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## Oceans and climate change

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- I. Background

The oceans play a vital role in the global climate system, generating oxygen and absorbing carbon dioxide from the atmosphere, while also providing essential goods and services for sustaining life on Earth. Changes to the climate, brought about by increasing levels of greenhouse gases in the atmosphere, will thus lead to changes in the oceans, including sea-level rise and ocean acidification, which will put marine ecosystems and coastal communities at risk.

The General Assembly has reiterated its serious concern over the current and projected adverse effects of climate change on the marine environment and marine biodiversity, and it has emphasized the urgency of addressing this issue (see [resolution 64/71](#), preamble). It has also expressed its concern over the current and projected adverse effects of climate change on food security and the sustainability of fisheries (see [resolution 64/72](#), preamble). More specifically, the General Assembly has reiterated its deep concern over the vulnerability of the environment and the fragile ecosystems of the polar regions, including the Arctic Ocean and the Arctic ice cap, particularly affected by the projected adverse effects of climate change (see [resolution 64/71](#), preamble). It has also expressed concern that climate change continues to increase the severity and incidence of coral bleaching throughout tropical seas, and weakens the ability of reefs to withstand ocean acidification, which could have serious and irreversible negative effects on marine organisms, particularly corals, as well as to withstand other pressures, including overfishing and pollution (see [resolution 64/71](#), preamble).

The [Ad Hoc Open-ended Informal Working Group](#), which was established by the General Assembly to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction (see [resolution 59/24](#), paragraph 73), has also expressed concerns over the impact of climate change on the oceans. In 2008, the Working Group recognized that the oceans faced numerous and diverse pressures from human activities and that there was growing evidence of the degradation of the ocean ecosystems and their biodiversity, including as a result of climate change (see [outcome](#) of the second meeting of the Working Group). The Working Group identified a number of anthropogenic impacts on marine biodiversity beyond areas of national jurisdiction requiring particular attention, including impacts of

climate change, to which developing countries, especially the least developed and small island developing States, were particularly vulnerable. In 2010, the Working Group reiterated that human pressures on the marine environment, including as a result of climate change, were increasing and impacting the long-term health, resilience and productivity of marine ecosystems and marine biodiversity (see [outcome](#) of the third meeting of the Working Group).

In regards to capacity-building, the Working Group recognized the need for increased capacity-building for developing States, and for efforts aimed at improving, inter alia, the capacity to mitigate and adapt to the impacts of a number of anthropogenic activities, including climate change, in accordance with the principle of common but differentiated responsibilities and respective capabilities, taking into account social and economic conditions and other relevant factors. It also highlighted the need for the transfer of relevant technologies (see [outcome](#) of the second meeting of the Working Group).

The international community has committed to address the challenges raised by climate change in the context of the [United Nations Framework Convention on Climate Change](#). Efforts are being made at various levels to mitigate the impact of climate change and adapt to projected climate change (see the [Gateway to the United Nations System's Work on Climate Change](#)). Recent action has also been taken by the United Nations system to coordinate action on climate change, including by developing an overview of its activities in relation to climate change and undertaking the development of an effective framework for greater coherence and coordination of the work of the system.

In regards to the oceans and seas, the legal framework for all activities relating to mitigation and adaptation is set out in the [1982 United Nations Convention on the Law of the Sea](#). The Convention provides for the long-term conservation and sustainable use of marine living resources, and establishes the fundamental obligation of all States to protect and preserve the marine environment, including the obligation to prevent, reduce and control pollution of the marine environment from or through the atmosphere.

## II. Impacts of climate change on the oceans

Recent observations indicate that the impacts of climate change on the oceans will exceed the projections of the Intergovernmental Panel on Climate Change (IPCC) in its [Fourth Assessment Report](#) of 2007. Many key climate indicators, including sea-level rise, global ocean temperature, Arctic sea ice extent and ocean acidification, are already moving beyond the patterns of natural variability within which contemporary society and economy have developed and thrived. With unabated greenhouse gas emissions, many adverse trends in climate will likely accelerate, leading to an increasing risk of abrupt or irreversible climatic shifts (see [Synthesis Report of the 2009 Climate Congress](#)).

According to recent studies, the past decade has been the warmest on record and the warmer climate has contributed to rising sea levels and sea-surface temperature. Ice cover in the Arctic Ocean has continued to decrease and 2009 marked the third smallest area of sea-ice extent. Arctic sea ice has become thinner and more prone to rapid melting, with growing proportions of one- and two-year old ice. Ocean acidification has also progressed at rates that far exceed models and projections, with impacts on shellfish and corals in the surface layer of the oceans.

