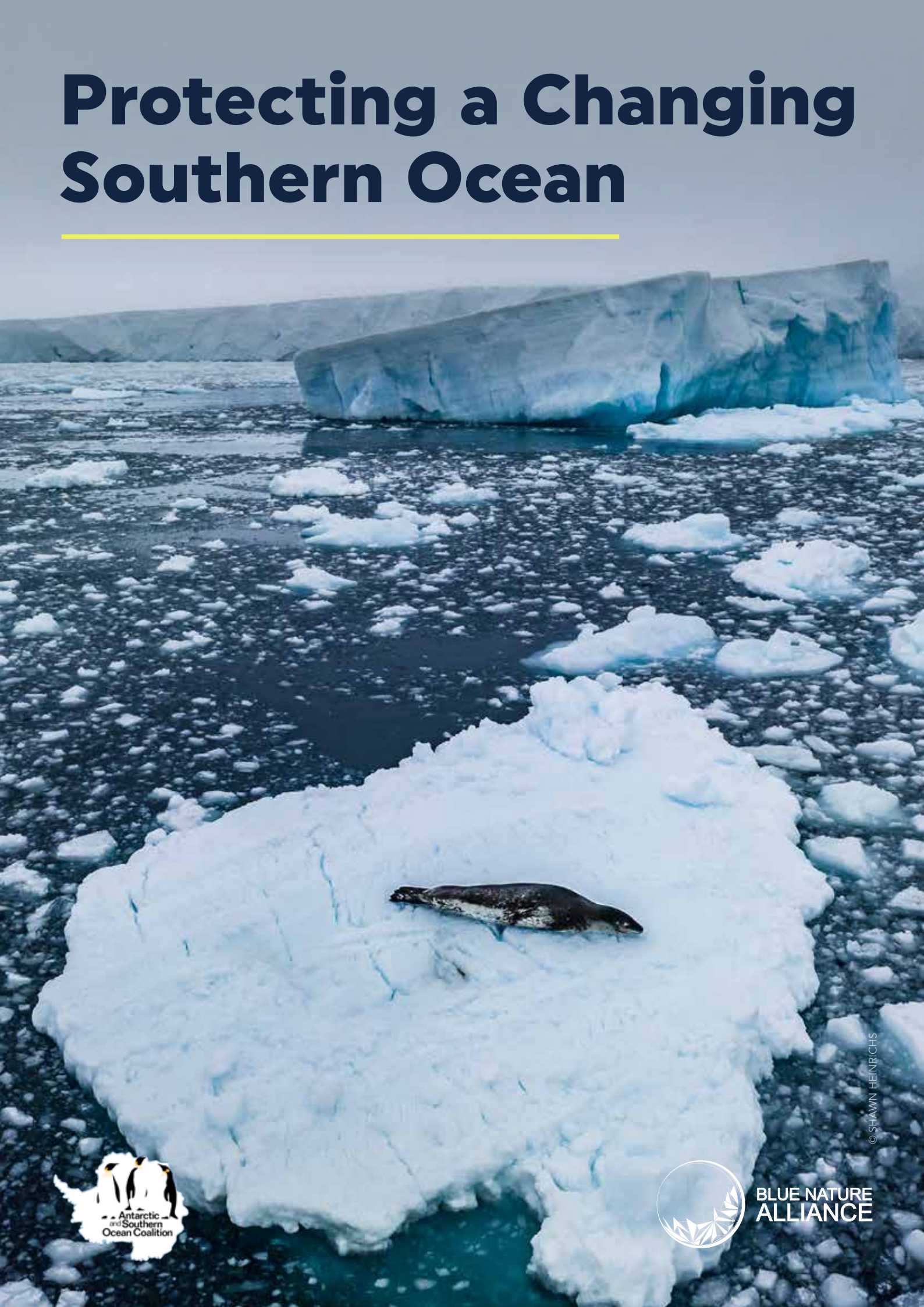
Protecting a Changing Southern Ocean



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Antarctic and Southern Ocean Coalition

BLUE NATURE ALLIANCE

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The Antarctic and Southern Ocean Coalition is an international coalition of organizations working to ensure the preservation of the Antarctic and the great Southern Ocean.

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The Blue Nature Alliance is a global initiative that is accelerating the pace, scale, and effectiveness of large-scale ocean conservation through partnership.

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EXECUTIVE SUMMARY

Antarctica resides in the mind as a place of unparalleled beauty and remains one of the most pristine locations on Earth. However, research is beginning to indicate a paradigm shift in Antarctica's oceanic and atmospheric condition: its long trend of resilience in the face of a changing global climate is beginning to wane.

The Southern Ocean is currently undergoing some of the most rapid responses to climate change on the planet. Coupled with increased human activity, this is likely to create a compounded stressor environment and lead to further complications for Antarctic ecosystem processes.

Fortunately, the foundations to safeguard Antarctica's marine environment, while simultaneously enabling present activity to continue, already exist.

Antarctica and the surrounding Southern Ocean are governed by the Antarctic Treaty System, which includes the Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention) that entered into force in 1982. The CAMLR Convention established an international organization, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), whose Members agreed by consensus in 2009 to create a representative system of marine protected areas (MPAs) in the Southern Ocean.

Well-designed MPAs that have strong levels of protection, and that encompass all trophic levels of an ecosystem, have been shown to increase species biomass and genetic diversity and create a spillover effect that produces benefits for adjacent areas.

Today, there is significant global momentum towards safeguarding the marine environment. In 2022, the United Nations Convention on Biological Diversity's (CBD) Kunming-Montreal Global Biodiversity Framework (GBF) was adopted, committing almost 200 nations to protect 30% of the planet by 2030 (the 30x30 target).

With the Southern Ocean constituting approximately 10% of the global ocean, the achievement of the 30x30 target is inextricably bound to progress that falls directly under the mandate of CCAMLR.

This report highlights that most Members of CCAMLR are signatories to the GBF, which means the clear majority of CCAMLR have agreed to deliver meaningful conservation by establishing protected areas. The Antarctic and Southern Ocean Coalition (ASOC) encourages CCAMLR to return to its original purpose as an organization that manages the Southern Ocean in accordance with Article II of the CAMLR Convention and to lead global efforts towards achieving 30x30.

Four proposals for large-scale MPAs in the Southern Ocean have already been presented to CCAMLR. Their adoption is critical to 30x30 ambition. Should the proposals be adopted, nearly 3% of the global ocean would come under the protection of CCAMLR. This is an opportunity for CCAMLR to return as a conservation leader and create an outstanding global legacy.

ASOC urges CCAMLR Members to adopt these four MPAs, alongside the development of an additional Domain 9 MPA, and in so doing establish the system of MPAs that it promised in 2009.

Furthermore, the report recommends that CCAMLR Members with direct responsibility for areas of the Southern Ocean that fall within their respective Exclusive Economic Zones (EEZs) review their established MPAs and marine reserves and expand protection according to the latest scientific information.

Time is not on the side of the Southern Ocean. It is vital that CCAMLR acts as the guardian of Antarctic marine life that it was created to be. ASOC urges CCAMLR Members to act collaboratively for the benefit of the Antarctic and adhere to the precautionary principle that is central to CCAMLR's mandate.

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1 Introduction

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Antarctica is a continent without comparison, a place that has largely avoided the disasters that humanity has caused throughout the rest of the world. But, as greenhouse gas emissions continue to rise, even the most isolated and distant continent is beginning to show the impacts of our actions.

The Southern Ocean is disproportionately important to our planet as the conduit linking the Atlantic, Pacific and Indian Oceans in the global ocean circulation system. This contiguous link between the world's largest oceans enables the Southern Ocean to disperse nutrients and oxygen across the global ocean, and to host an abundance of endemic, resident and migratory species. Antarctica is bursting with life, but much of it is unseen and most of it either lives in the marine environment or depends on it for existence. Moreover, as the region directly influences global atmospheric systems, there is no part of Earth's surface that is not affected by influences originating south of the Antarctic polar convergence.

Antarctica's rich biodiversity is inextricably linked to its extreme seasonal cycle and associated unique polar environment. Annual variances in sunlight and sea ice extent couple with the influences of the Antarctic Circumpolar Current (ACC) to establish a harsh yet unique ecosystem (Hawkins et al., 2018; Chapman et al., 2020). In an era when many of the world's large populations of birds and mammals are decreasing,

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Antarctica remains home to penguin colonies that number in the millions, crabeater seals estimated to be the second most populous mammal on Earth, and multiple cetacean species that have been rapidly recovering since the cessation of hunting activity (Dragon et al., 2011).

While Antarctica is still one of the most pristine locations on the planet, it is increasingly threatened by rising anthropogenic stressors. The region also has a history of overexploitation. Decades of whaling, sealing and overfishing decimated populations and led to the local extinction of species at sites across the Southern Ocean. Not until the establishment of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) were these trends towards depletion finally halted. Fishing was brought under international management, although illegal, unreported and unregulated (IUU) fishing continues to be a threat.

However, concerns have grown in recent years as research indicates a shift in Antarctica's oceanic and atmospheric condition (Yang et al., 2024). The lowest sea ice extents on record were reported in 2022 and 2023, destabilizing the Antarctic ecosystem and impacting many species still on a long road to recovery following overexploitation.

