

PROTECTING A CHANGING SOUTHERN OCEAN

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ABSTRACT

Antarctica remains one of Earth's most pristine regions, yet growing scientific evidence indicates a paradigm shift in its oceanic and atmospheric conditions. The resilience of the Southern Ocean, once considered robust against global climate pressures, is weakening. This article examines the urgent need for enhanced protection through the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the establishment of a representative system of marine protected areas (MPAs). Drawing from recent assessments, including the 2023 Marine Ecosystem Assessment for the Southern Ocean (MEASO), this analysis highlights the accelerating environmental changes, governance challenges, and the need to move protection of Antarctica in line with other international frameworks, such as the Convention on Biological Diversity's 30x30 target. Recommendations are presented to reiterate CCAMLR's conservation mandate through the immediate implementation of pending MPA proposals, development of a Domain 9 MPA, and refining nationally determined MPAs in the Southern Ocean to mitigate against climate change.

KEYWORDS

Southern Ocean, CCAMLR, marine protected areas, climate change, Antarctic governance.

INTRODUCTION

Antarctica resides in the global imagination as a realm of unparalleled beauty and one of the last bastions of environmental purity. However, emerging research signals a paradigm shift in Antarctica’s oceanic and atmospheric systems: the continent’s long-standing resilience in the face of climate change is showing signs of decline. Once perceived as remote and unchangeable, the Antarctic is now increasingly recognized as a frontline region for global climate disruption (Constable et al., 2023). The management of fishing activities and the protection of the Southern Ocean fall under the remit of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Founded in 1982 under the Antarctic Treaty System (ATS), CCAMLR’s central tenet is the application of an ecosystem-based precautionary approach to fisheries management and the conservation of Antarctic marine living resources. This approach recognizes that exploitation should not proceed without sufficient scientific understanding of its potential ecological consequences.

In 2009, CCAMLR committed to establishing a representative system of marine protected areas (MPAs) by 2012. Yet more than a decade later, progress remains stalled. Urgent implementation of these MPAs is now critical, as scientific evidence demonstrates escalating changes affecting the Southern Ocean, ranging from sea ice loss to ecosystem shifts impacting krill, penguins, and whales (Siegert et al., 2023).

Time is not on the side of the Southern Ocean. As the ecological transformations accelerate, CCAMLR must act as the guardian of Antarctic marine life it was designed to be. The Antarctic and Southern Ocean Coalition (ASOC) therefore calls upon CCAMLR Members to act collaboratively for the collective benefit of the Antarctic and uphold the precautionary principle that is central to the Convention.

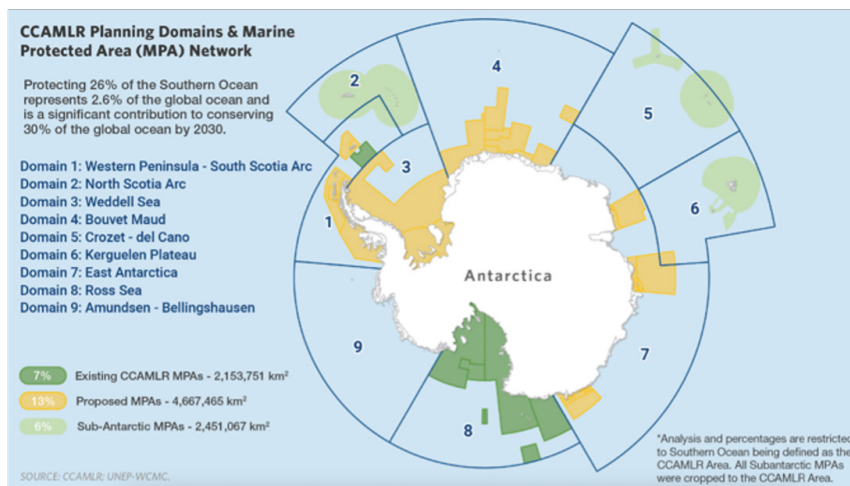


Figure 1. Proposed and implemented protected areas in the Southern Ocean. Credit: Michael Wissner, The Pew Charitable Trusts.

