

# Climate Change

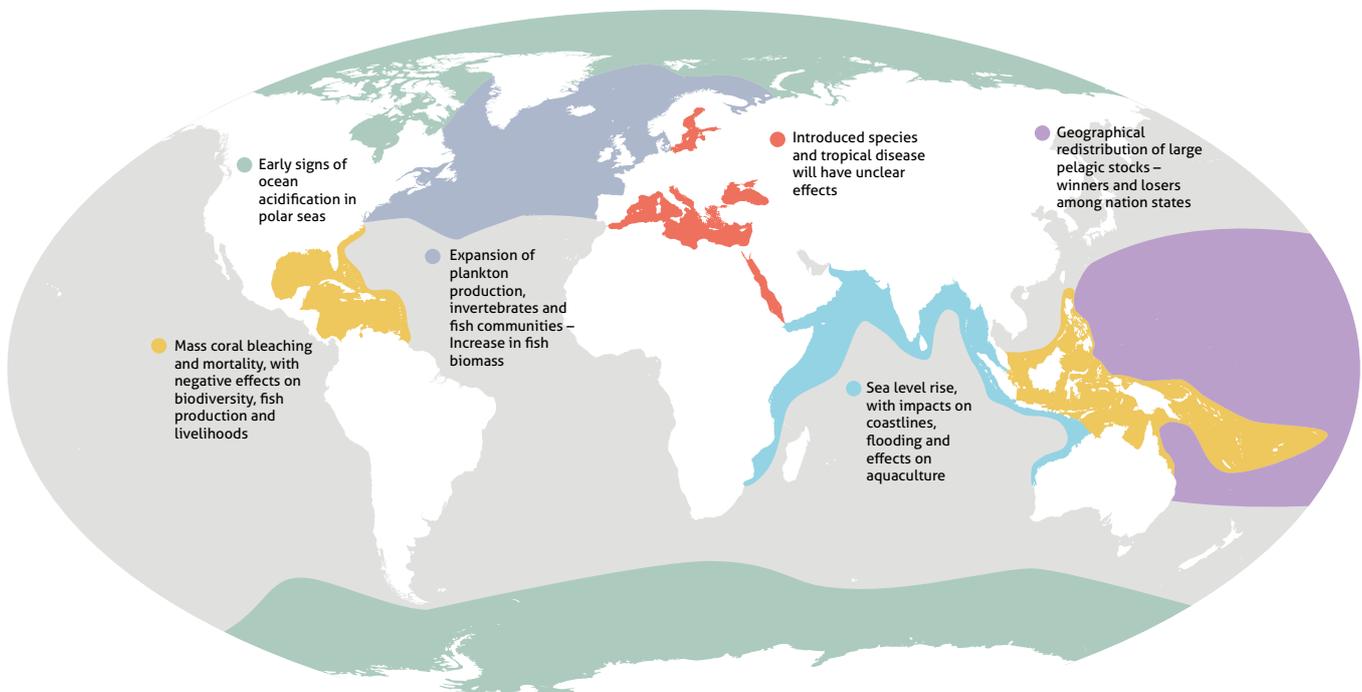
*Climate change is modifying the Earth's ecosystems and processes at an unprecedented speed and scale, with direct implications for fisheries and aquaculture production. The global seafood industry has a unique ability to adapt to such changes, but it should also play an important role in supporting strong and effective global climate policies.*

