

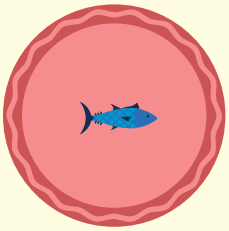
9% and 21%



and the maximum catch potential of fisheries between

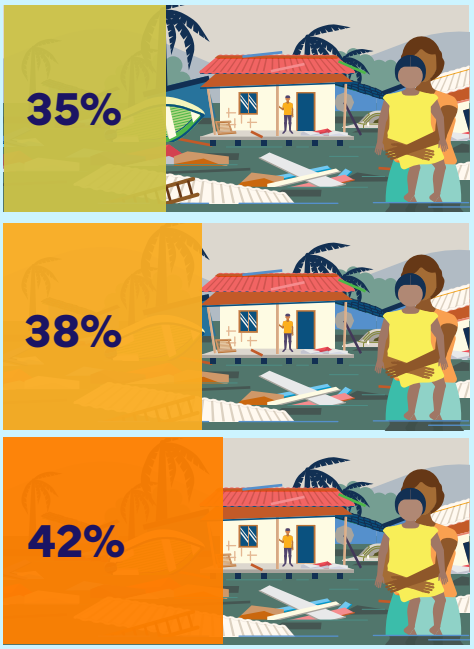
20% and 24%

by the end of the 21st century with projected declines to be highest in the tropics[2].



Over the **last three decades** an increasing percentage of hurricanes globally were rated as category

4 or 5 storms[3].

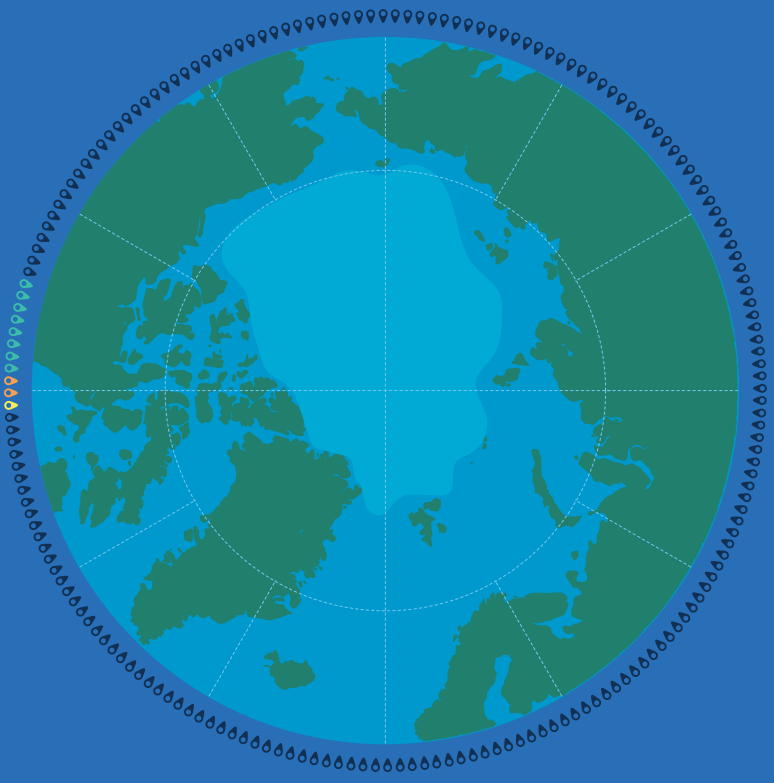


Despite the potential for the ocean to provide solutions for climate change mitigation, only:

8 of 192 countries with Nationally Determined Contributions (NDCs) include quantifiable measurements for carbon sequestration,