THREATS TO THE SOUTHERN OCEAN

The Southern Ocean is a reservoir of biodiversity, supporting complex food webs from phytoplankton to apex predators. Yet, it also carries a history of intense exploitation. The first major threat emerged when seal hunting began around 1790, rapidly decimating populations of species such as the Antarctic fur seal (*Arctocephalus gazella*).

Throughout the 19th and 20th centuries, extraction expanded to include whales and fish. Distant-water trawlers from multiple nations dismantled marine ecosystems, driving species such as marbled rockcod (*Notothenia rossii*) to near collapse, with populations that have yet to recover fully. This historical depletion created a legacy of ecological imbalance that continues to shape the region’s resilience today (Brooks et al., 2020).

In recent decades, the dominant threats have shifted from overfishing to anthropogenic climate change. The Marine Ecosystem Assessment for the Southern Ocean (MEASO) underscores that “substantial ecosystem changes are occurring now and could occur in the future over periods of only a few years or decades as a result of rapid environmental shifts, extreme events, or the crossing of system thresholds to alternative states” (Constable et al., 2023).

These “thresholds” reflect tipping points that, once crossed, can irreversibly alter ecosystem structure and function. Extreme events such as marine heatwaves, ice shelf collapse, and unprecedented temperature anomalies are now increasing in frequency. For example, the Antarctic continent recently experienced temperature deviations more than 30°C above seasonal norms, a phenomenon unmatched elsewhere on Earth (Siegert et al., 2023).

These climatic disruptions interact with human activities such as industrial krill fishing and expanding tourism. Fishing pressure can undermine krill availability for predators like penguins and seals, while tourism growth introduces invasive species and pollution risks. Collectively, these pressures compound the ecological stressors driven by global warming and ocean acidification.

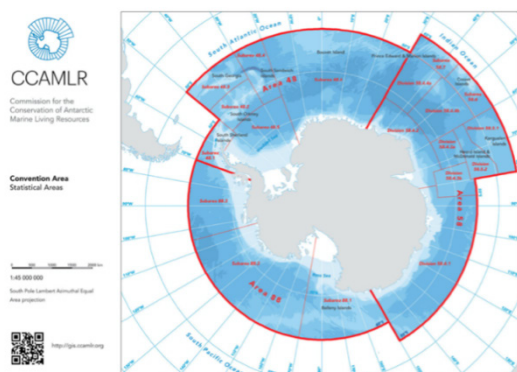


Figure 2. A figure showing CCAMLR’s management boundary. Source: CCAMLR 2024a.

THE ROLE AND MANDATE OF CCAMLR

The Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention) was established as part of the Antarctic Treaty System to address growing concerns over unregulated exploitation, especially the expansion of the krill fishery in the late 1970s (Trathan, 2023). CCAMLR, the Commission established to implement the Convention, was conceived not merely as a fisheries management body, but as a pioneering approach to ecosystem-based governance.

Article II of the CAMLR Convention unambiguously defines conservation as its paramount objective, explicitly requiring that rational use not compromise ecosystem integrity. This legal framing distinguishes CCAMLR from most regional fisheries management organizations (RFMOs), which typically balance conservation with exploitation objectives.

Despite this ambitious design, CCAMLR's consensus-based decision-making process, once lauded as a model of Cold War-era cooperation, has become a double-edged sword. While consensus fosters inclusivity, it also allows any Member to veto progress. This procedural rigidity has repeatedly hindered adoption of new MPAs, particularly since 2016 (Miller & Slicer, 2014).

MARINE PROTECTED AREAS: CONCEPT AND BENEFITS

Marine protected areas (MPAs) are foundational instruments for marine biodiversity conservation. They vary in design and management purposes, but their core purpose is to safeguard ecosystem processes, preserve species habitats, and enhance resilience to disturbance.

Scientific research consistently demonstrates that large, well-designed MPAs with strict protection, particularly no-take zones, produce substantial ecological benefits. These include increases in biomass, species diversity, and genetic variation, which in turn bolster ecosystem resilience against climate-induced shocks (Chavez-Molina et al., 2023).

Moreover, MPAs generate spillover effects, whereby populations within protected zones replenish adjacent fished areas. This phenomenon illustrates that conservation and rationale use can be complementary rather than mutually exclusive (Ashford et al., 2022).

