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Climate Change impacts on Antarctic marine ecosystems and implications for management

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A synopsis of the physical changes in the Southern Ocean to date are presented along with predicted and projected trends across global climate-ocean models from 1950-2010 and 1950-2100 at the ocean surface and seabed. Effects on ocean biogeochemistry, including impacts on patterns of primary production, nutrient cycling and carbon sequestration are also reviewed and contrasted at regional to local scales. The effects of different aspects of climate change (e.g. sea ice extent, wind strength, temperature rise, ocean freshening, oxygen concentration) are assessed for pelagic and benthic organisms in deep, shallow and coastal ecosystems. Contrasts in the likelihood of impacts and their severity, the product of which is a measure of risk, are found between widely distributed species in the Antarctic versus those that are range restricted. Contrasts are also found in the risks to marine communities in western versus eastern Antarctica. Habitat compression is likely for many species, including the key organisms Antarctic krill and salps, which demonstrate an overlap in realised habitat. The outcome of competitive interactions between these species are likely to reflect differences in the environment as well as aspects of their life history. Antarctic predators are showing population increases or declines reflecting a combination of current climate change effects, impacts of past hunting and other anthropogenic stressors, including bycatch outside of the Southern Ocean and pollution. The implications of climate-related impacts on the Antarctic marine fauna for the management of living resources and species and communities of conservation value are considered. Important knowledge gaps in our understanding of Antarctic climate change effects on Southern Ocean marine ecosystems are identified. Areas of science that will enable a better understanding of responses of these ecosystems to environmental change are also resolved. Further work is planned through small working groups in collaboration with wider efforts such as MEASO.