



## Opportunities for increasing ocean action in climate strategies

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The global ocean is warming, acidifying and losing oxygen, and sea level is rising. As a result, keystone species and ecosystems such as warm-water coral reefs, seagrass meadows and kelp forests will face high to very high risks by the end of this century even under low carbon dioxide (CO<sub>2</sub>) emissions (IPCC, 2019). Moreover, low-lying coastal settlements will face moderate to high sea-level rise risks by the end of the century, even under full and timely implementation of the Paris Agreement, unless comprehensive and intense adaptation efforts are undertaken. This calls for a dramatic scaling up of efforts towards ambitious mitigation and adaptation.

The ocean offers opportunities to reduce the causes and consequences of climate change, globally and locally, as shown by *The Ocean Solutions Initiative*<sup>1</sup> (Gattuso *et al.*, 2018) and other recent reports (Hoegh-Guldberg *et al.*, 2019; Because the Ocean 2019<sup>2</sup>). However, countries have poorly used ocean-based measures for tackling climate change and its impacts, in their Nationally Determined Contributions (NDCs; Gallo *et al.* 2017) under the Paris Agreement. The process towards the 5-year revision of NDCs, culminating at the 26th Conference of the Parties of UNFCCC, offers an opportunity for countries to adopt more ocean-inclusive mitigation and adaptation strategies.

In this *Policy Brief* we assess 18 ocean-based measures to support climate policies and the revision of NDCs in the areas of mitigation and adaptation. Ocean-related measures should not be considered as a substitute for climate mitigation on land, which must also be strongly pursued for the benefit of the atmosphere as well as the ocean.

<sup>1</sup> <http://bit.ly/2xj3EV6>.

<sup>2</sup> Ocean For Climate: Ocean-Related Measures in Climate Strategies, 2019. <https://www.becausetheocean.org/ocean-for-climate/>

### KEY MESSAGES

The ocean is a key element of our life support system and provides many services. Ocean-based actions can maintain or increase those services despite climate change.

Ocean-related measures cover both mitigation and adaptation, and range across four clusters (Decisive, Low Regret, Unproven, Risky) that offer a policy-relevant framing for decision and action.

Advancing knowledge on ocean-based solutions is timely ahead of COP25 (known as the "Blue COP" because of its ocean focus); COP26, by which Parties are due to revise and enhance the ambition of their NDCs; and the Global Stocktake in 2023.

The next iteration towards more ambitious NDCs should scale up ocean-based climate action by prioritising Decisive (e.g. *Marine renewable energy*) and Low Regret (e.g. *Conservation and Restoration and enhancement of coastal vegetation*) measures, improving knowledge on the Unproven measures, and very cautiously weighing the Risky ones.

Decisive and Low Regret measures are both key priorities for action because (1) the full implementation of Decisive measures will not completely eliminate coastal risks and (2) the effectiveness of Low Regret measures, especially nature-based solutions, depends on the global warming level.

## 1. OCEAN COMMITMENTS UNDER THE PARIS CLIMATE AGREEMENT

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The importance of coastal and marine ecosystems as sinks and reservoirs of greenhouse gases is formally recognised by the UNFCCC, and the Preamble of the Paris Agreement explicitly mentions the need to ensure the integrity of ocean ecosystems. However, ocean-based measures for mitigation and adaptation have received relatively little attention in climate discussions.

About 70% of the 161 NDCs submitted by June 2016 included some mention of marine issues (Gallo *et al.*, 2017). However, marine issues were most frequently included as components of adaptation action or in regards to climate impacts (see Fig. SM1 in Supplementary Material). Just over a third of submitted NDCs also included ocean-related mitigation measures. These measures largely rely on blue carbon ecosystems absorbing CO<sub>2</sub> and storing carbon in sediments (i.e. mangroves, saltmarshes and seagrasses), but also through various actions to reduce greenhouse gas emissions (i.e. changes in fisheries and ecosystem management, maritime transport and ocean renewable energy production).

NDCs vary dramatically in length (from 1 to 51 pages) and there are substantial differences in the specificity of marine-focused proposals. Some NDCs simply include general mentions of coastal impacts and adaptation needs while others provide specific adaptation plans with a budget and funding mechanism. Generally, ocean-based adaptation plans are more detailed than mitigation plans.