The Antarctic is currently undergoing some of the most rapid responses to climate change on the planet, with the impact of the climate crisis on Antarctica comprehensively summarized by the Scientific Committee on Antarctic Research (SCAR) in its 2022 report Antarctic Climate Change and the Environment: A Decadal Synopsis and Recommendations for Action.

The continued loss of sea ice and other responses to anthropogenic climate change will have profound impacts on the region. Already, we are seeing biotic and abiotic perturbations as a result of these changes: contraction in range of species, acidification of waters in the Southern Ocean, and declines in some penguin species. Climate change, coupled with increased human activity on the continent, is likely to create a compounded stressor environment. This could lead to further complications for Antarctic ecosystem processes, such as expediting the establishment of invasive species (Koerich et al., 2023).

The rapid responses already being observed in the Antarctic, and the major changes expected in the coming decades, present a critical challenge to CCAMLR's ability to meet its responsibility for conservation-based management in the Southern Ocean. These rapid changes require the Commission to take urgent action to fulfill its mandate to conserve Antarctic marine living resources through the precautionary management of human activities, and to proactively implement measures to build ecosystem resilience.

One management tool proven to be effective in supporting conservation goals is marine protected areas (MPAs). In 2009, CCAMLR agreed to establish a representative system of MPAs in the Southern Ocean by 2012 (para 7.19, CCAMLR 28). The time to act on that pledge is now.

There is currently significant global momentum around the implementation of MPAs. In 2022, the United Nations Convention on Biological Diversity's (CBD) Kunming-Montreal Global Biodiversity Framework (GBF) was adopted, committing almost 200 nations to protect 30% of the planet by 2030. Significantly, in addition to the spatial target, the GBF's '30x30' target requires nations to conserve these protected areas using an approach that is "ecologically representative, well-connected and equitably governed" (CBD-GBF Target 3, 2022).

MPAs can support and build natural processes, which in turn increases resilience to climate stressors. MPAs can also serve as refugia, maintaining or restoring climate resilience in many ways, from promoting genetic diversity to increasing population size and ecosystem integrity, with larger MPAs promoting greater climate resilience (Bruno et al., 2018; O'Regan et al., 2021; Schmidt et al., 2022).

By establishing areas of minimal or no human activity, MPAs also alleviate other anthropogenic stressors, such as fishing. This reduction of compounding stressors allows for further resilience against the pressures of climate change to be embedded in species and ecosystems (O'Regan et al., 2021). In an era of unprecedented change, CCAMLR should be implementing MPAs as a key adaptation tool.

CCAMLR's MPA commitment is consistent with the GBF, and the Commission has all the tools and experience it needs to implement the 30x30 target in the CAMLR Convention Area without delay. CCAMLR stands just one political decision away from significantly contributing towards the global 30x30 ambition.

ASOC calls on CCAMLR to deliver on its commitment to establish a representative system of MPAs, to act proactively and in a precautionary manner, and to fulfill its mandate to safeguard the natural wonder that is Antarctica for future generations.

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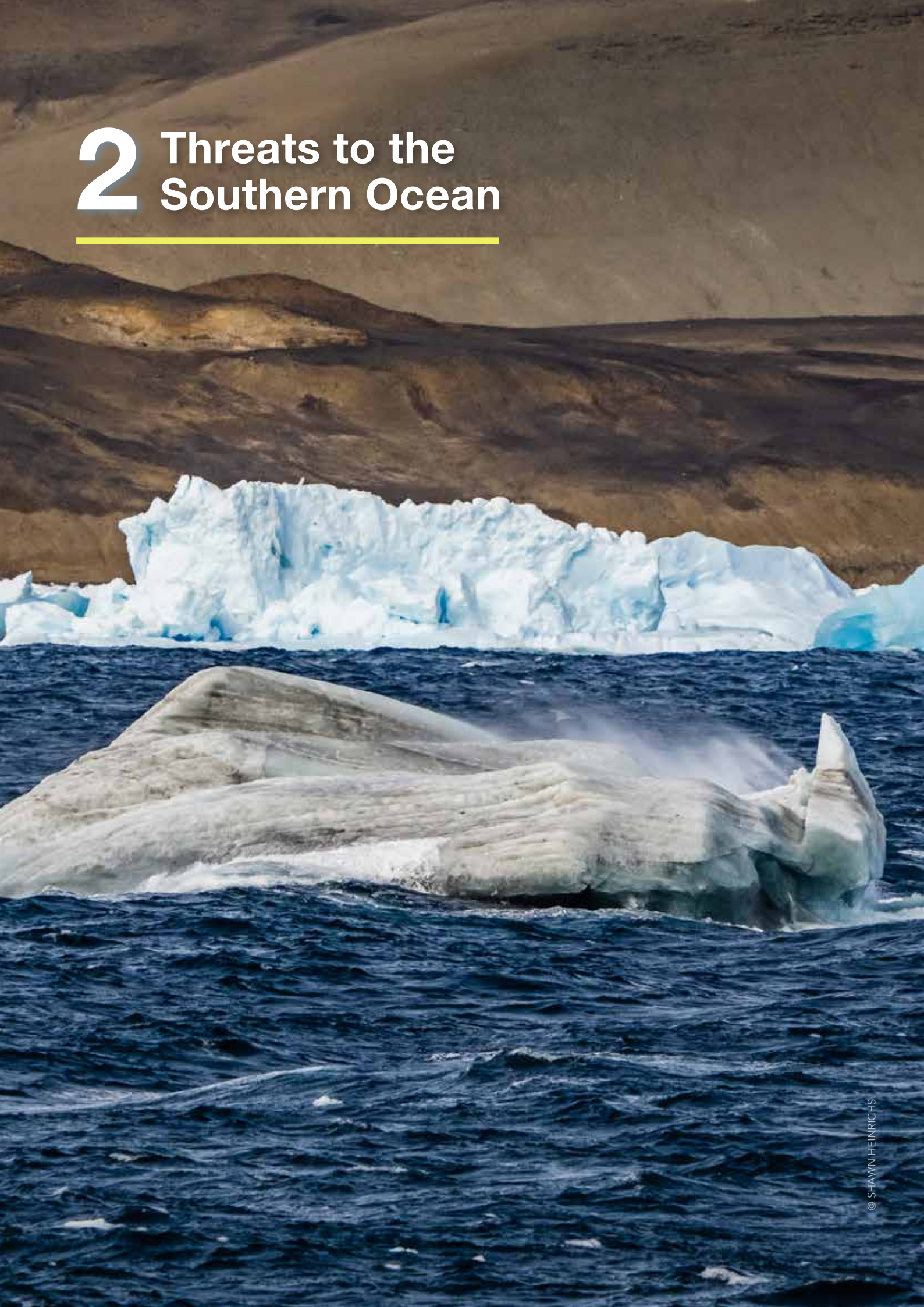
2 Threats to the Southern Ocean



The Southern Ocean is currently in a period of contradiction. The cessation of whaling, sealing and rampant IUU fishing has seen welcome rebounds in the populations of many previously threatened species. However, conversely, rising concentrations of pollutants and the profound and compounding effects of climate change are now causing observable alterations in temperature, oceanic currents, weather, and ice dynamics, all of which threaten the entire Antarctic ecosystem.

Since its establishment in 1982, CCAMLR has taken positive steps towards conserving Antarctic marine ecosystems, but it has not kept pace with the recent rate of change. While CCAMLR continues to stall on implementing conservation measures, the Antarctic region is increasingly responding to rapid changes occurring as a result of both global and local human activity.

The ecosystem is in flux. Fishing effort is increasing, concentrations of pollutants and microplastics are rising, and in recent years (2022 and 2023) sea ice has been at its lowest observed extent. Moreover, the recent Highly Pathogenic Avian Influenza (HPAI) outbreak is yet another reminder of just how fragile this region is. Effective, coordinated management is desperately needed.

There is a management tool that could help CCAMLR address many of the threats the region faces, and that has already been agreed by consensus: designating a representative system of MPAs across the Southern Ocean. Fully protected MPAs that limit human activity will build resiliency into an ecosystem under pressure while simultaneously continuing to support, and even increase, the ecosystem services that the region provides, including vital fish stocks and Antarctica's unique cultural contribution to humanity.

Climate Change

The effects of human-induced climate change have resulted in perturbations across the planet with ice-dominated regions such as Antarctica displaying some of the most rapid responses. As stated in the 2023 Marine Ecosystem Assessment for the Southern Ocean (MEASO) report, Antarctica and the Southern Ocean "is showing 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, changing patterns of variability, extreme events, or the crossing of system thresholds to alternative states."

Extreme events are on the rise. Temperature anomalies unseen anywhere else on Earth are now happening in Antarctica, marine heatwaves are occurring more frequently, and a step change in sea ice loss may now be the new regime, with corresponding implications for dependent biota (Siegert et al., 2023).

It is important to reflect that, as these stressors become more pronounced, their impacts across the Antarctic region are not uniform. Western Antarctic areas are exhibiting greater flux than East Antarctica, with the Western Antarctic Peninsula warming by approximately 2°C in the upper 150 m of the water column over the past 81 years (Constable et al., 2023).

ICE SHELVES

Ice shelves are marine extensions of ice from glaciers and ice sheets on land, fringing much of Antarctica's coast and stabilizing the rate of ice flow from the continent into the Southern Ocean.