CURRENT CCAMLR NEGOTIATIONS ON MARINE PROTECTED AREAS (2012–2024)

CCAMLR's deliberations on MPAs span more than a decade. In 2009, CCAMLR formally endorsed the development of a representative system of MPAs and agreed to a framework for establishment (CM 91-04) in 2011. Early successes included the 2009 South Orkney Islands MPA, the world's first high seas MPA, and the 2016 Ross Sea Region MPA. However, since 2016, the Commission has failed to agree on any new designations, despite strong scientific consensus supporting additional MPAs in East Antarctica, the Weddell Sea, and the Antarctic Peninsula (Domain 1).

Between 2017 and 2022, successive CCAMLR meetings reaffirmed support for these proposals but failed to reach consensus. Political divisions, primarily between conservation-oriented and resource-extraction-oriented Members, have repeatedly impeded progress (Brooks et al., 2020; Pew Charitable Trusts, 2023). The Scientific Committee (SC-CAMLR) consistently validated the science underpinning the proposals, yet the Commission's requirement for unanimity has proven a formidable procedural obstacle.

The 2023 annual meeting (CCAMLR-42) again placed MPA establishment at the top of the agenda (ASOC, 2023a). Discussions focused on refining the East Antarctica (EAMPA), Weddell Sea (WSMPA Phase 1), and Domain 1 (D1MPA) proposals. Although Members acknowledged the urgent need for action in the face of accelerating climate impacts, negotiations concluded without agreement. Several Members cited geopolitical tensions and differing views on zoning and fishery access as reasons for deferral (ASOC, 2023b).

In 2024, a mid-year symposium co-convened by the United States and the Republic of Korea sought to harmonize the Domain 1 MPA's boundaries with updated krill fishing management strategies. Despite productive exchanges, the October 2024 Hobart meeting once again ended without MPA designation (ASOC, 2024). Moreover, the Commission failed to renew Conservation Measure 51-07, a protective measure that distributed krill catch to prevent local depletion, raising further concerns about ecosystem resilience.

Observers noted that while scientific data are ample, with the Domain 1 MPA proposal including 150 data layers, political inertia persists. To many stakeholders, the inability to advance MPA designations, despite compelling evidence, represents a crisis of credibility for CCAMLR's precautionary mandate.

ANTARCTICA AND THE GLOBAL 30X30 FRAMEWORK

Recent international commitments have reinvigorated global attention to marine conservation. In December 2022, the Convention on Biological Diversity (CBD) adopted the Kunming-Montreal Global Biodiversity Framework (GBF), pledging to protect 30% of Earth's land and ocean areas by 2030.

Given that the Southern Ocean constitutes roughly 10% of the global ocean, CCAMLR's progress, or lack thereof, will substantially determine the feasibility of achieving the 30x30 target. The Southern Ocean's ecological significance extends far beyond its boundaries; it regulates global carbon cycles, drives thermohaline circulation, and supports migratory species that connect hemispheres.

CCAMLR's leadership in implementing MPAs represents not only a regional obligation, but also a global responsibility. The Antarctic region's inclusion within the 30x30 vision would symbolize multilateral environmental cooperation at its most ambitious scale (Chavez-Molina et al., 2023).

A NETWORK OF MPAS IN THE SOUTHERN OCEAN

Despite the recent stalemate, CCAMLR has a history of conservation milestones. The adoption of the South Orkney Islands Southern Shelf MPA in 2009 and the Ross Sea Region MPA in 2016 established precedents for high-seas protection under multilateral governance. However, only 13% of the Southern Ocean is currently designated as MPAs, and a mere 5% falls under strict no-take status (Brooks et al., 2020).

Four large MPA proposals remain pending, each scientifically vetted, with two gaining endorsement from the Scientific Committee to CCAMLR (SC-CAMLR):

- Domain 1 MPA (460,000 km²): Encompasses critical habitats for emperor penguins and foraging areas for humpback whales. It also protects nursery and early life stage zones for krill, a keystone species (proposed 2017).
- East Antarctica MPA (970,000 km²): Hosts extensive vulnerable marine ecosystem (VME) indicator species such as sponges and cold-water corals (proposed 2012).
- Weddell Sea MPA Phase 1 (2.2 million km²): Supports a third of known emperor penguins, half the world's Antarctic petrels, and benthic ecosystems comparable in complexity to tropical coral reefs (proposed 2018).
- Weddell Sea MPA Phase 2 (780,000 km²): Covers biologically significant areas like the Maude Rise, among the planet's most pristine environments (proposed 2023).