Significant differences also exist between negotiating blocks within the UNFCCC. Annex I Parties<sup>3</sup> typically under-represent marine issues within their NDCs, whereas Small Island Developing States (SIDS) have the highest focus on marine issues. Annex I Parties have historically focused on mitigation, where there is an overall poorer representation of ocean issues, whereas SIDS have focused on climate change impacts and adaptation, including in marine ecosystems. Despite having large coastal regions and Exclusive Economic Zones, several parties (e.g. Australia, Brazil, the European Union, Micronesia, New Zealand, Norway, the Russian Federation, and the United States) did not include any explicit reference to marine ecosystems within their NDCs. However, it is important to note that because the majority of the world's population is in developing countries, the 112 countries that included the ocean in their NDCs represent 73% of the 2019 global population.

Parties may adjust NDCs at any time, but must revise and update them every five years. It is therefore both critical and timely to identify further opportunities to include ocean-related measures in the next round of NDCs in 2020, but also in National Adaptation Plans, adaptation communications, and national action plans.

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<sup>3</sup> Annex I Parties include industrialised countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition, including the Russian Federation, the Baltic States, and several Central and Eastern European States.

## 2. FOUR POLICY-RELEVANT CLUSTERS FOR OCEAN-BASED CLIMATE ACTION

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We consider 18 ocean-related measures to enhance both global mitigation and local coastal adaptation (Fig. 1). These options are clustered into four policy-relevant categories: Decisive, Low Regret,<sup>4</sup> Unproven and Risky.

*Cluster 1* – Two **Decisive** measures address the causes of climate change: *Marine renewable energy* and *Carbon Capture and Storage (CCS)*. *Marine renewable energy* has the theoretical potential to meet all global electricity requirements, although requiring further infrastructure development. Whilst some local adverse impacts are inevitable, these can be minimised. Importantly, CCS is a Decisive measure only if implemented in a way which avoids significant leakage. When ocean-based CCS is deployed for enhanced oil recovery, that application negates its climate mitigation benefits. Three societal adaptation measures can also be considered Decisive (*Infrastructure-based adaptation*, *Relocating and diversifying economic activities*, and *Relocating people*), but can also be Risky depending on the context within which they are implemented, as discussed below.