As these ice shelves collapse, the glaciers they originate from increase their rate of flow, discharging ice from land to sea and directly contributing to global sea level rise. The Intergovernmental Panel on Climate Change (IPCC) Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) estimates that, between 2006 and 2015 alone, the Antarctic Ice Sheet lost mass at an average rate of 155 ± 19 Gt yr–1 (0.43 ± 0.05 mm yr–1), mostly due to the rapid thinning and retreat of major outlet glaciers draining the West Antarctic Ice Sheet (SROCC, 2019).

In the Antarctic Peninsula, ice shelves have, on average, retreated over the last 50 years. Large sections of several ice shelves have collapsed catastrophically in recent decades, and iceberg calving events are now occurring more frequently (Siegert et al., 2023). Since 2009, major calving events have occurred across 10 Antarctic ice shelves.

Antarctica contributes six times more water mass to the ocean than it did just 30 years ago (IMBIE, 2018). It is highly likely that, with continually increasing greenhouse gas emissions, global sea level may increase by more than one meter this century and by much more thereafter (Siegert et al., 2020).

SEA ICE

Sea ice is a key habitat and defining feature of the Southern Ocean. Its annual advance and retreat are synonymous with our imaginations of the frozen poles as the heartbeat of the planet. The extent of Antarctic

sea ice varies annually between a low of 2–4 million km^2, usually in late February, and a September high of 18–20 million km^2 (NSIDC, 2023), with this seasonal fluctuation driving a number of ecosystem processes and regulatory functions.

When present, sea ice regulates the transfer of heat and gases between the ocean and atmosphere, influences ocean salinity, regulates global ocean circulation, and provides habitat for a large number of species (Swadling et al., 2023). However, this seasonally dependent procession and regression is now being dramatically impacted by climate change. The past decade has been marked by extreme low sea ice events; 2022, followed by 2023, exhibited the lowest austral winter sea ice on record (Siegert et al., 2023).

These changes to sea ice are rapid, unpredictable, and have diverse ecological impacts. Recent low sea ice years have been associated with krill range contraction (Atkinson et al., 2019), emperor penguin colony breeding failure (Fretwell et al., 2023), and regime changes in phytoplankton communities in the Southern Ocean (Latorre et al., 2023). There is great uncertainty around the future of sea ice seasonality and extent in the Southern Ocean, but recent papers suggest that observable fluctuations in Antarctic sea ice are now behaving differently to the previous century (Eayrs et al., 2021; Purich and Doddridge, 2023; Constable et al., 2023).

The continued decline of sea ice will have huge ramifications for the global environment and for the Southern Ocean ecosystem, particularly its keystone species – Antarctic krill, which forms the foundation of the entire ecosystem. As krill is already shifting its range in response to diminishing sea ice extent, the retraction of krill larval habitat will have cascading effects for dependent species and will necessitate the effective management of the growing krill fishery.

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OCEAN ACIDIFICATION

The ocean provides a vital service to the global climate system by absorbing CO_2 and thereby limiting global warming. However, this ocean carbon absorption comes at a price: our increasing CO_2 emissions leads to an increasingly acidic ocean, thus lowering the availability of carbonate ions in the water column. The global rate of ocean acidification is faster now than at any point in the past 300 million years (Hönisch et al., 2012), and the Southern Ocean is one of the world's most rapidly acidifying oceans.

To further compound the Southern Ocean's vulnerability to acidification, cooler waters absorb more CO_2 than warmer water. The deep-water upwelling in the Southern Ocean is cold and already rich in CO_2, leaving the Southern Ocean uniquely susceptible to acidification (Henley et al., 2020; Constable et al., 2023).

Many of the organisms in the Southern Ocean have adapted to stable pH conditions that have existed for millennia. Today's rapid alterations to oceanic chemistry mean there is insufficient time for these organisms to adapt. Increasing acidity makes it difficult for shell-building animals to build and maintain their structures. Shell damage and reduced shell building is already being observed in some species the Southern Ocean, such as foraminifera (Gutt et al., 2015).

WEATHER

Antarctica is a place of extremes. It is the highest, coldest, driest and windiest continent on the planet.

The continued burning of fossil fuels has led to the increased frequency and severity of extreme weather events. These events are occurring globally, and the Southern Ocean is no exception. In 2022, a surface temperature anomaly of 38.5°C occurred in East Antarctica, the greatest temperature disparity ever recorded (Siegert et al., 2023). These extreme temperature anomalies are continuing, with a second anomalous heatwave of 28°C recorded in East Antarctica in March 2024 (Washington Post, 2024).

Extreme temperature events in the ocean are often referred to as marine heatwaves (MHW), which are categorized as extended periods of anomalously high temperatures that can exert significant impacts on marine biodiversity and ecosystems (Siegert et al., 2023). Between 2002 and 2018, there were 19 MHW events recorded in the Southern Ocean (Montie et al., 2020).

Observed changes in Antarctic weather include greater rainfall events, including during the penguin chick rearing period. The warmer temperatures resulting from climate change are responsible for the shift from snow to rain. During the austral summer of 2013–2014, an Adélie penguin colony near Dumont d'Urville experienced a complete reproductive failure. Rainfall events caused the death of all the colony's chicks, whose downy plumage is not waterproof (Ropert-Coudert et al., 2015; Vignon et al., 2021).

BIOLOGICAL RESPONSE

The profound environmental changes that Antarctica is undergoing affect dependent ecosystems, causing alterations to the phenology, distribution and behavior of many key and iconic species in the region.

Starting with the small: many Antarctic species of zooplankton (such as Antarctic krill and crystal krill) are undergoing range shifts, following the changing locations of the optimum conditions for growth and recruitment (Melbourne-Thomas et al., 2016; Piñones and Fedorov, 2016; Klein et al., 2018).

Zooplankton responses will not occur evenly throughout the Southern Ocean, with the greatest reductions in krill predicted for the section facing the southwest Atlantic. This region contains dense swarms of krill and is both an important foraging ground for krill predators and the main area of operation of the krill fishery (Kawaguchi et al., 2013; Piñones and Fedorov, 2016).

Benthic species with low mobility are expected to be significantly impacted by the effects of climate change due to their inability to adapt by migrating. Griffiths et al. (2017) modelled distribution changes for 963 benthic invertebrate species in the Southern Ocean under a high emissions scenario (RCP8.5). Their results suggest that 79% of Antarctica's endemic benthic invertebrates will face a reduction in suitable temperature habitat over the current century, with the most pronounced reductions occurring in the Western Antarctic Peninsula and the Scotia Sea region.

Many Antarctic fish have a narrow thermal tolerance as a result of their physiological adaptations to cold water, leaving them extremely vulnerable to changes in water temperature (Beers and Jayasundara, 2015; Mintenbeck, 2017). The observed and predicted increases to water temperature will displace species such as icefish and the Antarctic toothfish from marginal habitats, with ramifications for the contiguous ecosystem they inhabit.

Of all Antarctica's species, the iconic emperor penguin is exhibiting the most severe reactions to the huge changes occurring in the Southern Ocean. As a species that relies almost exclusively on sea ice as a breeding habitat, they are now threatened by the climate driven loss of sea ice combined with the profound transformation of their foraging habitat. Emperor penguin populations are estimated to decline by over 90% this century under a climate scenario in which greenhouse gas emissions continue at their current rate (RCP8.5). By contrast, under a scenario in which emissions are reduced and warming is limited to 1.5°C above the historical baseline (below RCP2.6), populations may only decline by 37% from their 2009 population size (Jenouvrier et al., 2021).

Representative Concentration Pathways (RCPs)

In order to model and predict future climate, scientists need to make assumptions about the economic, social and physical changes to our environment that will influence climate change. Representative Concentration Pathways (RCPs) are the primary method for capturing those assumptions within a set of scenarios (Met Office, 2018).

RCPs specify concentrations of greenhouse gases that will result in total radiative forcing being increased by a target amount by the year 2100, relative to pre-industrial levels. Total radiative forcing is the difference between the incoming and outgoing radiation at the top of the atmosphere.

These radiative forcing targets by 2100 have been set at 2.6, 4.5, 6.0 and 8.5 watts per square meter (W m-2), respectively, and incorporate a range of predictive future emissions scenarios. The corresponding scenarios are labelled RCP2.6, RCP4.5, RCP6.0 and RCP8.5, with each pathway resulting in a different range of global mean temperature increases over the 21st Century (Met Office, 2018).

RCP	Predicated temperature increase (C)
2.6	1.8
4.5	2.7
6.0	3.6
8.5	4.4

Figure 1: RCP forecasts. Source: IPCC, 2023. Climate Change 2023: Synthesis Report.

Fisheries

As there are no Indigenous Peoples in Antarctica, the exploitation of the Southern Ocean has always been the result of anthropogenic activities by people with distant citizenship. Antarctica's rich marine resources began being exploited soon after its formal discovery in the 18th Century, resulting in the near extinction of a number of species of whales and seals, and some finfish populations (Brooks et al., 2022).

Before the onset of industrial whaling in the Southern Ocean, South Georgia was probably the most densely populated region on Earth for large whales (Richardson et al., 2012; Calderan et al., 2020). Between 1904 and 1965, over 176,000 marine mammals were caught within a day's sailing of South Georgia (Allison, 2016), and this intense hunting led to whale populations diminishing and remaining extremely low for the remainder of the 20th Century (Bamford et al., 2022).