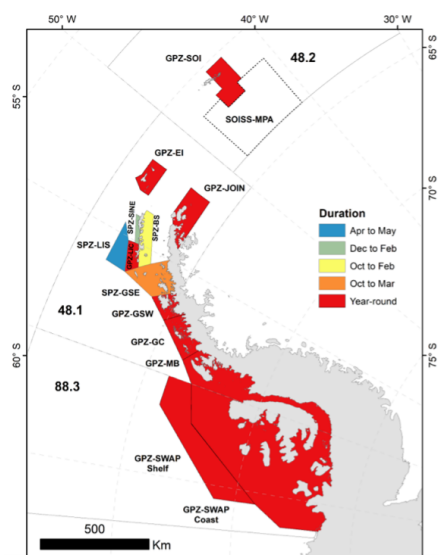


Figure 3. *The Domain 1 MPA: General protection zones and seasonal protection zones with colors representing the periods of closure. Source CCAMLR 2024b*

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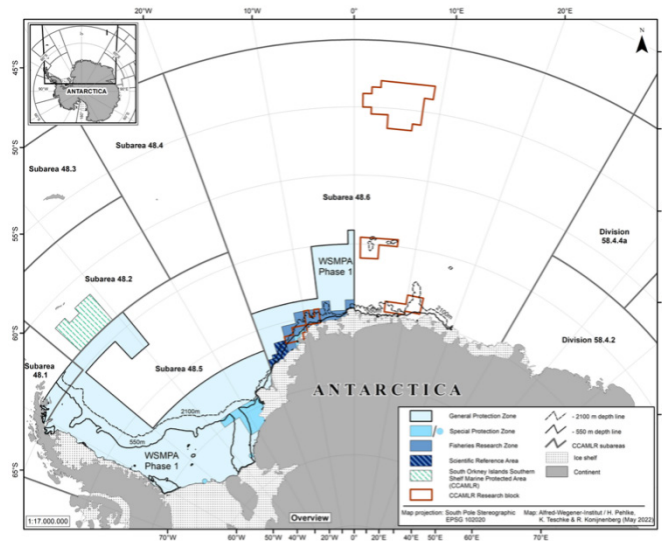


Figure 4. Proposed Weddell Sea MPA (WSMPA) Phase 1 (in blue). Source: Alfred Wegener Institute Weddell Sea MPA proposal status 2023.

Each of these proposals represents years of cooperative scientific effort and negotiation. Their adoption would advance CCAMLR toward a truly representative MPA network, aligning its mandate with the CBD's 30x30 framework and the broader objectives of the United Nations Decade of Ocean Science. When adopted, combined with existing protections, 26% of the Southern Ocean and 2.6% of the global ocean would be protected, a critical step towards 30x30 ambition.

DOMAIN 9: THE MISSING LINK

Among CCAMLR's planning domains, Domain 9, the Amundsen-Bellinghousen Sea, is the least studied and most neglected in terms of proposed protection. The absence of an MPA proposal in this region leaves a significant gap in CCAMLR's commitment to representativeness.

Scientific studies have identified Domain 9 as home to productive polynyas, cold-water corals, seamounts, and hydrothermal vents, particularly near Peter I Island (Adams et al., 2021). Establishing an MPA here would complete the geographic coverage envisaged under CCAMLR's 2011 framework and protect one of the last intact marine ecosystems on Earth.

NATIONALLY DETERMINED MPAS

The Southern Ocean has a number of notable islands outside of Antarctica's immediate vicinity and beyond CCAMLR jurisdiction, albeit still part of the Southern Ocean because they are shaped

by the Antarctic Circumpolar Current (ACC). These sub-Antarctic islands - which are overseas territories administered by Australia, France, Norway, South Africa, and the United Kingdom - host extraordinary biodiversity, including millions of penguins, vast seal colonies, and migratory seabirds (Brooks et al., 2019). It is important to note, however, that CCAMLR does not recognize territorial claims and some Members formally dispute such claims.