2 mention ocean-based renewable energy,

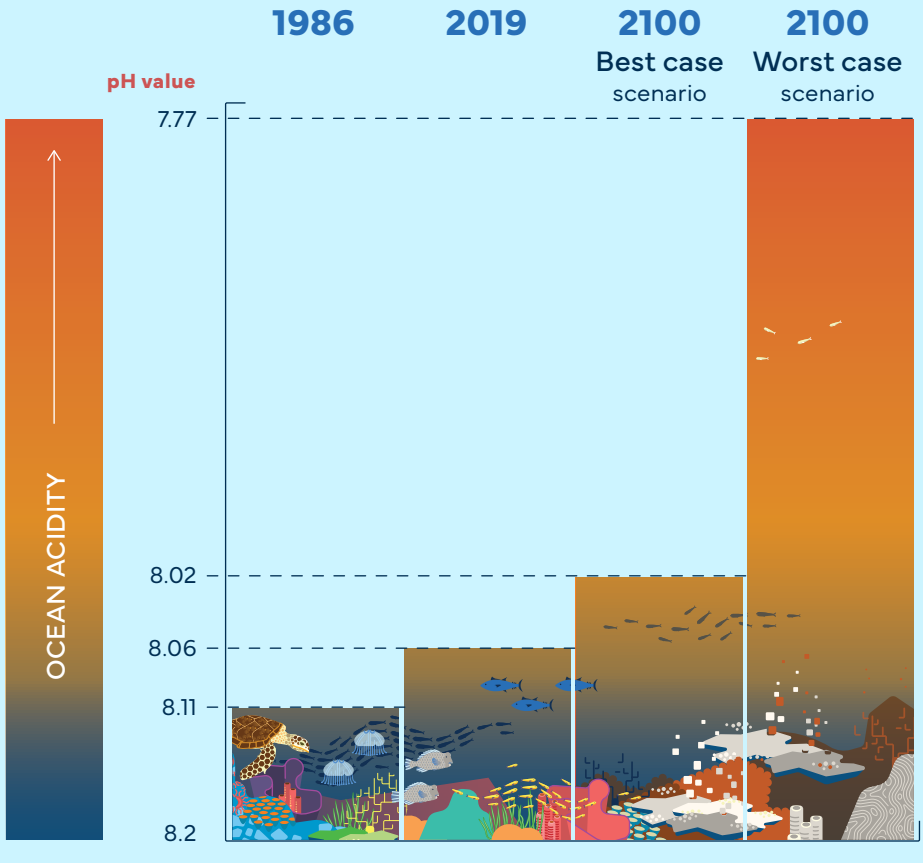
and **1** mentions sustainable shipping[4].



The shipping sector recognizes the urgency to reduce greenhouse gas (GHG) emissions while allowing time for the industry to make the needed changes for zero-carbon bunkering fuel. It recently committed to reduce emissions to 50% or more by 2050[5] through zero-carbon bunkering, thus removing 1,056 million tones[6] from its current total emissions.

From 1986 to 2018, ocean acidity increased by 30%. Climate modelling for 2100 predicts further increases in acidity, as much as 100% in the worst case scenario. More acidic waters will further weaken the shells of many organisms (e.g. oysters), slow the growth of some coral reefs and reduce the number of calcareous algae species[7]. IPCC predicts a 20%–90% loss of coastal wetlands globally by 2100, and almost all warm-water coral reefs will suffer significant losses and local extinctions due to climate impacts[2].

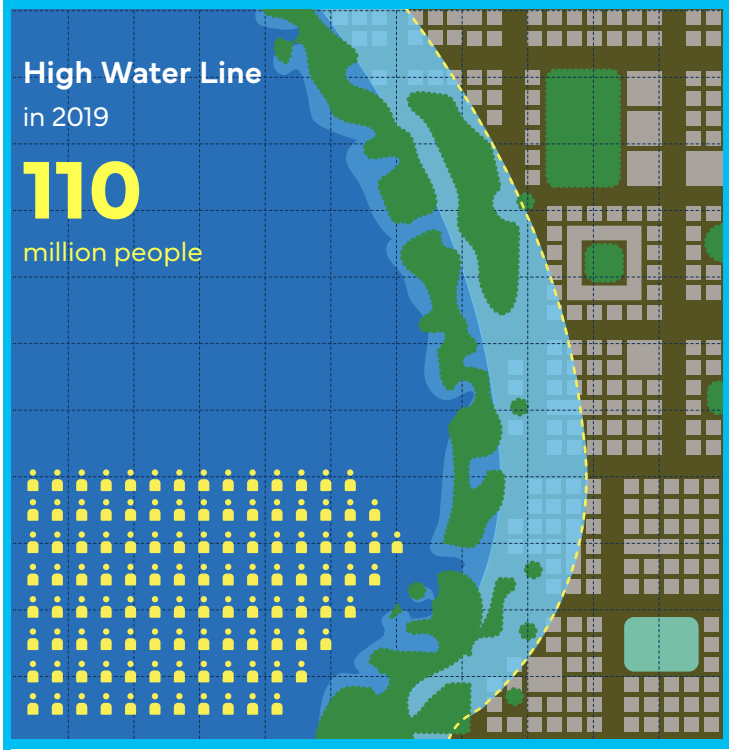
Increase in ocean acidity globally by 2100 under best and worst case IPCC scenarios

