



Icebergs with adélie penguins on top flow near Antarctic peninsula. ©Jo Crebbin/Shutterstock

Climate Change and Southern Ocean Resilience

REPORT FROM AN INTERDISCIPLINARY SCIENTIFIC WORKSHOP

Introduction and Executive Summary for Policymakers

I. INTRODUCTION BY EVAN T. BLOOM¹

As the world prepares for the Glasgow Climate Change Conference in November 2021, there is considerable focus on the Southern Ocean. The international community has come to realize that the polar regions hold many of the keys to unlocking our understanding of climate-related phenomena - and thus polar science will influence policy decisions on which our collective futures depend.

Global sea-level rise is linked to future melting of

the Antarctic ice sheets and shelves. New research on the Antarctic Ice Sheet indicates that rapid sea-level rise from Antarctica will be triggered if Paris Agreement targets (2°C warming in the twenty-first century) are exceeded. A recent article notes that, if current emissions rates continue and put the world on course towards 3°C warming, this tipping point will be reached by 2060, and no human intervention, including geoengineering, would be able to stop 17 to 21 centimeters (cm) of sea-level rise from Antarctic ice melt alone by 2100².

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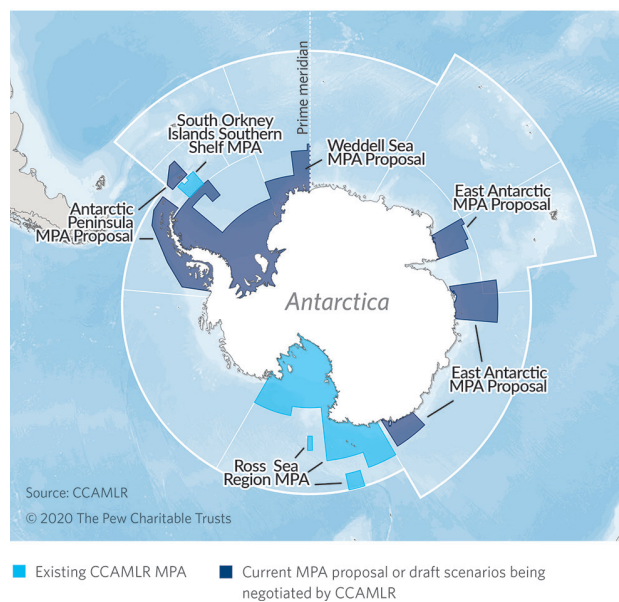
Antarctica's main diplomatic fora, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the Antarctic Treaty Consultative Meeting (ATCM), have both had climate change on their respective agendas for years and have taken substantial actions to boost Southern Ocean resilience, such as designating the Ross Sea region Marine Protected Area. Even so, the level of attention on the issue of climate change is increasing. On March 30, 2021, the Wilson Center's Polar Institute and the Pew Charitable Trusts brought together leading scientists for virtual discussions about the relationship between climate change and the Southern Ocean. The scientists were asked to discuss why policymakers should care about the Southern Ocean, considering two questions: what are the discrete management actions that CCAMLR can take in the next four-to-eight years to address climate impacts in the Southern Ocean? And how does what is happening in the Southern Ocean – both in terms of climate impacts and management action – affect broader global climate, human, and ecological systems?

The report below provides a number of responses to these important questions and makes a compelling case for the parties at both CCAMLR and the ATCM to incorporate climate considerations into their work.

It is clear that Marine Protected Areas (MPAs) can play an important role in climate policy, and CCAMLR is already committed to establishing a representative system of MPAs, with three major proposals before the Commission requiring final negotiation. Given its size and the relative lack of human activity there, the Southern Ocean is a favorable location for establishing large-scale MPAs. In turn, MPAs generate benefits for fisheries and biodiversity by protecting key habitats, while delivering significant climate resilience gains. MPAs can also serve as climate reference areas; the relatively undisturbed Southern Ocean provides a natural laboratory for studying complex ecosystem responses to climate change impacts, such as

Fig. 1: Southern Ocean regions proposed for protection

A network of MPAs would allow for conservation of distinct areas, each representing unique ecosystems



warming and acidification, and how to best manage the ocean for climate mitigation, adaptation, and conservation potential. The Ross Sea region MPA, for example, holds the potential to promote climate science by allowing scientists to assess climate impacts on fished, unfished and, in some cases, more lightly fished areas.