Trawl fishing for a range of Antarctic fish species occurred from the mid 1960s. Marbled rockcod (*Notothenia rossii*) was the first fish species to be commercially exploited and high catches were taken between 1967 and 1972 by Soviet trawlers, resulting in the stock declining to very low levels (Koch, 1992; Hollyman et al., 2021).

It was not until the formation of CCAMLR in 1982 that these declines began to reverse, although some species, such as marbled rockcod, are yet to recover (Hollyman et al., 2021). The recovery of many Antarctic fish species, alongside reductions in IUU activity, are among the most important achievements CCAMLR has made to date (Davis and Hanich, 2022). These victories serve as a reminder of what the Commission can accomplish when it is appropriately fulfilling its obligations under its mandate.

Fifteen nations intend to pursue fishing activity in the Southern Ocean during the 2023-2024 fishing season, despite large uncertainty remaining over the long-term impacts on the ecosystem. CCAMLR manages fisheries through what is termed an 'Olympic style', whereby CCAMLR announces an opening date for the fishery and the total allowable catch. All eligible vessels then 'compete' for the available catch until the limit is reached and the fishery closed.

The 'rush to fish' approach that Olympic fisheries bring about is often linked to severe competition for fish. This leads to harvests that exceed sustainable levels and fisheries characterized by an increasing number of highly efficient vessels fishing at an increasing pace, with season lengths becoming shorter and shorter (Environmental Defense Fund, 2024).

Although fishing in the Southern Ocean is now more controlled, it is still impacting the Antarctic environment and there is still a long way to go towards effective and responsive management.

KRILL

Antarctic krill (*Euphausia superba*) is a large bodied, fast swimming, and aggregating zooplankton that is central to the Southern Ocean ecosystem and key to biogeochemical cycles (Tarling and Fielding, 2016; Sylvester et al., 2021). Moreover, due to their central role as a biochemical distributer, krill sequester large quantities of carbon through the molting of exoskeletons and fecal matter, which sink, trap, and store carbon deep in the ocean (Cavan et al., 2022).

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Antarctic krill is the target of a large and growing fishery in the Southern Ocean. Recent years have seen significantly increased catch, and the spatial distribution of this catch is concentrated on relatively small regions within the Western Antarctic Peninsula (WAP) and the South Orkney Islands (Santa Cruz et al., 2018; Kruger et al., 2021).

Concerns are growing that, despite krill fishing remaining within the precautionary total allowable catch, the hyper-localized nature of fishing activity is increasingly occurring in nearshore predator 'hotspots' (Brooks et al., 2022). As a result of this direct competition for krill between the fishery and krill's predators, in 2021 there were three instances of humpback whale bycatch. This is in addition to the reported incidental mortality of over 16 seals and many seabirds over several seasons (CCAMLR, 2022; Brooks et al., 2022). The Scientific Committee on the Conservation of Antarctic Marine Living Resources (SC-CAMLR) reported at the 42nd Meeting of the Commission (SC-CAMLR 42) in October 2023 that an estimated 747 birds had hit experimental net monitor cables and trawl warps over 188 days of fishing (para 3.41, SC-CAMLR, 2023).

Alterations to the behavior of the krill fleet reflect the changing climate in the region, as the general trend of decreasing winter sea ice extent and duration allows the fleet to continue fishing activity beyond the austral summer (Nicol et al., 2012; Kruger et al., 2021). While CCAMLR may deem current practices to be 'sustainably managed', the impacts of climate change have not historically been considered when setting catch limits. It is likely that the current management approach does not adequately protect krill now that their once stable environment is rapidly changing.

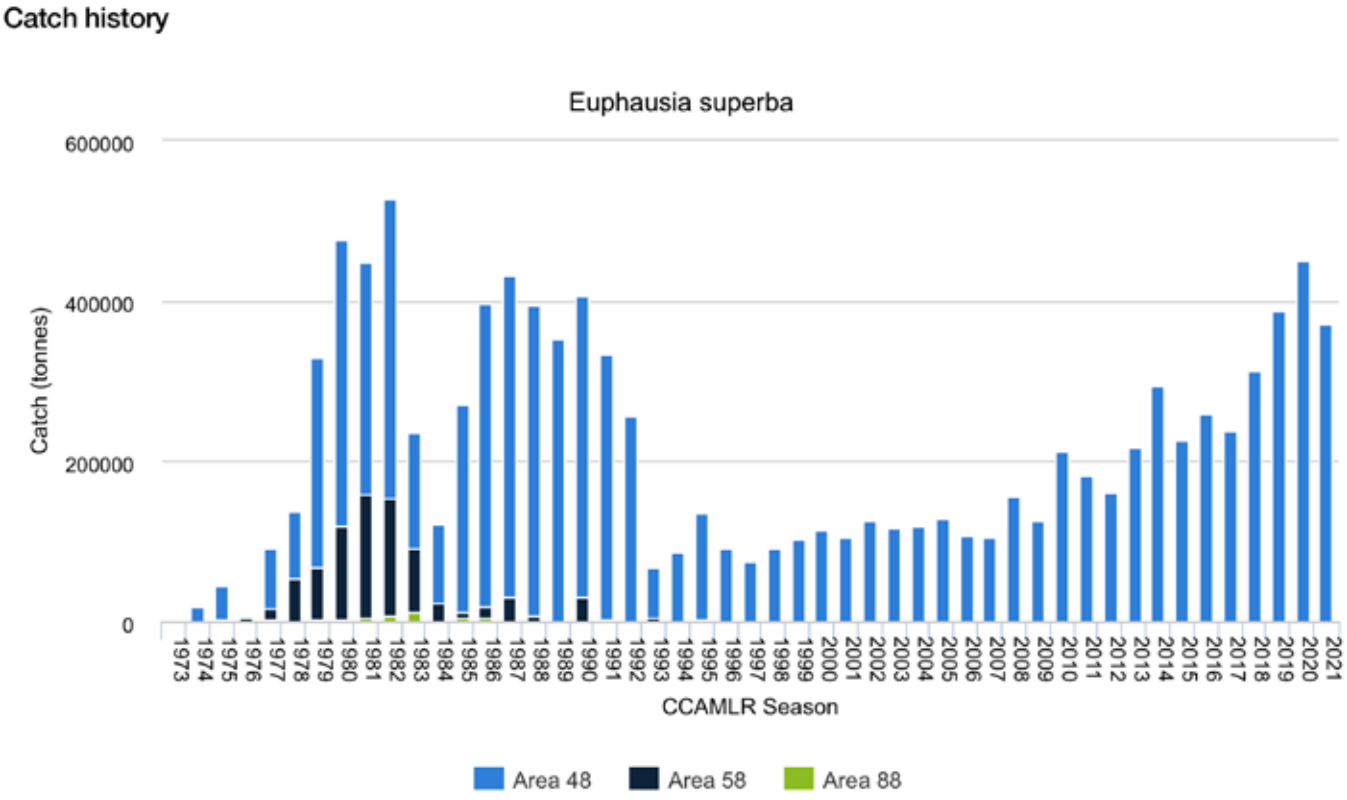

Figure 2: Catch of krill Euphausia superba in Area 48. Source: CCAMLR, 2021a.

TOOTHFISH

There are two species of toothfish in the Southern Ocean and both are pursued in commercial fisheries. The Antarctic toothfish (*Dissostichus mawsoni*) is found at higher latitudes and in cooler waters around Antarctica, whereas the Patagonian toothfish *(Dissostichus eleginoides*) occurs further north, around sub-Antarctic islands such as South Georgia. There is, however, some overlap in their distribution in intermediate areas. Both species can grow to large sizes, reaching lengths in excess of 2 m and weighing more than 200 kg, (Collins et al., 2010; Seong et al., 2023). Both species are also relatively long-lived and characterized by slow growth, low fecundity, and late maturity (Collins et al., 2010).

Toothfish were initially caught as bycatch in shallow trawl fisheries, but with the advent of a deep-water longline fishery, the landings grew rapidly from the late 1980s, reaching a peak of 40,000 tonnes in 1995 (Collins et al., 2010). The rapidly growing fishery came with significant issues, including major bird bycatch and stock overexploitation as a consequence of IUU fishing (Collins et al., 2010).

Today, the issues of IUU fishing have largely been addressed, but the status of toothfish stocks across the Southern Ocean remain a concern. Stock assessments in 2023 indicated that biomass for several fisheries had decreased to below the CCAMLR agreed target ($50\%B_0$, meaning 50% of the expected stock under a no fishing scenario) in several toothfish fisheries (e.g. Heard and McDonald, and South Georgia). Given some of the uncertainties at SC-CAMLR 42, the SC-CAMLR proposed, and CCAMLR agreed, to only maintain current catch limits for one more year, while further research and analysis is undertaken. This issue was given a high priority for SC working groups (para 2.123 and 2.124, SC-CAMLR, 2023).

Although huge improvements have been made, instances of bycatch continue in the fishery. In 2023, the mortality of approximately 132 seabirds, alongside marine mammal incidental mortalities of twelve elephant seals and one unidentified seal, were reported in longline fisheries (SC-CAMLR, 2023).