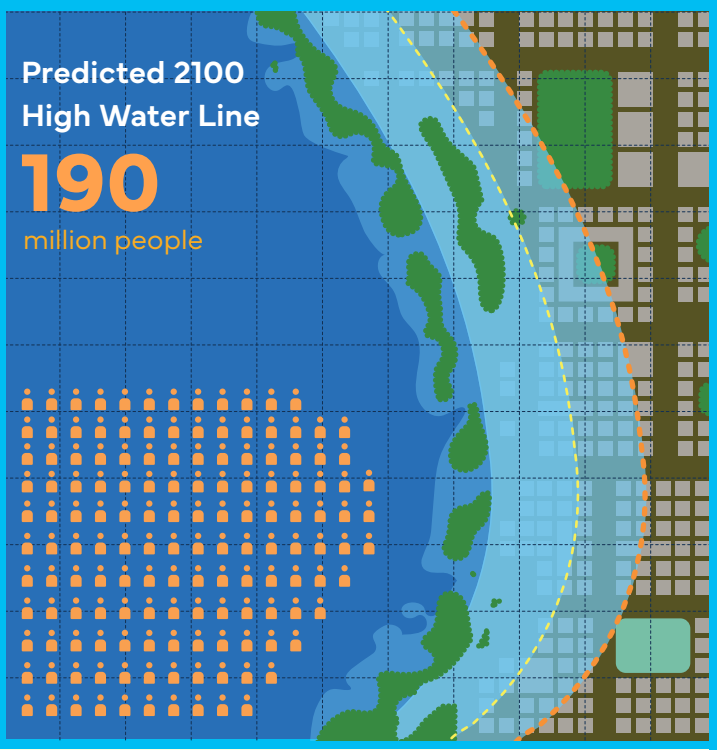


By 2100, 630 million people could be living below the current high water line[8].

Sea-level rise caused by climate change will affect millions of people, it will displace some while others will need to find strategies to adapt.

Millions of People Living Below High Water Line



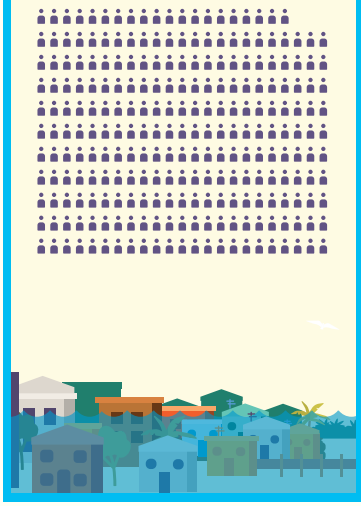


Predicted Population Impacted by Coastal Flooding in:

2019

250

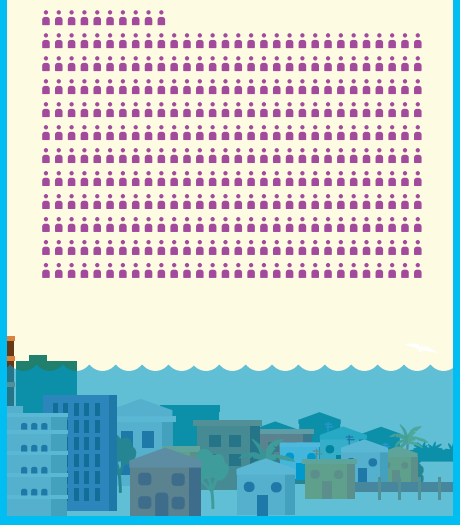
million people



2050

340

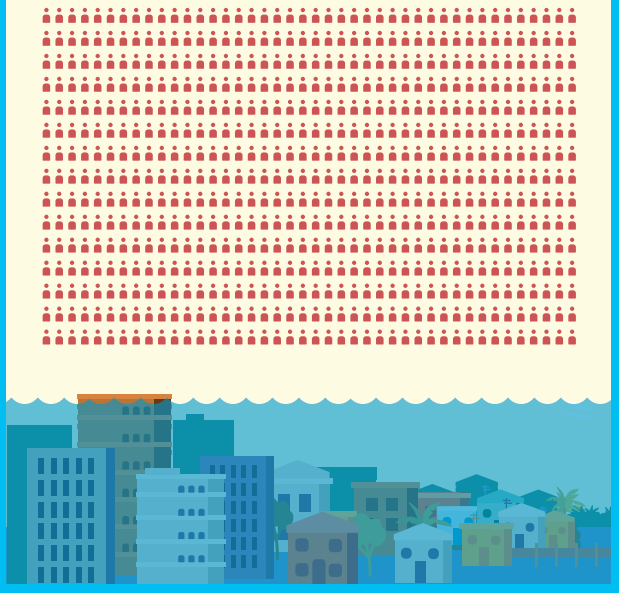
million people



2100

630

million people



KEY BENEFITS OF CLIMATE-INFORMED MSP

- **Low-carbon pathways** by allocating space and specifying uses that contribute to mitigation efforts in the different marine sectors, such as offshore renewable energy, low carbon fuel bunkering, decarbonized maritime transport and port infrastructure, carbon capture and storage, sequestration of blue carbon and limiting areas used by sectors with high greenhouse gas emissions.
- **Adaptive marine spatial plans** that prepare for and dynamically respond to changes in resource distribution and abundance, and ecosystem services resulting from climate change impacts.
- **Enhanced climate resilience** in coastal-marine areas through both nature-based solutions and other hybrid infrastructure that maintain and restore biodiversity and ecosystem services essential to protect people from coastal climate events (storms, sea-level rise, etc.).
- **Prevent loss of life and property** from coastal flooding through the establishment of early warning systems for tsunamis, tropical storms, and include coastal setbacks to protect property and communities from erosion.
- **Effective processes to explore synergies and trade-offs** between climate mitigation and adaptation measures to reduce vulnerabilities, increase resilience and to plan and implement these measures across sectors at varying geographic scales.
- **Investments that account for key climate change impacts** at the planning stage and support sectors to transition to lower carbon pathways, thus de-risking and leveraging the private sector.
- **Blue sectors addressed in NDCs.** Countries can improve their understanding and commitments to implement NDCs in blue sectors.
- **World Bank Group Climate Change Action Plan** 2021-2025 implemented.

WHO NEEDS TO BE INFORMED?

Policy Makers

Climate change considerations apply at all phases of MSP and across all sectors, therefore, discussions and collaborations among policy makers and decision makers are key to finding appropriate MSP actions to address climate impacts.

Civil Society

Climate change affects people in different ways, and they need a mechanism or tool to share concerns, experiences and solutions and to collaborate on ways to mitigate and adapt to impending climate changes. Therefore, participation of beneficiaries—mainly coastal communities—throughout the MSP process is critical[9].

Private Sector

Private sector actors have a better understanding of how climate change can impact their sector. They also need certainty to access marine resources in the face of climate change, and to take part in climate change mitigation and adaptation efforts.