CCAMLR and its Scientific Committee also need to prioritize the wider integration of climate into management and decision-making; the previously proposed Climate Change Response Work Program lays out many of these opportunities to boost Southern Ocean resilience. Similarly, the ATCM and Committee for Environmental Protection within the Antarctic Treaty System should strengthen efforts to integrate climate considerations into their work. All these organizations pride themselves on acting on the basis of best available science, and that science has to take into account climate considerations.

I trust that the Members of CCAMLR and the Antarctic Treaty Consultative Parties will find this report helpful in their coming deliberations.

II. EXECUTIVE SUMMARY

**Andrea Capurro, Florence Colleoni,
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The Antarctic has long been seen as an untouchable wilderness where few venture beyond scientists at remote research bases, scattered fishing vessels, and a limited number of well-heeled tourists. Yet shifts in Antarctic processes, driven by human-caused climate change, are impacting wider earth systems, with profound implications for human and ecological communities far from the icy continent. The Wilson Center's Polar Institute and The Pew Charitable Trusts co-convened an *ad hoc* Expert Working Group of leading Antarctic scientists globally³ to discuss climate-driven changes to the Southern Ocean around Antarctica. Key considerations were how these changes impact global marine, climate, and human systems, and how management actions taken through the Antarctic Treaty System, in particular CCAMLR, can build resilience to these changes in the Southern Ocean.

3. Participants of the workshop held on March 30, 2021 included, inter alia: Viviana Alder; Andrea Capurro; Rachel Cavanagh; Florence Colleoni; Sylvia Earle; Alexey Ekaykin; Susie Grant; Eileen Hofmann; Bettina Meyer; Jessica O'Reilly; Evgeny Pakhomov; Jean-Baptiste Sallée; Mercedes Santos; Fokje Schaafsma; and Bert Wouters.

The Expert Working Group identified key interconnected Southern Ocean processes that are being impacted by climate change, and which will cumulatively result in widespread changes well beyond the Antarctic region. Five of these were highlighted as priority topics for conservation and management: shifts in sea ice and ice sheet dynamics; changes in ocean chemistry; increases in ocean temperatures; changes to the biological carbon pump; and alterations to ecosystems and species. The report details how some of these processes are moving towards tipping points - critical thresholds to irreversible, rapid, and substantial change - that can have devastating impacts on regional ecosystems and on far-flung human communities. In addressing these challenges, the Expert Working Group considered how CCAMLR could take concrete climate change-related actions by 2030, including expanding habitat protections, re-evaluating existing fisheries management, leveraging precautionary and ecosystem-based management approaches, and adopting a comprehensive work plan that considers climate change effects in all its conservation measures.

As Southern Ocean dynamics play a major role in global climate regulation and broader marine ecosystems, collective action to protect and enhance its resilience to climate change can benefit societies and economies around the world. Building this



Chinstrap penguins in Antarctica. Penguin population structures are shifting as prey species, ice regimes, and weather patterns shift in the Southern Ocean. © SZakharov/Shutterstock

resilience requires additional actions, beyond CCAMLR, that recognize mandates and interconnections within and between regions. Importantly, these actions by the international community must include immediate and significant cuts to greenhouse gas emissions across sectors and geographies to avoid tipping points to physical processes in the Antarctic, as well as the wider suite of dire impacts predicted under future emissions scenarios.