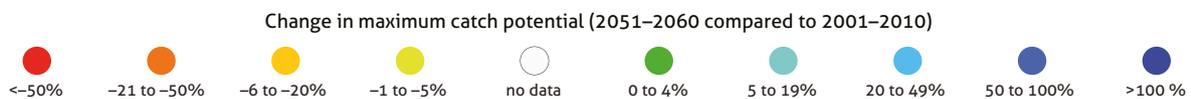
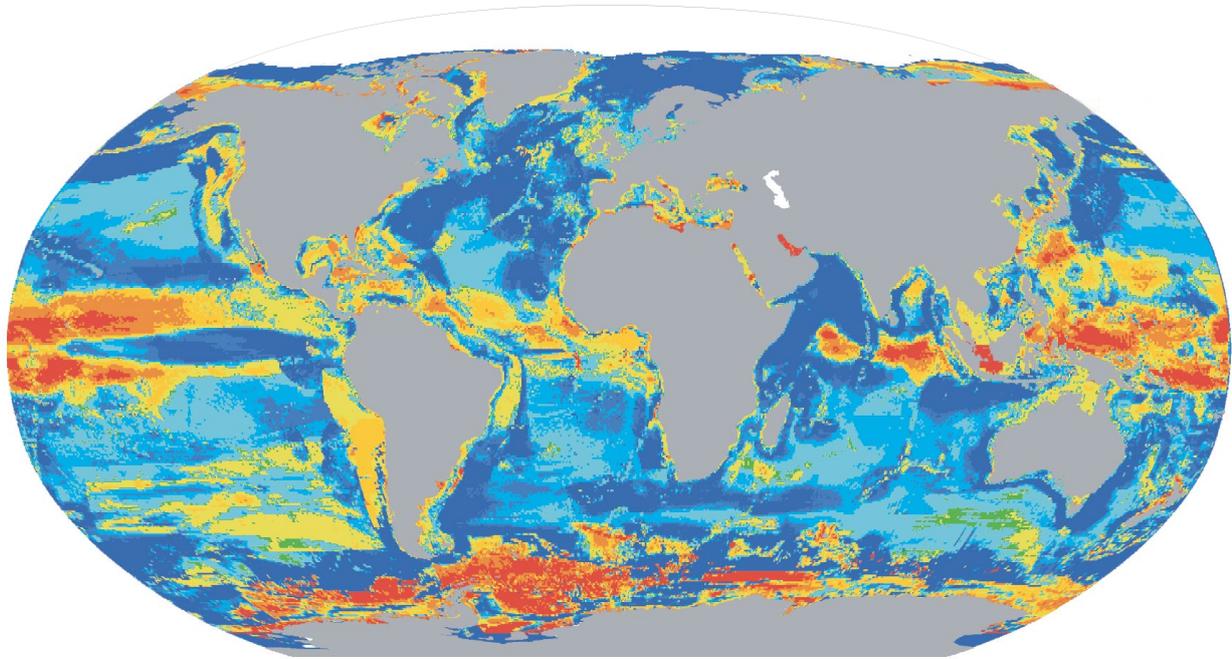
## Overview

Climate change will influence ecosystems, business opportunities and food security, in both the near and distant future. Although the exact implications are still unclear, existing scenarios underline the importance of implementing the Paris Agreement on climate change and of improved governance of seafood production. Climate change further emphasises the need to adapt and transform towards sustainability in the face of change.

## Impacts on marine ecosystems

Man-made climate change is altering the oceanographic and atmospheric conditions that regulate marine systems<sup>1</sup>. Climate change is causing a long-term rise in sea levels, melting of sea ice and modification of water temperatures. Together these changes are influencing the movement and distribution of marine animals, towards either the poles or greater depths<sup>2</sup>.





Changes in maximum catch potential of ~1000 exploited marine fish and invertebrate species under climate change scenario SRES A1B (Special Report on Emission Scenarios A1B). Modified from Cheung *et al.* 2010 [11] and IPCC 2014 [1].

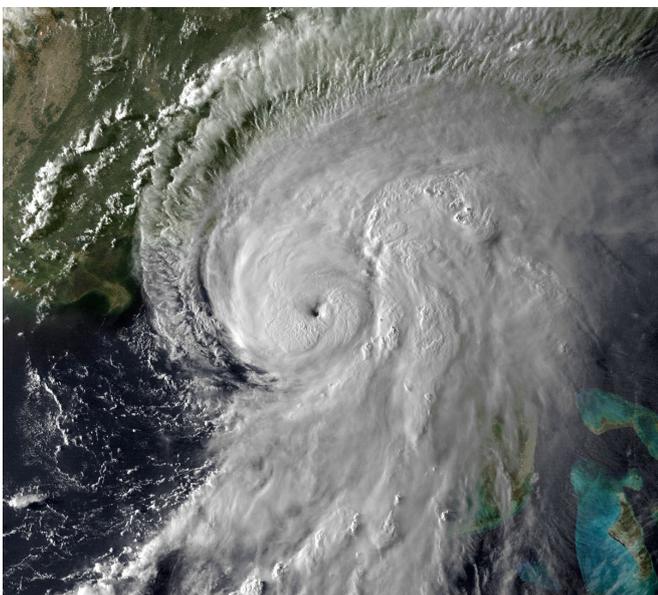
Changes in ocean chemistry, such as a decrease in oxygen levels or an increase in ocean acidity, will further influence the number of suitable habitats and have direct negative impacts on marine organisms<sup>3</sup>. Ocean acidification already affects marine seafood, in particular species that have calcareous structures directly exposed to the ocean, such as bivalves. The extent of the impacts of further reduction of ocean pH is unclear, but preliminary analysis and laboratory experiments suggest that ocean acidification represents a substantial threat to the way marine ecosystems function and thrive.