KEY AREAS FOR CLIMATE-INFORMED MSP

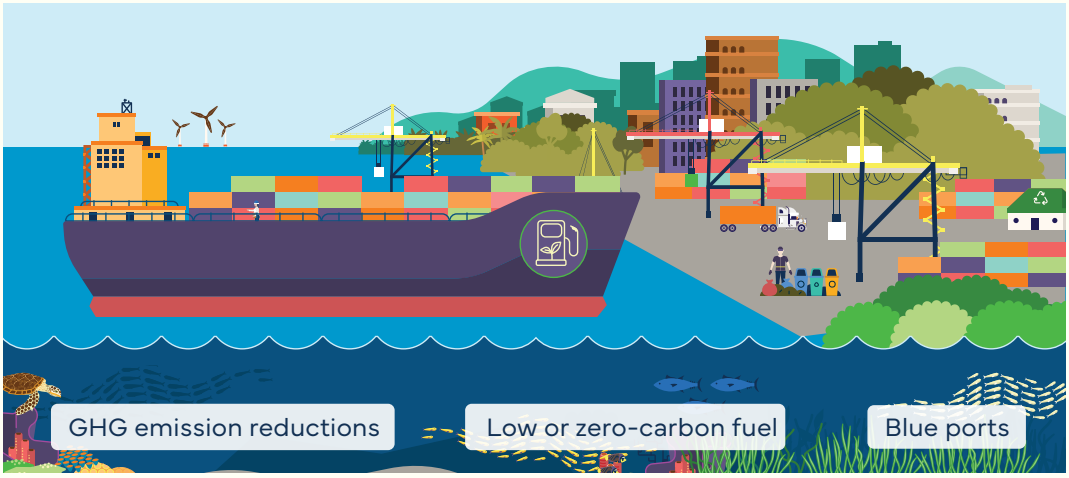
Nature-Based Solutions

Rehabilitation and restoration of healthy ecosystems and their services can return many benefits to humans and nature. Marine habitats such as seagrasses, mangroves, and benthic macroalgae play an important role in climate change mitigation, accounting for 50% of carbon buried in marine sediments[10]. Mangroves and seagrasses dissipate wave energy and trap sediments to build and maintain the seafloor and buffer the impacts of rising sea level and wave action from climate change. Healthy coral reefs can protect against climate hazards by reducing wave energy by an average of 97%[11]. Corals and other calcareous algae also provide the major building material of white sand beaches and coastal dunes, with the benefit of being the last line of protection between the sea and land. Mangroves are expected to adapt to about 7mm of annual sea level rise, but this may not be enough[12].

Establishing limits to urban sprawl and removing or relocating barriers (hard structures such as seawalls, roads, buildings) will allow ecosystems to shift inland if space is available, and therefore increase their adaptability to sea-level rise[13]. MSP can help mainstream solutions such as extending marine protected area boundaries and restoring native species. Protecting habitats against other stressors will also increase the overall health and resilience of existing coastal habitats and thus their provision of climate change benefits.

Shipping and Transportation

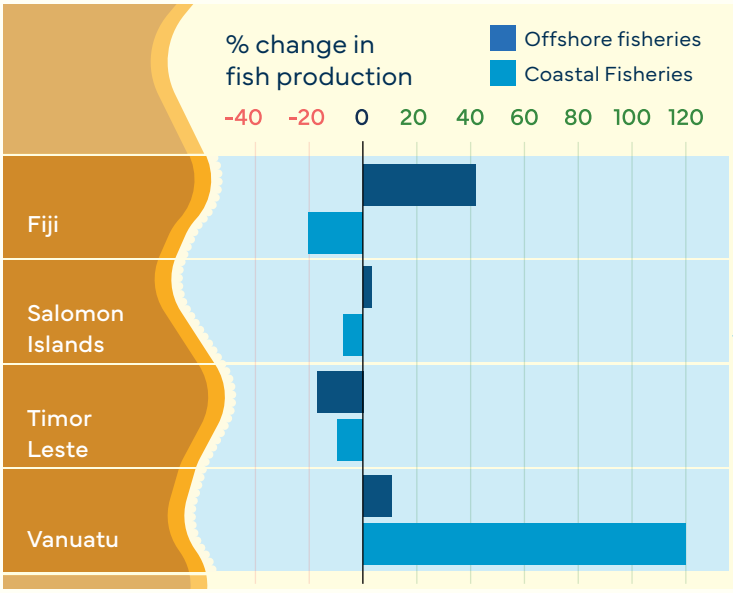
Climate focus in the shipping sector is mostly on mitigation measures to reduce ships' GHG emissions by at least 50% by 2050[6].



Blue ports are important to reaching the target since 45%-55% of the emissions occur while ships are in port[14]. Transitioning to low or zero-carbon fuel is key to achieving this target. It is also important to include fishing vessels in this transition, since MSP can support siting new bunkering facilities and shipping channels, and preventing and reducing climate, social and environmental risks. Adaptation is also important, particularly for blue ports, because of sea-level rise, flooding, wave heights and changing wind and current patterns[15]. Blue ports can contribute to mitigation and adaptation efforts by ensuring projects include GHG emission reductions, energy use and efficiencies and climate change resilience. MSP also needs to consider suitable marine areas for nature- based solutions to reduce the impacts of dredge spoils, rebuild or relocate climate-proofed blue ports and reconsider shipping channels.