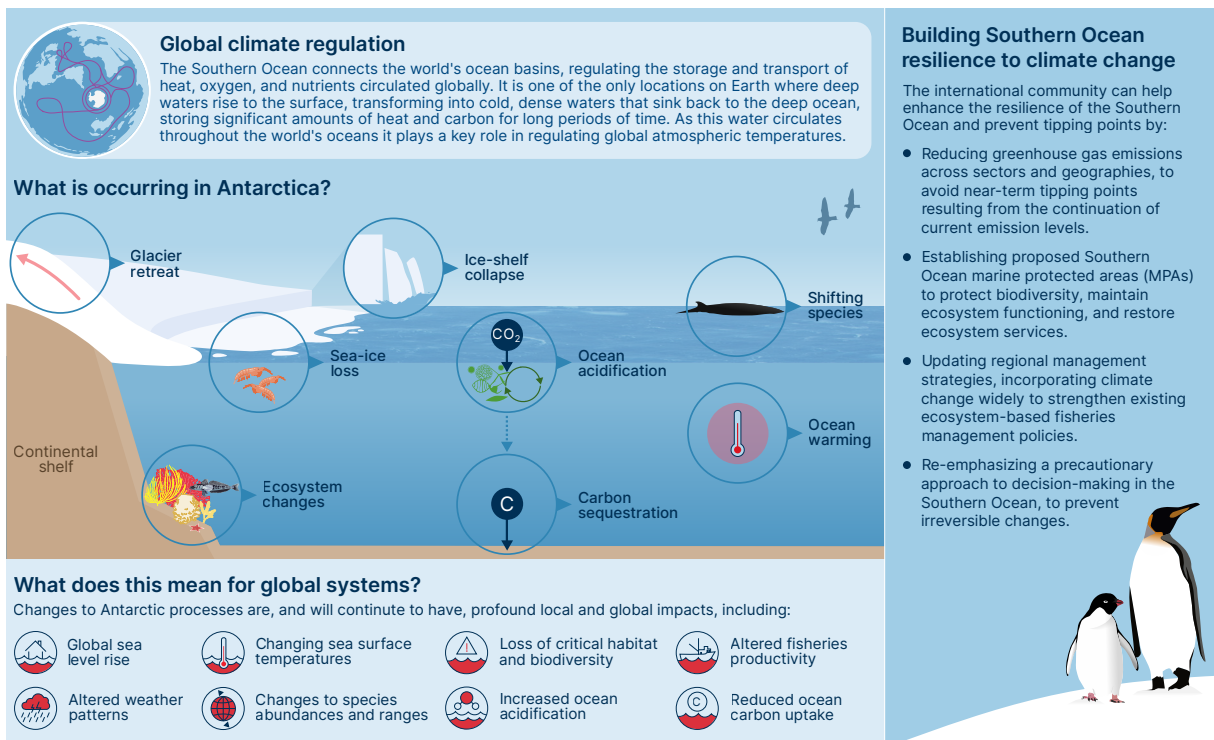
The early success of the Antarctic Treaty led to it being seen as a global model for multilateral regional governance, as countries came together to manage the Antarctic for peace and science and the framework became a platform to launch robust scientific partnerships. CCAMLR, in particular, has an important role in the conservation of Southern

Ocean marine life and in leading research that underpins decision making. As climate change effects challenge the Antarctic Treaty System, and nations cope with a dizzying array of global-level crises, stronger collaborations and coordinated work are needed within the Antarctic realm.

This Expert Working Group has demonstrated the value of these international idea exchanges to help expand our understanding of the importance of research and governance in this remote, yet vital, region. By drawing greater awareness to climate impacts within the Southern Ocean and highlighting its connection to global systems, this report can help policymakers elevate the governance dialogue around Antarctica and the Southern Ocean and bring the challenges of this distant region closer to home.

Fig.2 Climate Change and Southern Ocean Resilience

Global human-caused climate pressures are rapidly changing Antarctic processes, with profound implications for human and ecological systems around the world. Of particular concern is evidence which suggests the approach of imminent **tipping points**, which may set in motion irreversible, rapid, and substantial change to Antarctica's biogeochemical cycles and its role in regulating global climate.



Graphical summary illustrating climate change impacts on the Southern Ocean and global systems, and the key requirements for building resilience in the Southern Ocean. Source: Visual Knowledge, www.visualknowledge.design



Lead Author: Andrea Capurro





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