Tourism

During the 2022-2023 Antarctic tourism season, visitor numbers surpassed 100,000 for the first time (IAATO, 2023). This milestone had been anticipated for several years but was delayed due to the COVID-19 pandemic. These numbers may not seem particularly large for an entire continent, but most Antarctic tourism takes place on a limited, yet growing, number of landing sites in the Antarctic Peninsula, one of the most rapidly warming places on Earth.

Tourism may be acting in concert with the krill fishery and scientific research activities to compound the direct anthropogenic impact on the Peninsula. There are likely to be cumulative impacts from these various activities. It is therefore critical that Antarctic Treaty States agree to regulate tourism. The International Association of Antarctica Tour Operators (IAATO), the tourism industry association, should also do its part to minimize the impacts of tourism on the Antarctic environment.

Global observations highlight further risks to Antarctic ecosystems from ship traffic, including through biofouling, the introduction of invasive species, black carbon, and grey water pollution. In particular, the risk of invasive species grows as the Southern Ocean continues to warm, making it more likely for non-native species to be able to survive in Antarctic waters that were once inhospitable to many.

Both the known impacts of tourism, and the huge gaps in our understanding of the consequences for Antarctic ecosystems, highlight the urgent need for active management of the sector that incorporates a more precautionary approach. This could include identifying larger areas as wilderness sites to protect particularly vulnerable spaces from further perturbation from tourism.

The International Association of Antarctica Tour Operators (IAATO)

The International Association of Antarctica Tour Operators is a voluntary body, consisting of several tour companies that work in the Antarctic region. IAATO broadly advocates for safe and environmentally responsible travel to Antarctica.

Over the years, IAATO and its members have developed guidelines and self-imposed measures to minimize the impacts of their activities. These include geofencing areas to mitigate strike risks from vessel operations in whale-rich areas, speed restrictions in sensitive areas, and behavior guidelines for tourists in landing sites.

However, as tourist numbers continue to increase, the existing regulations do not adequately protect the environment of Antarctica from the impacts of tourism, including damage at visitor sites and along travel routes, and the disturbance of wildlife (IUCN, 2023; ASOC, 2024). Alongside the direct impacts associated with increased tourism is the growing recognition of the industry's overall carbon contribution towards a warming planet.

It is likely that new regulations to safeguard Antarctica are needed. These regulations should adhere to the precautionary principle and support the advance of effective spatial management in the region.

Plastics

Plastics are a pervasive and growing problem in the Southern Ocean. The 2023 MEASO report makes it clear that microplastics are increasingly being detected in the environment and organisms of the Southern Ocean.

Sources of plastic introduction are located both outside and within the Southern Ocean, with the tourism and fisheries sectors predominantly responsible for the introduction of this pollutant within the region (Constable et al., 2023). Plastics are introduced to the marine environment through several vectors, including via the discharge of microplastics through grey water emitted by ships and research bases, paint erosion, and direct or accidental littering.

Plastics and microplastics are ubiquitous in Antarctica. They have been found in coastal seawater samples (Lacerda et al., 2019), snow samples (Aves et al., 2022), and fecal samples from penguin species (Adélie, king, gentoo and chinstrap) across the Antarctic and sub-Antarctic (Fragão et al., 2021). Moreover, a synthesis of scientific literature from the late 1980s to 2023 on the ingestion of plastics by seabirds from polar regions reported that, of the 756 Antarctic birds sampled, 97% had at least one microplastic fragment or fiber in their stomach contents or pellets (regurgitated undigested food), with 100% of pellet samples containing microplastics (Taurozzi and Scalici, 2024).

Once ingested, microplastics can have toxic effects on keystone species, and impacts can affect entire marine ecosystems through bioaccumulation and biomagnification (Waller et al., 2017). Microplastics may also act as a vector for pathogenic bacteria (Caruso et al., 2023), and when further degraded into nanoplastics, can accumulate in organisms and cross internal biological barriers, such as the blood-brain barrier (Mattsson et al., 2017).

The accumulation of compounding and complementing threats in Antarctica is causing observable impacts on an ecosystem that is dependent on a stable and healthy Southern Ocean. It is clear that urgent and effective action needs to be taken by all Parties to the Antarctic Treaty and Members of CCAMLR before further irreparable damage is done.

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3 Management in the Antarctic

Antarctic Treaty System

The international management of Antarctica was established in 1959 through the signing of the Antarctic Treaty, which came into force in 1961. The Antarctic Treaty established the framework for collaborative activity in Antarctica, with science at its core and restoring and conserving ecosystems as a central objective (Press and Constable, 2022).

The Antarctic Treaty manages activities in the region through the decisions of Antarctic Treaty Consultative Meetings (ATCM), where management decisions are made by consensus by the Antarctic Treaty Consultative Parties. Through the decisions of the ATCM, a body of international law and institutions that govern the obligations of Parties to the Antarctic Treaty, known as the Antarctic Treaty System (ATS), has been created.

The ATS currently consists of the Antarctic Treaty, the Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention), and the Protocol on Environmental Protection to the Antarctic Treaty. The CAMLR Convention has its own determinant commission in relation to the management of marine living resources, called the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

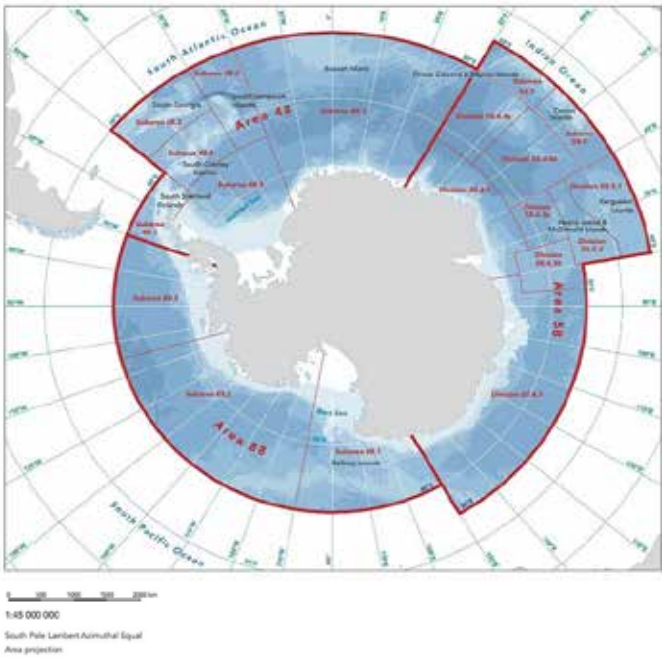

Figure 3: Map of CCAMLR's jurisdictional area. Source: CCAMLR, 2024a.

Convention on the Conservation of Antarctic Marine Living Resources

The Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention) was developed in response to concerns about a growing, unregulated krill fishery and the potential this fishery had to adversely impact Antarctic marine ecosystems (Trathan, 2023).

The responsibility for implementing the CAMLR Convention, and the management of marine living resources, rests with CCAMLR.

CCAMLR's management area encapsulates the Southern Ocean, constrained to the north by the Antarctic Polar Front and to the south by the Antarctic continental coastline. CCAMLR is made up of 27 Members, who make decisions by consensus.

CAMLR, the Convention and the Commission

a. The Convention on the Conservation of Antarctic Marine Living Resources, referred to as the CAMLR Convention, is part of the Antarctic Treaty System and has, as its primary objective, the conservation of marine living resources. "Conservation" includes rational use, which means "any harvesting [fishing] and related activities" must follow ecosystem based and precautionary conservation criteria outlined in the Convention (CCAMLR, 2024b).

b. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) was established in 1982 to implement the CAMLR Convention mandate to conserve marine life. CCAMLR Contracting Members include all States or regional economic integration organizations which have ratified, accepted, approved or acceded to the CAMLR Convention (CCAMLR, 2024b).

c. Membership of the Commission is open to any Contracting Party that is engaged in research or harvesting activities in relation to the marine living resources to which the CAMLR Convention applies. Members take part in scientific research and/or fishing subject to CCAMLR conservation measures. Only Members contribute to the CCAMLR budget and participate in decision-making (CCAMLR, 2024b). Members of the Commission currently includes 26 States and the European Union.

There are two subsidiary bodies under the overarching body of CCAMLR, the Standing Committee on Implementation and Compliance (SCIC), which focuses on compliance with CCAMLR regulations, and the Scientific Committee (SC-CAMLR), whose role is to provide the best available scientific information on harvesting levels and other management issues to aid decision-making by the Commission.

A central tenet of CCAMLR is its focus on conservation. Article II of the CAMLR Convention unambiguously and unequivocally states that its paramount objective is the conservation of Antarctic marine living resources (CCAMLR-XXXV/BG/28). Importantly, CCAMLR employs a precautionary approach to management, to complement its conservation focus, which is what distinguishes it from other international bodies, such as regional fisheries management organizations (RFMOs) (Haward, 2021; Liu and Brooks, 2018; Rosemarin et al., 2023).

The Antarctic Treaty System delivered important conservation successes even at the height of the Cold War. These achievements continued within the CCAMLR context, including the establishment of the South Orkney Islands Southern Shelf (SOISS) MPA in 2009, the world's first high seas MPA.

However, due to years of inaction, CCAMLR's effectiveness has recently been called into question.

