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The effects of climate change on seafloor ecosystems

Ocean warming driven by climate change will reduce the amount of food reaching marine life on the seafloor, a recent study suggests. This would result in a 5.2% global reduction in seafloor biomass by the end of the 21st century and biodiversity hotspots, such as cold-water coral reefs, will be particularly badly affected, say the researchers.

The open ocean harbours a vast array of biodiversity. One especially sensitive habitat is the deep seafloor, where organisms rely mainly on decaying organic material for food, such as the remains of plants and animals living in the upper layers of the oceans.

Climate change is expected to warm the ocean surface, reducing the amount of nutrients that rise up from below. This affects the growth of phytoplankton, microscopic plants that form the basis of the marine food web. In turn, there is less organic material to sink down to seafloor communities. This can affect deep-sea ecosystems' composition, how they function and the valuable services they provide, such as deep-water fishing.

This study was the first to assess the impact of climate change on the total global biomass of organisms living on the deep seafloor. The researchers used a range of atmospheric ocean climate models to determine changes in food supply reaching the deep-sea floor during the 21st century and established relationships between food supply and biomass using a global marine life database.

The results show that as a result of reduced food supply, global seafloor biomass will decline by 5.2%, with the loss of marine life weighing more than every person on the planet, say the researchers. In addition to smaller populations, individuals will also be affected; because larger creatures need more energy, seafloor animals will tend to become smaller as food becomes less available. Those living in the deepest waters, in the abyssal (greater than 3 000 metres deep) and hadal zones (greater than 6 000 metres) will be most affected.

The model predictions show that the Atlantic, Pacific and Indian Oceans will see significant losses of biomass and the northeast Atlantic Ocean in particular will experience large decreases. In fact, on the large Porcupine Abyssal Plain in the northeast Atlantic, biomass could decrease by as much as 38%. In the Southern and Arctic Oceans of the polar regions, seafloor biomass is expected to increase; however, this will not be sufficient to counter-balance the negative effects felt elsewhere.

The researchers also found that over 80% of deep-sea biodiversity hotspots, such as cold-water coral reefs and underwater mountains and canyons, could experience significant declines in biomass. For example, cold-water coral reefs could suffer biomass losses of more than 8% with the effects causing long-term damage, particularly when combined with the impacts of projected ocean acidification, and canyons could lose more than 5% of their current biomass. This could affect deep-sea fishing, for example, on the major fishing grounds along the underwater mountains of the North Atlantic and South Pacific Oceans.

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Contact:
dj1@noc.ac.uk

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