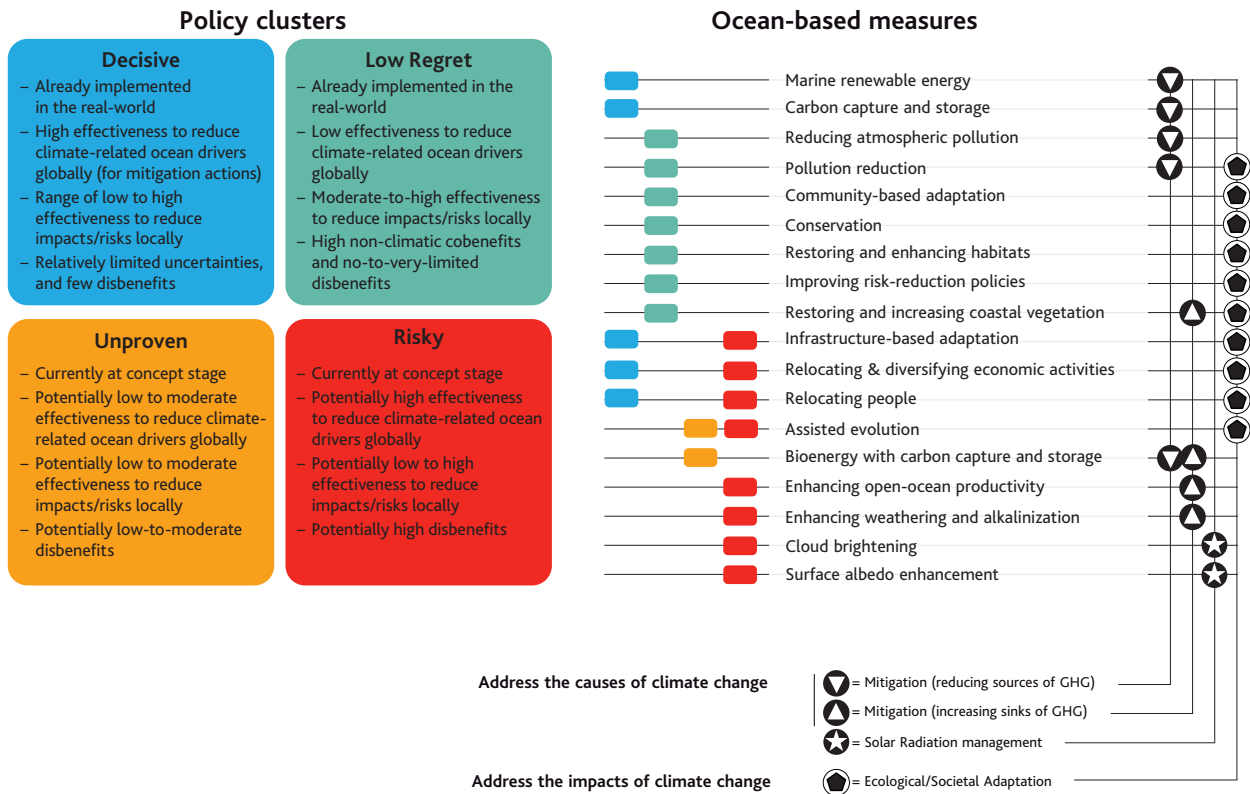
*Cluster 2* – **Low Regret** measures provide both climatic and non-climatic benefits, with few disbenefits (associated adverse impacts and other undesirable consequences, including opportunity costs). For example, *Conservation* measures can protect carbon-rich coastal ecosystems from direct human disturbance and loss, and play an important role in limiting local climate impacts. Similarly, *Restoring and enhancing coastal vegetation* supports ecological adaptation whilst providing storm protection, contributing to food security, and enhancing biodiversity. It can also increase carbon uptake, at levels that may be locally and/or nationally significant. Nevertheless, because of the limited total area for restoring such blue carbon ecosystems, this action can only make a very small contribution to climate mitigation at the global scale (IPCC, 2019). *Pollution reduction* in coastal waters removes contaminants and excess nutrients that impair ecosystem function, thereby supporting ecosystem-based adaptation. Reduced pollution from shipping can also, to a limited degree, address the causes of climate change. The societal measures *Community-based adaptation* and *Improving risk reduction policies* are also considered as Low Regret, providing self-evident benefits. However, these actions are not cost-free, requiring well-informed planning and effective coordination over a wide range of spatial and temporal scales. It is critical to note that, in many contexts, Low Regret measures will only be effective under the lowest levels of warming (IPCC, 2019).

*Cluster 3* – **Unproven** measures are illustrated by *Marine bioenergy with carbon capture and storage*, and some forms of *Assisted evolution*. The former would use macroalgae (seaweed) or cultivated microalgae as the biomass source for bioenergy. Such measures have potential but their practicality and

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<sup>4</sup> The term "low regret" is used to show that there are costs as well as benefits for these actions. However, on balance the benefits are considered greater, and therefore many of these measures could also be considered as "no regret".

**FIGURE 1.** Policy clusters of ocean-based climate action. The measures considered are modified from Gattuso *et al.* (2018) and Abram *et al.* (2019). See Supplementary Material SM2 for brief definitions.



cost-effectiveness for climatic benefits have yet to be demonstrated. *Assisted evolution* envisages alterations to species and genetics; the feasibility of such actions is uncertain, and they are also considered Risky.

*Cluster 4* – Four other actions are regarded as **Risky** measures especially based on their potentially high disbenefits: *Enhancing open-ocean productivity* through ocean fertilization;<sup>5</sup> *Enhancing weathering and alkalization*, by adding CO<sub>2</sub>-absorbing materials to the ocean; and the sunlight reflection techniques of marine *Cloud brightening* and *Surface albedo enhancement*, neither of which would ameliorate ocean acidification. Whilst all these actions have a very large theoretical potential to address climate change globally, only the first one has been tested in the field, with limited success. Risky measures may also have unintended adverse consequences and some are short-lived, implying a long-term commitment. Much more attention needs to be given to their international governance and public acceptability before they can be considered for implementation as climate policy responses.