Consensus-based decision-making allows any party to block progress, and the interest of individual Members can undermine international cooperation (Miller and Slicer, 2014). Global political tensions are now being reflected in the Antarctic arena and are stymieing any environmental progress (ASOC, 2023a).

Consensus blocking at CCAMLR is most prominent over the establishment of MPAs, but also occurs over other area-based management tools. In 2023, it prevented the establishment of Special Areas of Scientific Study (SASS) and designation of a Vulnerable Marine Ecosystem (VME) for a Jonah's icefish nesting area in the Weddell Sea (ASOC, 2023a).

In contrast to the persistent blocking of area-based management initiatives, the adoption of fishing conservation measures has, with some exceptions, largely continued as usual. This has led to a situation where fisheries are easily approved, but consensus cannot be reached on enacting meaningful protection based on rigorous science.

This overturns the precautionary approach and prioritizes rational use over CCAMLR's primary conservation mandate. With climate change beginning to exert greater influence in the CCAMLR Area, it is imperative that Members come together to reach consensus on critical precautionary conservation measures necessary to protect Antarctica.

Rational Use

Although the primary objective of CCAMLR is conservation, there exists the opportunity for Members to pursue activity in line with 'rational use'. This is generally understood to refer to activities that do not violate the conservation principles in Article II of the CAMLR Convention.

However, the inclusion of rational use has enabled some Members to create an alternative interpretation of CCAMLR's objective. While the vast majority of Members view CCAMLR as a conservation body, rational use has provided a base for some States to find support for 'the right to fish' (Jacquet et al., 2016; Sykora-Bodie and Morrison, 2019).

This misinterpretation has hindered MPA establishment in the Southern Ocean, with some Members claiming that prohibiting fishing and other human activity through the establishment of no-take MPAs is counter to their interpretation of Article II: that there should be a 'balance' between conservation and rational use, which they generally take to mean not limiting commercial fishing.

This 'right to fish' view is diametrically opposed to what Article II sets out to achieve. The objective of the Convention, together with the clarification of rational use in Article II.3 and Article IX.2(g), stipulates explicitly that CCAMLR is a conservation regime. It is clear that the term "rational use", as used in Article II.2 of the Convention, is a subsidiary to the objective of "the conservation of Antarctic marine living resources" in Article II.1 and does not have equal standing in the application of the Convention (CCAMLR-XXXV/BG/28).

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CCAMLR and the 30x30 Target

Recent years have seen significant international momentum towards safeguarding the global marine environment. In December 2022, the United Nations Convention on Biological Diversity's (CBD) Kunming-Montreal Global Biodiversity Framework (GBF) was adopted, committing almost 200 nations to protect 30% of the planet by 2030. Significantly, in addition to the spatial target, the GBF's '30x30' target requires nations to conserve these protected areas in an approach that is "ecologically representative, well-connected and equitably governed" (CBD-GBF Target 3, 2022).

The CBD's definition of a protected area is an area that is "designated or regulated and managed to achieve specific conservation objectives," and Target 3 of the GBF specifies protected areas as one of the main area-based conservation tools which can be implemented to achieve the 30x30 ambition.

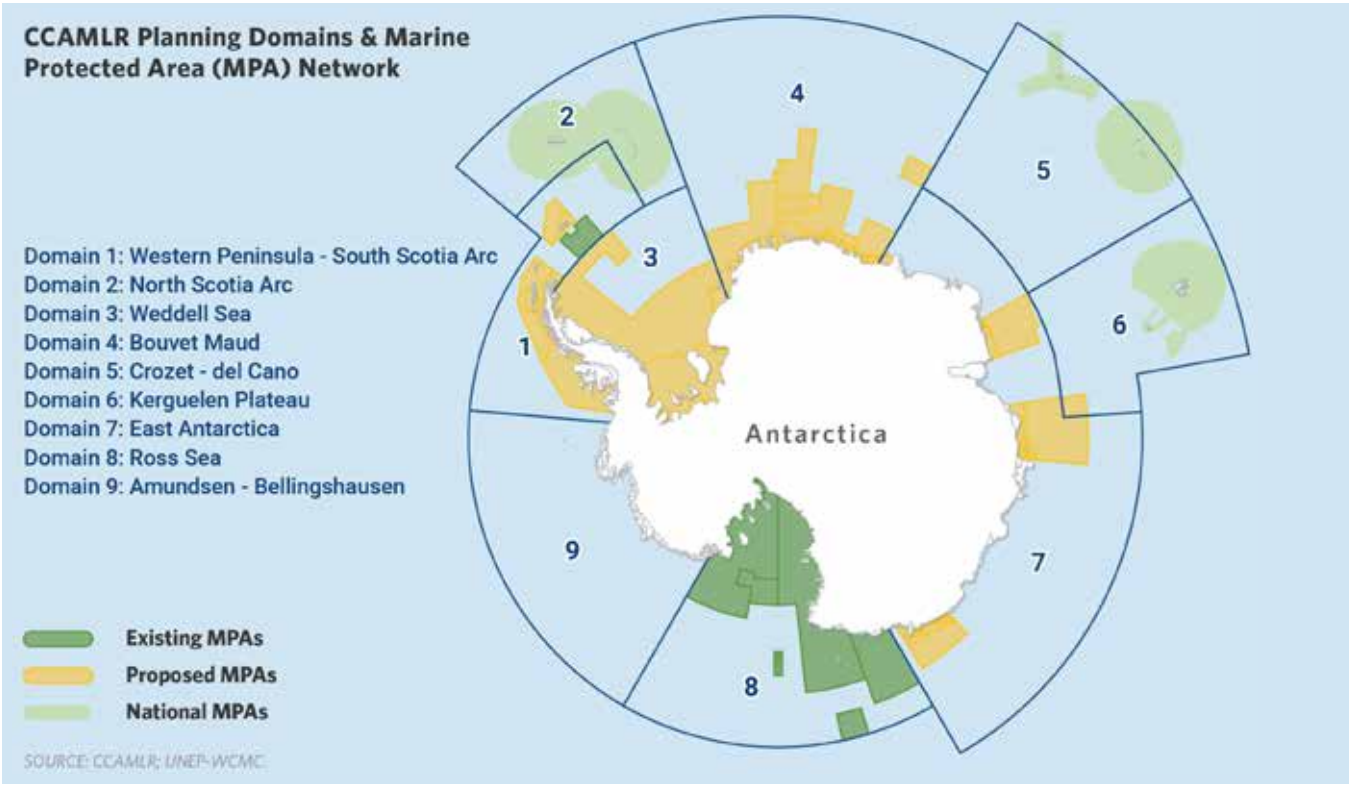


Figure 4: Map showing existing MPAs and proposed MPAs in the Southern Ocean. Credit: Michael Wissner, The Pew Charitable Trusts.

Article II of the CAMLR Convention

1. The objective of this Convention is the conservation of Antarctic marine living resources.
2. For the purposes of this Convention, the term 'conservation' includes rational use.
3. Any harvesting and associated activities in the area to which this Convention applies shall be conducted in accordance with the provisions of this Convention and with the following principles of conservation:
   (a) prevention of decrease in the size of any harvested population to levels below those which ensure its stable recruitment. For this purpose its size should not be allowed to fall below a level close to that which ensures the greatest net annual increment;
   (b) maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources and the restoration of depleted populations to the levels defined in sub-paragraph (a) above; and
   (c) prevention of changes or minimisation of the risk of changes in the marine ecosystem which are not potentially reversible over two or three decades, taking into account the state of available knowledge of the direct and indirect impact of harvesting, the effect of the introduction of alien species, the effects of associated activities on the marine ecosystem and of the effects of environmental changes, with the aim of making possible the sustained conservation of Antarctic marine living resources.

The UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) is charged with managing the World Database on Protected Areas (WDPA) as part of the Protected Planet Initiative. As of September 2024, approximately 8.35% of the global ocean is protected by some form of MPA (Protected Planet, 2024).

The recently adopted international High Seas Treaty will also contribute to the 30x30 target by allowing for a comprehensive and streamlined approach to determining MPAs in areas beyond national jurisdiction (ABNJ). ABNJ cover approximately 61% of the ocean and, at present, have extremely poor MPA coverage.

As the Southern Ocean comprises approximately 10% of global ocean space, the achievement of the global 30x30 ambition is inextricably bound to progress that falls directly under the mandate of CCAMLR.

The adoption of both the GBF and the 2023 Agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction (also known as the High Seas Treaty) reflects that many policymakers, including the majority of CCAMLR Members, have agreed to deliver meaningful conservation through protected areas.

GBF Target 3 will not be achieved by 2030 without the rapid expansion of MPAs in ABNJ, including in the Southern Ocean. Antarctica is a region of the world where protection is both urgently needed and which has protected area proposals ready for adoption.

Existing proposals for four large-scale MPAs in the Southern Ocean present CCAMLR with an opportunity to deliver against agreed international marine conservation goals. It also represents a meaningful contribution to global ocean conservation. By enacting the four proposed large-scale MPAs, CCAMLR would have approximately 26% of its waters under protection.

There would remain work to do for CCAMLR to complete a representative network of Southern Ocean MPAs, but enacting these four large-scale MPA proposals, alongside the protection already in place, would safeguard approximately 2.6% of the globe's marine environment. In doing so it would enable the Commission to reclaim its position as a world leader in conservation and create an outstanding global legacy.