The General Assembly has recognized the importance of improving understanding of the impact of climate change on the oceans. It has thus encouraged States to enhance their scientific activity to better understand the effects of climate change on the marine environment and marine biodiversity, and develop ways and means of adaptation (see [resolution 64/71](#), paragraphs 114 and 119). In particular, it has encouraged States and competent international organizations and other relevant institutions to urgently pursue further research on ocean acidification, especially programmes of observation and measurement (see [resolution 64/71](#), paragraph 113). The General Assembly has also stressed the importance of increasing the scientific understanding of the oceans-atmosphere interface, including through participation in ocean observing programmes and geographic information systems, such as the [Global Ocean Observing System](#) (see [resolution 64/71](#), paragraph 169). Ocean observation systems, comprised of satellite measurements of the ocean surface and in situ surface and sub-surface observations, play a critical role in building the knowledge-base on climate change.

The [Ad Hoc Open-ended Informal Working Group](#) has also stressed the need for further study of the connections between climate change, the increased vulnerability of marine species and ecosystems and the need for urgent action. It has recognized, however, that such studies require additional resources, both financial and technological, and entail the development of involvement by States, in particular small island developing States (see [outcome](#) of the first meeting of the Working Group, paragraphs 19, 35 and 42).

In 2009, the World Ocean Conference recognized the importance of improving understanding of the impact of climate change on the ocean and the need to consider ocean dimensions to inform adaptation and mitigation strategies. It emphasized: (a) the need for improved understanding of the role of oceans in climate change and the effects of climate change on marine and coastal ecosystems, marine biodiversity and coastal communities, especially in developing countries and small island States; (b) the need for gathering and exchange of information related to the impact of climate change on marine ecosystems, communities and fisheries and other industries; emergency preparedness; monitoring and forecasting of climate change and ocean

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variability; and measures to improve public awareness of early warning system capacity; and (c) the need to promote affordable, environmentally sound and renewable ocean technologies and know-how, particularly in developing countries (see the [Manado Ocean Declaration](#)).

For further information on the impacts of climate change on the oceans, see the following recent reports of the Secretary-General: [A/64/66/Add.2](#), paragraphs 44-47, 85-91 and 98-101, [A/64/66/Add.1](#), paragraphs 341-348, [A/63/63/Add.1](#), paragraphs 259-263, [A/63/63](#), paragraphs 354-359, [A/62/66/Add.2](#), paragraphs 57-60, [A/62/66/Add.1](#), paragraphs 225-235, and [A/62/66](#), paragraphs 326-330.

### III. Climate change and sustainable development

Climate change will have direct impacts on coastal communities that rely on the oceans for a range of goods and services, including food, income, security, cultural identity and recreation. Significant and immediate examples of such impacts include coastal erosion and loss of land and property, flooding, saltwater intrusion, shifts in the distribution and abundance of marine habitats, species and biodiversity, and the accelerated spread of invasive species. Additional consequences include coral bleaching and increased coral mortality, loss of coastal wetland ecosystems and fishing grounds, and growth in the spread of marine dead zones (see [Adapting to Coastal Climate Change](#)).

Climate change will thus likely slow progress towards sustainable development, and impede achievement of the [Millennium Development Goals](#), as well as the oceans-related goals of the [World Summit on Sustainable Development](#). In this regard, coastal communities that rely on marine and coastal ecosystems to provide essential goods and services are likely to suffer economic and development losses due to the diminished productivity of these ecosystems. These impacts will affect the livelihoods of local fisheries and food supplies for coastal communities, which will also impair the contribution of fisheries to food security and poverty alleviation.

Densely populated and low-lying coastal areas where adaptive capacity is relatively low are especially at risk, particularly in areas that already face other challenges and human-induced pressures. Small island developing States are particularly vulnerable and the existing adaptive capacity of some communities will be insufficient to respond. Some small island communities have already been displaced due to rising sea levels, and forced displacement of these populations will present significant challenges and could promote wider instability (see [Impacts of Sea Level Rise on Developing Countries](#)).

Climate change will also compound the effects of other stressors on coastal communities, including increased coastal development, pollution, overfishing and unsustainable fishing practices (see [UNEP report, In Dead](#)

[Water](#)). In regards to fisheries, climate change will represent a compounding threat to the sustainability of capture fisheries and aquaculture development (see [FAO report](#)). Although some communities and fishery management systems have already adapted to climate-driven fluctuations, in light of other pressures on natural resources and on community function, according to FAO, there are doubts that existing adaptive capacity will be sufficient to respond to additional vulnerability resulting from global climate change (see [FAO Policy Brief](#)).