Fisheries and Aquaculture

The latest IPCC report predicts climate impacts on fish production will differ regionally. Some countries will see increased fish production while others will have decreased production. The figure below shows an example of the coastal fisheries of 3 of 4 countries declining, and ocean fisheries such as tuna increasing[16,17,18]. These changes, along with changing fish distributions and migration patterns, risk food security of coastal communities that rely on coastal fisheries. Marine spatial plans can use marine protected areas, other closures and fish management measures to adapt to these impacts. Other approaches include "dynamic zoning", which facilitates changing area uses and regulations in response to resource distribution dynamics. Aquaculture's potential role to mitigate climate impacts may include bio-extraction using seaweeds. Many growing seaweeds take up carbon dioxide and nutrients from their environment, removing dissolved acid and nutrients and sequestering carbon on the sea floor[19]. MSP can allocate geographic areas for these important activities that are sited away from critical habitats, transport lanes and offshore infrastructure to avoid habitat degradation. Species diversification can contribute to reducing climate change impacts, as well as other measures such as using feed-efficient species or genetic strains that reduce GHG emissions, and tolerate a wide range of temperature and salinity levels. Adoption of climate-smart aquaculture technologies in the marine space may increase species adaptive capacity, reduce disease incidences and loss of fish through natural disasters like floods and sea-level rise. These benefits ultimately enhance community resilience.



Offshore Renewable Energy

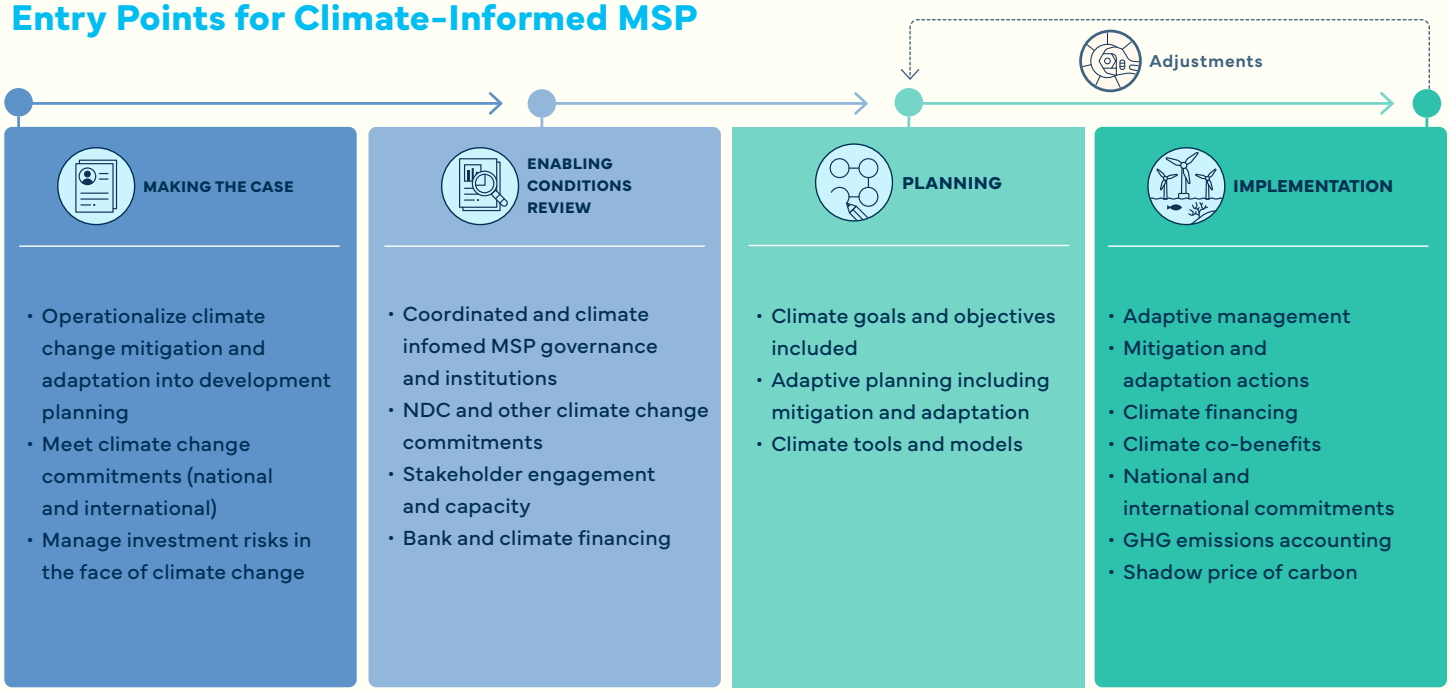
Offshore renewable energy is emerging as an environmentally and economically viable alternative to fossil fuels. It encompasses a range of technologies: offshore wind turbines, floating solar photovoltaic, and wave, tidal, salt gradient and ocean thermal conversion energy technologies.