Sub-Antarctic Islands in the Southern Ocean

The Southern Ocean has a number of notable islands outside of Antarctica's immediate vicinity, albeit still influenced by the Antarctic Circumpolar Current (ACC). These are known as sub-Antarctic islands and host a bewildering array of wildlife, from millions of pairs of penguins on Zavdovksy to huge populations of pinnipeds in the Heard and McDonald Islands (Brooks et al., 2019).

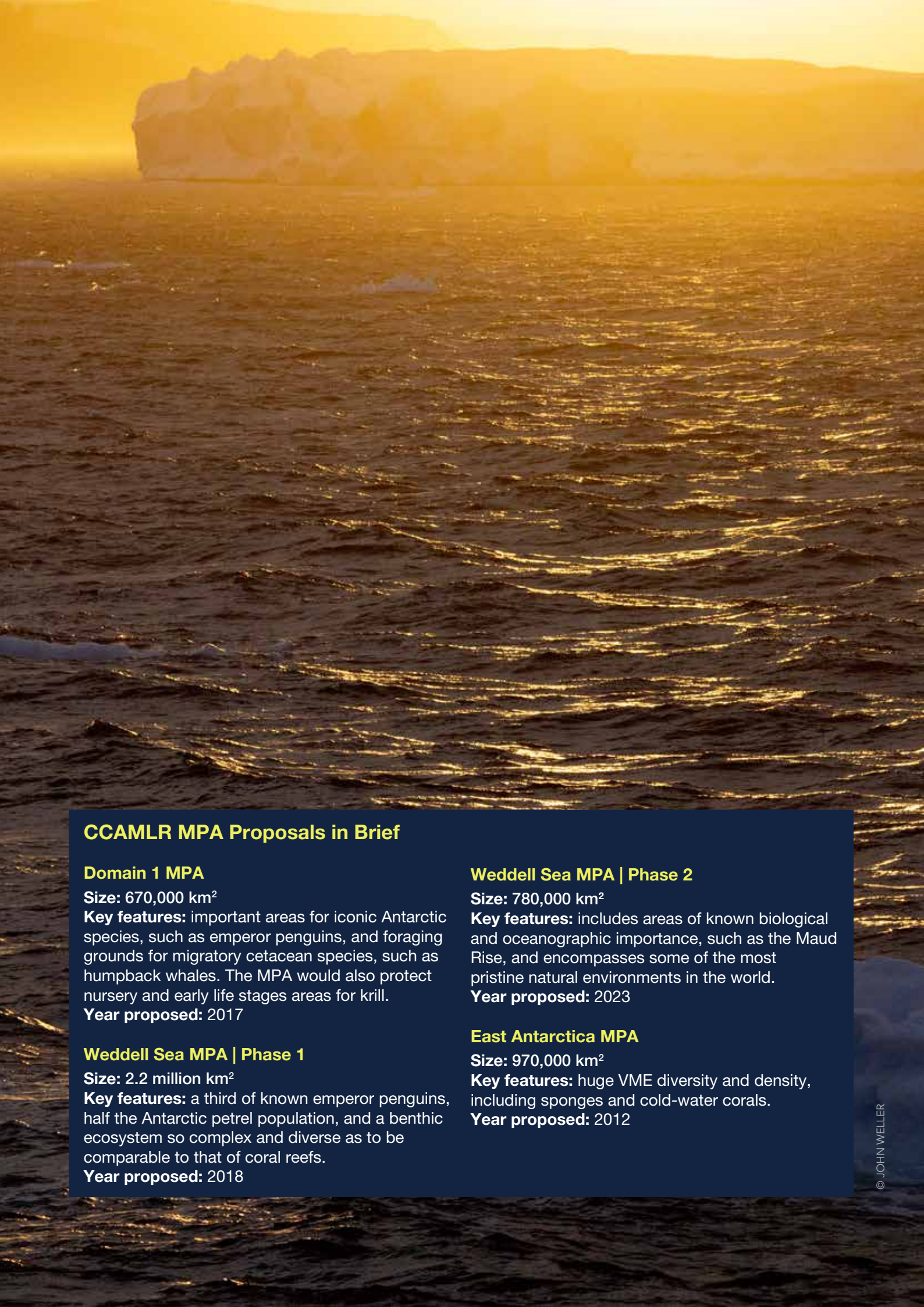
The large diversity across these islands is due to their spatial and temporal heterogeneity, responding to extreme seasonal changes in climate, the influences of the ACC, and their geographical isolation (Hogg et al., 2011; Hogg et al., 2021).

Although some of these islands fall within the bounds of CCAMLR's jurisdictional area, many sub-Antarctic islands are claimed as overseas dominions and territories. Australia (Heard Island and McDonald Islands), France (Kerguelen Islands, Crozet Islands, Saint Paul and Amsterdam Islands), Norway (Bouvet Island), South Africa (Prince Edward Islands), and the United Kingdom (South Georgia and South Sandwich Islands) all claim overseas territories in the Southern Ocean. In the UK's case, territorial sovereignty is not recognized by CCAMLR and is disputed by some Members.

Some of the world's largest MPAs are located around sub-Antarctic islands. That is because, while progress on MPA implementation has been glacial under CCAMLR's direction, many nations have pressed ahead with protecting sensitive areas of the Southern Ocean outside of CCAMLR's jurisdiction.

There are now seven MPAs in the Southern Ocean, with five of these located around sub-Antarctic islands (Brooks et al., 2020). Overall, 13% of CCAMLR's area is under the general protection of MPAs; nearly half of this protection is accounted for by nationally managed MPAs surrounding sub-Antarctic islands (Brooks et al., 2020).

Two things are clear. First, nationally managed MPAs are contributing significantly towards Southern Ocean protection, but with further scaling up required to reach 30x30 ambitions. Second, CCAMLR is failing in its commitment to implement a system of representative MPAs in its jurisdictional area.



CCAMLR MPA Proposals in Brief

Domain 1 MPA

Size: 670,000 km^2
Key features: important areas for iconic Antarctic species, such as emperor penguins, and foraging grounds for migratory cetacean species, such as humpback whales. The MPA would also protect nursery and early life stages areas for krill.
Year proposed: 2017

Weddell Sea MPA | Phase 1

Size: 2.2 million km^2
Key features: a third of known emperor penguins, half the Antarctic petrel population, and a benthic ecosystem so complex and diverse as to be comparable to that of coral reefs.
Year proposed: 2018

Weddell Sea MPA | Phase 2

Size: 780,000 km^2
Key features: includes areas of known biological and oceanographic importance, such as the Maud Rise, and encompasses some of the most pristine natural environments in the world.
Year proposed: 2023

East Antarctica MPA

Size: 970,000 km^2
Key features: huge VME diversity and density, including sponges and cold-water corals.
Year proposed: 2012

4 MPAs and the Opportunity for CCAMLR

Marine protected areas (MPAs) are varied in their design but, in principle, all aim to protect the ecological processes and ecosystem integrity of an area identified as important and/or sensitive. The huge benefits an MPA can bring about vary accordingly to the locality and objective of the MPA design. This can range from areas of refuge from fishing to areas of study where the effects of climate change can be disentangled from other stressors.

Large-scale, well-designed MPAs with strong levels of protection, which encompass all trophic levels of an ecosystem, have been shown to increase species' biomass and genetic diversity, which in turn enhances species' resilience to environmental impacts (Chavez-Molina et al., 2023). Moreover, although the main objective of MPAs is to promote the conservation and recovery of exploited species within their boundaries, they simultaneously produce benefits for adjacent areas, which is known as 'spillover' (Ashford et al., 2022).

MPAs are becoming an increasingly important ecosystem-based management tool for conserving biodiversity, especially in the light of climate change. By protecting habitats, removing anthropogenic stressors, and increasing ecological connectivity and diversity, MPAs can enhance climate resilience (Chavez-Molina et al., 2023). While it is not their primary purpose, MPAs have also been shown to support effective fisheries management.

The Kunming-Montreal Global Biodiversity Framework calls for 30% of ocean space to be protected by 2030. With the global High Seas Treaty yet to enter into force, CCAMLR is one of the only existing mechanisms able to establish MPAs in areas beyond national jurisdiction (ABNJ) and deliver against the 30x30 target.

Benefit of MPAs to Fisheries

Aside from their primary purpose as a conservation tool to rebuild ecological integrity and protect Vulnerable Marine Ecosystem (VME) species from human activity, well-designed MPAs can also provide benefits to adjacent fishing activity (Adams et al., 2021).

In particular, MPAs with no-take zones incorporated within their design produce environmental benefits, such as increases in the abundance and individual sizes of species, within MPA boundaries and beneficial spillover effects. Spillover is a term used to describe increased abundance and size of species just outside an MPA's boundaries as a result of larval production and egg recruitment to the fishery, as well as increased abundance and size of mature fish (Lester et al., 2009; Adams et al., 2021).

Area-based Management Tools and Other Effective Area-based Conservation Measures

It is worth nothing that MPAs are one tool within a suite of area-based management tools (ABMTs), which are spatial instruments for conserving and managing different forms of ocean use. A broad diversity of ABMTs exist, each with their own purpose, mandate and authority. Some tools are focused on managing industrial activities in a specific area, such as areas closed to fishing, shipping and mining. Other tools are more cross-sectoral in their approach to management, such as Marine Protected and Conserved Areas (MPCAs), including MPAs. While MPAs seek to coordinate several types of activity in the same area, Other Effective area-based Conservation Measures (OECMs) are more sectoral, primarily focusing on one specific activity.