Some societal adaptation measures cannot be classified in a single policy cluster because their effectiveness critically depends on the environmental and societal contexts of their implementation. While seawalls and other *Infrastructure-based adaptation* can protect against sea level rise in densely populated coasts, they can be counterproductive to natural environments

(e.g. sand-dune systems, mangroves and coral reefs) as they tend to undermine ecosystems' natural adjustments to ocean changes, inland migration, and future ability to provide coastal protection. In the former case, *Infrastructure-based adaptation* is Decisive while in the latter it is Risky. The benefits of *Relocating people* are also context-dependent: if planned and at a local-scale (e.g. within an island), such relocation can help save lives, and it is therefore Decisive; but if unplanned or forced, relocation can generate multiple and ramifying detrimental effects on both the displaced people and host communities, and it is therefore Risky. The same caution applies to *Relocating and diversifying economic activities*, which can either secure local jobs and economies, or generate the opposite effect.

### 3. IMPLICATIONS FOR THE NEXT GENERATION OF NDCs

Countries looking ahead to increase the ambition of their NDCs in 2020, as well as beyond, may wish to consider the above policy clustering to identify priority areas of ocean-based action, depending on their national challenges, circumstances and other policy drivers.<sup>6</sup> Every country ought to also consider

<sup>5</sup> As regulated by the London Protocol, with an amendment prohibiting such action unless constituting legitimate scientific research authorised under permit. That amendment has not yet legally entered force.

<sup>6</sup> Countries may wish to include some of these measures in their adaptation communications or in their domestic mitigation and adaptation plans instead, to allow experimentation without committing to enhancing these measures over time under their NDCs.

which elements of the ocean actions require to be supported by which type of enabling conditions, for example financial support, institutional capacity and/or social acceptability. From a political perspective, countries may also consider whether they place ocean-based measures under conditional or unconditional actions.

Given that only 19% of NDCs from coastal countries refer to coastal ecosystems for mitigation purposes (Seddon et al., 2019) there is ample room for increasing coastal and marine Low Regret nature-based mitigation solutions in future NDCs. Nature-based solutions have a relatively low mitigation potential globally but their contribution can be important nationally and provide important co-benefits such as improved water quality and increased resilience of ecosystems and communities. Furthermore, nature-based solutions will only be effective under low emission scenarios (IPCC, 2019), with global warming less than 1.5 or 2.0 °C; they are therefore no substitute for rapid, deep and global emission reductions. Another area of enhanced action relates to ocean-related measures that synergise adaptation and mitigation, e.g. *Restoring and increasing coastal vegetation*, as they are underused in current NDCs (Seddon et al., 2019).

Beside the role of ocean-based measures for climate action at large, and therefore the benefits of moving towards more ocean-inclusive NDCs, one additional benefit would be to increase the transparency, at the country level, on who is involved in writing and revising NDCs and how stakeholders are engaged in this process. Inclusion of representatives from the fisheries sector; local and global non-governmental organisations that work on marine issues; and members of the academic ocean science community in the stakeholder process would likely result in more robust representation of marine issues within NDCs. In this respect, the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) represents a critical opportunity to support multi-stakeholder climate action.

In conclusion, there is a clear need to secure robust national-to-local enabling conditions and enhanced international support for climate action at large with specific opportunities for ocean-related measures. This is important because the majority of NDCs which include ocean-related measures are conditional on external financing and support. Enhancing the enabling conditions for ocean-based climate action could be one of the priority concerns for the 'Blue COP25'. Key goals for COP25, COP26 and the subsequent Global Stocktake in 2023 could be (i) to strengthen the formal recognition of the ocean-climate nexus and the ocean as a provider of solutions for climate change, and (ii) to facilitate the Party delegations' understanding of the role of ocean-related measures and how to include them in the next generation of NDCs.

• Supplementary material is available at <http://bit.ly/2MOD2dC>

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<sup>7</sup> Additional relevant publications are available as Supplementary information (SM3).

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