Currently, offshore wind (34.4 GW in 2020) has considerable mitigation potential[20]. A typical 500 MW offshore wind project can reduce CO^2 emissions by 945,000 tons annually[21]. It also has a role in achieving the 1.5°C pathway by contributing to mitigating carbon emissions.

The International Renewable Energy Agency (IRENA) envisions around 2,000 GW of installed offshore wind capacity by 2050, which would avoid around 4 gigatones of CO2 per annum[22]. Realizing this offshore wind potential requires investments of USD 177 billion annually to 2050[23].

This investment will primarily be from the private sector, which requires certainty to access areas for development, preventing environmental and social risks. The MSP process can provide certainty while supporting climate mitigation. Other offshore infrastructure with significant decarbonization potential include submerged datacenters, as the ocean temperatures can be used to cool sealed units to reduce energy consumption[24].

Entry Points for Climate-Informed MSP



KEY RECOMMENDATIONS FOR CLIMATE-INFORMED MSP

The following recommendations provide guidance on strengthening the inclusion of climate change at each stage of the MSP process.

Making the Case

1) Integrate NDCs into MSP and implementation to help meet and strengthen national and international climate change commitments, and to bolster commitments in the next review of NDCs.

Enabling Conditions

2) Identify appropriate governance/regulatory frameworks dealing with climate change and marine resources (tenured and not tenured) and relevant institutions, and include them in all MSP processes.
3) Address land-ocean interactions, which interact with climate impacts, when developing marine spatial plans.
4) Build capacity to identify, collect and analyze national and local level data, and improve tools availability.

Planning

5) Use climate and disaster risk assessments to identify in advance potential areas where people, built assets, and ecosystems (and fisheries) are more vulnerable to climate impacts and for climate adaptation actions.
6) Consider how to mainstream practices such as nature-based solutions, blue ports and zoning for climate mitigation and adaptation actions
7) Include local stakeholders and communities to evaluate and validate historical climate change, current impacts, and propose climate change adaptation and mitigation actions.
8) Consider the synergistic impacts of a warming ocean, acidification and lower oxygen levels where possible.

Implementation

9) Consider potential economic opportunities arising from decarbonized blue investments, including offshore wind and as drivers of revenue through international carbon markets.

Monitoring and Evaluation

10) Include climate indicators along with tracking Climate Co-benefits, GHG Accounting and Shadow Price of Carbon during project design and monitor the indicators during implementation.

MEETING WORLD BANK GROUP'S CLIMATE CHANGE COMMITMENTS THROUGH MSP

The WBG's Second Climate Change Action Plan (2021-2025) has set a target of 35% of its financing to have climate change co-benefits over the next five years. This commitment is besides the WBG's IBRD and IDA target of 50% of financing support for adaptation and resilience activities. MSP is a process supported by Bank-financed projects, which will help client countries adapt their policies and use of marine and coastal space in a changing climate. MSP can support clients to mitigate (e.g. offshore renewable energy) and adapt (e.g. nature-based solutions) to climate impacts. MSP can also support the implementation and strengthening of NDC commitments and close the current financing gap. MSP can assist in de-risking private sector investment and making it more predictable by allocating space. Simultaneously, MSP can further enhance the value and contributions of the Blue Economy, enabling the Bank to support client countries to increase their climate co-benefits and other climate change targets.

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This publication is intended to support Bank staff and its clients involved in the MSP process.

PROBLUE is an umbrella multi-donor trust fund, administered by the World Bank, that supports the sustainable and integrated development of marine and coastal resources in healthy oceans.