Climate change is also expected to decrease overall productivity of the oceans<sup>4</sup>, but with large regional variations. Polar regions, for instance, will be more productive due to increased primary production and longer growing seasons following the retreat of sea ice. Observations from the Barents Sea illustrate this point: changing oceanic conditions, combined with management interventions, have resulted in a major increase in abundance of Barents Sea cod<sup>5</sup>.

### Risks of tipping points

Growing understanding of the dynamics of ecosystems and species migration patterns is leading to new insights about how species may adapt to relatively small changes in environmental conditions. However, once changes exceed critical tipping points, shifts in abundance and productivity may occur abruptly. Tipping points are increasingly likely in coral reefs, but also in major ecosystems that regulate earth system processes, such as the West Antarctic Ice sheet and summer sea ice in the Arctic<sup>6,7</sup>.

Ocean warming, deoxygenation and acidification are likely to have substantial effects in tropical regions, where large-scale coral bleaching may become an annual event for most reefs<sup>8</sup>. Due to lower productivity, catches in tropical regions are predicted to decrease substantially. These changes will not only influence global fisheries, but will also impact the availability of ecosystem services of vital importance to the wellbeing of coastal communities.



Hurricane Hermine approaching Florida in September 2016. Photo: NOAA

## Sharing benefits and burdens

Climate change will lead to a redistribution of resources, often from a developing South to a developed North, with substantial implications for poor developing countries. There are important implications, too, for the production portfolios and strategies of seafood companies that operate globally. A new study estimates that climate change could lead to losses of revenues for the global fishing industry totalling US\$10 billion annually by 2050<sup>9</sup>. Similarly, ocean acidification is expected to impact shellfish production with considerable costs<sup>10</sup>.

Projected long-term change in average conditions (temperature, sea ice extent, pH and oxygen levels) underlines the importance of strategic planning. Alongside this, the predicted increase in frequency and intensity of extreme events (El Niño, hurricanes, floods) emphasises the importance of building resilience to cope with sudden shocks and disturbances.

## The necessity of transformative change

There is now a very clear sign of the growing effects of global warming and the likely major implications for societies and business opportunities around the world. Only a drastic and rapid reduction of anthropogenic CO<sub>2</sub> emissions will enable the oceans to maintain their essential economic and nutritional contributions.

The goal of the United Nations Framework Convention for Climate Change (UNFCCC) is to prevent “dangerous anthropogenic interference with the climate system”. The Paris Agreement aims to substantially reduce the risk of catastrophic tipping points in individual ecosystems, some of which are critical for the functioning of the Earth system. Moving beyond a 2°C temperature increase would generate serious risk of collapsing systems, with catastrophic effects on coastal cities, island nations and global food supply<sup>7</sup>.

Meeting the Paris Agreement requires global and transformative change. Climate scientists argue that the power to enable such change may lie within a small group of particularly powerful nations. Change is already happening with China taking substantial steps towards closing coal mines, India investing in renewables, and the divestment movement changing the incentives for companies<sup>7</sup>.

Transnational corporations directly dependent upon the dynamics of marine ecosystems are important stakeholders in the endeavour to enable transformative change. Their lobbying and engagement with governments is critical to ensure that they can deliver on their commitments.



Ships travelling through ice in the Arctic. Photo: NOAA/CC BY 2.0



Bleached corals on Indonesian reef. Photo: B Christensen/Azote

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