Currently, seven MPAs exist in the Southern Ocean, five of them surrounding these sub-Antarctic islands are nationally determined. Collectively, they account for nearly half of all MPA coverage in the region. It is apparent then that the contribution of individual Members towards the protection of the Southern Ocean has and will continue to be crucial in light of a changing climate. The enhanced protection around sub-Antarctic islands also serves to highlight the inadequacy of CCAMLR's own efforts to implement protective measures, and represents a gap that must urgently be closed.

Expanding and enhancing the protection of sub-Antarctic islands is essential for building climate resilience. As environmental shifts intensify, national MPA reviews must consider dynamic management approaches—adjusting boundaries and enhancing protection in response to changing conditions (ASOC, 2023c).

RECOMMENDATIONS

CCAMLR was once heralded as a model of multilateral conservation, yet its credibility now depends on renewed action. Implementing a representative network of MPAs across the Southern Ocean would restore confidence in its governance and signal that Antarctic protection remains a global priority.

-Recommendation I: Implement Pending MPA Proposals

The Antarctic Peninsula (Domain 1), Weddell Sea Phase 1, East Antarctica, and Weddell Sea Phase 2 MPA proposals are based on robust science and are ready for adoption, pending the political will. ASOC calls on all Members to uphold the precautionary principle, follow the advice of best available science and adopt these proposals without further delay.

-Recommendation II: Develop a Domain 9 MPA

CCAMLR must begin formal consideration of a Domain 9 MPA to close the gap in the commitment to a representative network of MPAs. Although CCAMLR has yet to begin the formal process of developing a Domain 9 MPA proposal, a suite of information is already available from scientific surveys and from members of the science community who have researched the region and whose findings should be utilized.

-Recommendation III: Review Nationally Determined MPAs for Climate Resilience

Given the pace of ecological change, ASOC recommends systematic review of all nationally determined MPAs to ensure they remain effective under new environmental conditions. Specific

recommendations include:

- Australia: to further expand the marine reserve boundaries within the Heard and McDonald Islands Exclusive Economic Zone (EEZ), ahead of its statutory review in 2034, to incorporate key areas such as undersea canyons, biodiverse seamounts and the Williams Ridge.
- Norway: to immediately expand the reserve around Bouvet Island to 200 nm and in doing so create an International Union for Conservation of Nature (IUCN) Category 1 MPA to protect key oceanographic features and the local ecosystem.
- South Africa: to review the Prince Edward Islands MPA and implement enhanced conservation measures. In its current design only 5.5% of the EEZ prohibits all human activity, with key sites such as seamounts falling outside of highly protected areas.
- France: to revisit its marine spatial planning for Crozet Islands, which remains largely open to human activities, such as fishing, to ensure France commits to safeguarding 30% of its marine environment in the Terres Australes et Antarctiques Françaises (TAAF) region through protected areas by 2030.
- South Georgia and South Sandwich Islands (UK): to continue the formal MPA review every five years, or more frequently if data is suggesting urgent action is needed.

Together, these actions would lay the foundation for an adaptive, climate-resilient conservation network in the Southern Ocean, bringing the world a critical step closer to achieving global ocean conservation goals.

CONCLUSIONS

The fate of the Southern Ocean reflects the broader crossroads facing global environmental governance. CCAMLR's ability, or failure, to act will determine whether the region remains a sanctuary for biodiversity or becomes another casualty of political paralysis.

By fulfilling its commitments—adopting pending MPAs, developing a Domain 9 MPA proposal, and ensuring adaptive management—CCAMLR can reclaim its leading role in international conservation. Protecting the Southern Ocean is not only vital for Antarctic species and ecosystems, but also for maintaining planetary stability. The time for action is now.

ACKNOWLEDGEMENTS

The author thanks the Antarctic and Southern Ocean Coalition (ASOC) for its continued leadership on Antarctic conservation and acknowledges contributions from the Pew Charitable Trusts, the Scientific Committee on Antarctic Research (SCAR), and partner institutions whose data and cartographic resources informed this analysis.

Financial support for this report comes from the Blue Nature Alliance. This global partnership aims to safeguard global ocean biodiversity, build resilience to climate change, promote human wellbeing,

and enhance ecosystem connectivity and function.

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