Further information on the impacts of climate change on coastal communities can be found in the reports of the Secretary-General (see, for example, [A/64/66/Add.2](#), paragraphs 46-47 and 98-101, [A/64/66/Add.1](#), paragraphs 358-361, [A/63/63/Add.1](#), paragraphs 264-270, [A/63/63](#), paragraphs 355-357, and [A/62/66/Add.1](#), paragraphs 228-234). On the possible security implications of climate change, see [A/64/350](#).

#### IV. Mitigation and adaptation

Efforts are being made at various levels to mitigate the impact of climate change in the context of ocean-related activities. These efforts include the development of technical and operational measures by the [International Maritime Organization](#) to reduce greenhouse gas emissions from ships. The importance of reducing greenhouse gas emissions from ships has been reinforced by [recent evidence](#) of the impact of ship emissions on climate change. Further information on this issue can be found in recent reports of the Secretary-General (see, for example, [A/64/66/Add.2](#), paragraphs 44-47, 66-67 and 71-72, [A/64/66/Add.1](#), paragraphs 349-353, and [A/63/63/Add.1](#), paragraphs 271-277).

New and emerging activities and technologies are also being developed to mitigate the impact of climate change, including [carbon sequestration](#) and large-scale [ocean fertilization](#). These activities are being discussed in various fora, as particular concerns have been raised over activities that lack proper scientific assessment of environmental impacts and effectiveness. Further information on these issues can be found in the reports of the Secretary-General (see, for example, [A/64/66/Add.2](#), paragraphs 85-91, [A/64/66/Add.1](#), paragraphs 354-357, and [A/63/63/Add.1](#), paragraphs 278-283), the outcome of the second meeting of the Ad Hoc Open-ended Informal Working Group ([A/63/79](#), paragraph 14) and related documents (see Compilation of recent international statements, agreements and recommendations regarding ocean fertilization, IMO document [LC 30/INF.4](#) and [Add.1](#); CBD [Decision IX/16](#), the [2008 Monaco Declaration](#), and the [2008 Valencia Declaration](#). Also see [Deep-Sea Biodiversity and Ecosystems](#)).

In this regard, the oceans provide both solutions to help address climate change and opportunities for sustainable development. For example, halting the decline of oceans and coastal ecosystems, including mangroves, salt marshes

and seagrasses, which are responsible for storing up to 70 per cent of the carbon in the marine environment, will help to mitigate the impact of climate change. Adaptation strategies to enhance the resilience of these ecosystems will help generate economic revenue and improve food security and livelihoods in coastal communities (see [UNEP report, Blue Carbon](#)).

In this context, the General Assembly has urged States, either directly or through appropriate subregional, regional or global organizations or arrangements, to intensify efforts to assess and address the impacts of global climate change on the sustainability of fish stocks and the habitats that support them (see [resolution 64/72](#), paragraph 3). It has also encouraged States and relevant international institutions to improve efforts to address coral bleaching by, inter alia, improving monitoring to predict and identify bleaching events, supporting and strengthening action taken during such events and improving strategies to manage reefs to support their natural resilience and enhance their ability to withstand other pressures, including ocean acidification (see [resolution 64/71](#), paragraph 159). In addition, the General Assembly has encouraged States and competent international organizations and other relevant institutions to increase national, regional and international efforts to address levels of ocean acidity and the negative impact of such acidity on vulnerable marine ecosystems, particularly coral reefs (see [resolution 64/71](#), paragraph 113).

Coastal communities are now taking a wide range of measures to adapt to the impacts of climate change on the oceans. In this regard, the adoption of integrated conservation and management measures can help to prevent or reduce the decline or extinction of marine species. Addressing other stressors, such as overfishing and land-based pollution, will enhance the ability of marine ecosystems to adapt to climate impacts and provide lasting benefits for human welfare (for additional information, see [Adapting to Coastal Climate Change](#)).

In this context, the World Ocean Conference highlighted the need to increase the resilience of coastal and marine ecosystems and vulnerable communities. In particular, the [Manado Ocean Declaration](#) recognized the need to: achieve long-term conservation, management, and sustainable use of marine living resources and coastal habitats; establish national strategies to sustainably manage marine and coastal ecosystems and enhance their resilience; reduce marine pollution; increase understanding and information exchange on coasts, oceans and climate change, particularly in developing countries; and establish and effectively manage marine protected areas, including resilient networks.

More generally, adaptation strategies will need to improve the sharing of scientific information and knowledge on climate change, and increase capacity-building and the transfer of technology to developing States. Reducing the vulnerability of coastal communities, more generally, will enhance their ability to adapt to a range of stresses, including climate variability and extreme weather

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events. At the international level, the topic of climate change will need to be more firmly positioned in the broader sustainable development agenda and action on climate change will need to be integrated into broader development efforts and scientific research.