A review of 124 global marine reserves found that, within a decade of its implementation, a highly protected MPA (with little to no human activity permitted) achieves approximately 21% higher species richness, 28% larger organisms, and 6.7 times the fish biomass compared to nearby unprotected areas (Lester et al., 2009).

Partially protected MPAs achieve similar results, albeit with lower returns, with fish biomass reaching an average of 1.8 times greater than in unprotected areas (Sala and Giakoumi, 2018).

As larger fish are more fecund than smaller fish of the same species, it is estimated that one hectare of a highly protected MPA produces on average at least 5 times as many fish offspring as an equivalent unprotected hectare (Sala and Giakoumi, 2018; Adams et al., 2021).

MPAs in the Southern Ocean should therefore be used in conjunction with other management tools, such as catch quotas and fisheries licenses.

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CCAMLR's Commitment to MPAs

In 2009, CCAMLR established the South Orkney Islands Southern Shelf MPA, the first MPA agreed by CCAMLR and the world's first high seas MPA (Trathan, 2023). This was followed in 2016, when CCAMLR agreed to the Ross Sea Region MPA, the largest MPA in the world and represented a highpoint in CCAMLR's nearly 40 years of existence.

Since the establishment of the Ross Sea Region MPA, progress on implementing a representative system of MPAs in the Southern Ocean has stalled. Unfortunately, CCAMLR's reputation as a global frontrunner in conservation is now at risk of declining during a critical period for the future of the Southern Ocean.

In the years since the Ross Sea Region MPA's adoption, CCAMLR Members have proposed four scientifically robust MPAs: Weddell Sea Phase 1 MPA, Weddell Sea Phase 2 MPA, East Antarctic MPA, and the Domain 1 MPA (D1MPA). All four MPA proposals are yet to be designated, despite an incredible amount of supporting data, with two gaining endorsement by SC-CAMLR.

Each MPA proposal has implicit and explicit precautionary conservation measures in place, including the protection of deep shelf depressions (East Antarctic MPA), a krill no-take zone adjacent to an area where penguin populations have experienced reproduction failure (East Antarctic MPA), the protection of demersal fish nests

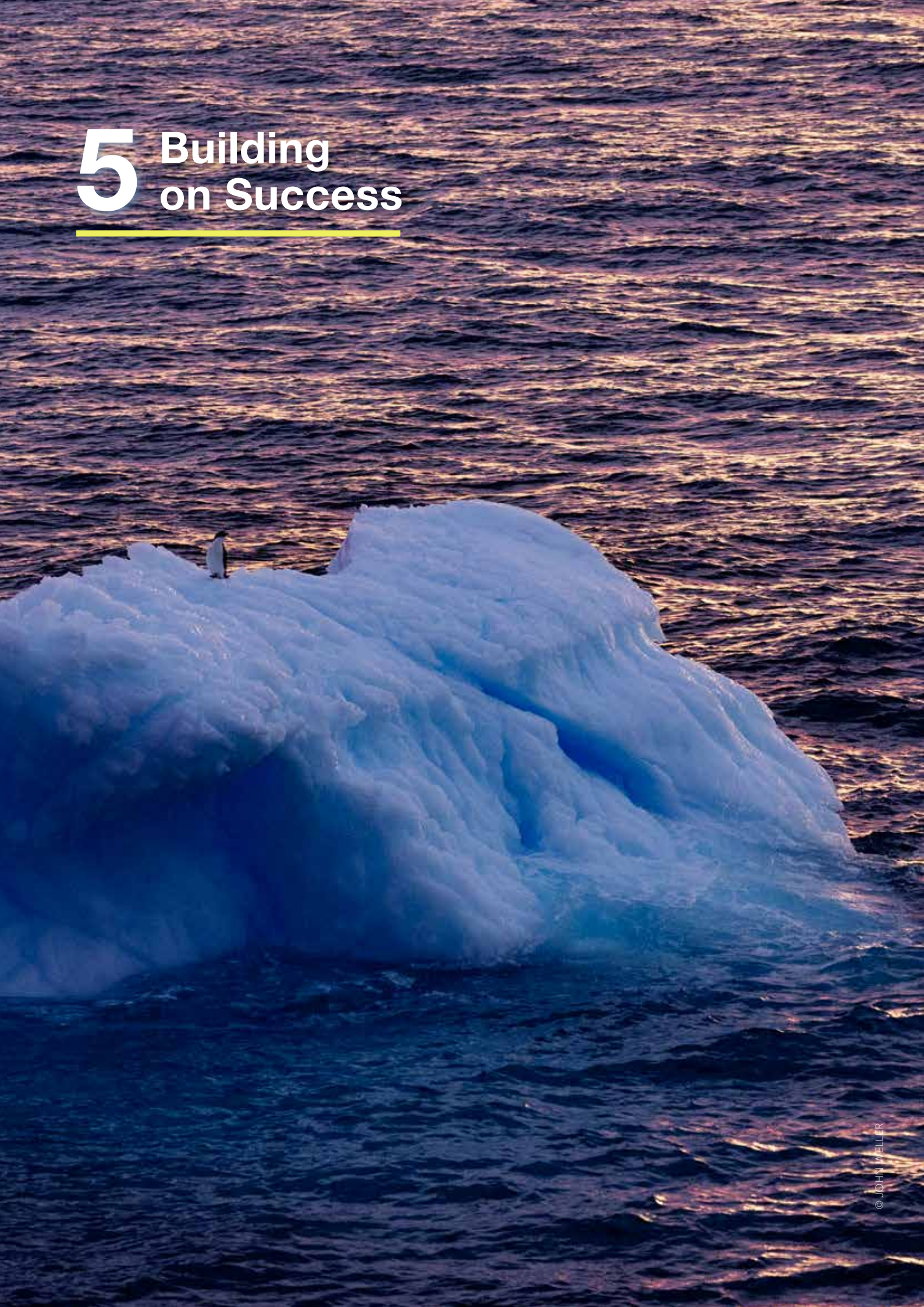
(Weddell Sea MPA Phase 1), the protection of land-based predators in areas where krill fishing currently takes place (D1MPA), and specialized foraging areas for migratory birds (Weddell Sea MPA Phase 2).

Regulating the Southern Ocean through fisheries management alone – such as catch limits, spatial management, and licensing – will not be sufficient to adequately protect many key aspects of the marine environment (Trathan and Grant, 2020; Trathan, 2023). Achieving adequate conservation in the face of climate change and increased fishing pressure will require the implementation of a system of MPAs as a key facet of CCAMLR's ecosystem approach to management and conservation.

Now is a critical time for the Southern Ocean and for CCAMLR. The commitment to establish a representative system of MPAs, made well over a decade ago, urgently needs to be put into action. Both the Ross Sea Region and South Orkney Islands Southern Shelf MPAs are huge achievements, but on their own they do not offer adequate protection to a region undergoing profound changes.

CCAMLR Members must rejoin the path towards a representative system of MPAs in order to keep pace with global progress on marine protection and return to the original spirit on which the Antarctic Treaty System was founded.

5 Building on Success



Despite its recent inaction, CCAMLR has a long history of conservation successes that it can draw from when developing its stated ambition of establishing a system of MPAs in the Southern Ocean. The Parties to the CAMLR Convention, signed in 1982 during the Cold War, have since delivered meaningful protection and for many years lived up to its mandate.

CCAMLR has collectively delivered two MPAs, and has defined and agreed the framework needed to establish future MPAs. Moreover, in 2022, CCAMLR agreed Resolution 36/41, a climate change resolution that, inter alia, encourages Members to "commit to integrating climate change science across all CCAMLR activities to better mitigate and prepare for and respond to impacts" (ASOC, 2023b).

This prior experience of developing an MPA framework and establishing two MPAs, coupled with an agreed concern for climate change impacts, gives cause for optimism.

South Orkney Islands Southern Shelf MPA

The South Orkney Islands are an island archipelago located close to the Antarctic Peninsula and are situated between the Antarctic Circumpolar Current (ACC) to the north and the Weddell Sea Gyre in the south (Brasier et al., 2018). The confluence of the ACC and the Weddell Sea Gyre creates unique oceanographic conditions that provide a key habitat area for Antarctic krill and krill-dependent predators, including Adélie penguins and Antarctic fur seals.

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The benthos around the South Orkney Islands is known to be an area of exceptionally high biodiversity. Approximately one fifth of all Southern Ocean species have been recorded in the South Orkneys (Barnes et al., 2009).

In 2009, CCAMLR recognized this incredible biodiversity and adopted a proposal, led by the United Kingdom, to designate an MPA prohibiting commercial fishing over an area of 94,000 km^2. In doing so, CCAMLR enacted the world's first high seas MPA and began the process of implementing a system of MPAs across the Southern Ocean.

Vulnerable Marine Ecosystems (VMEs)

Another ecosystem-based management tool available to CCAMLR is designating Vulnerable Marine Ecosystems (VMEs) with limited spatial protection. Under CCAMLR Conservation Measure 22-07, fishing vessels are required to notify the CCAMLR Secretariat once a certain threshold of bycatch of VME indicator species has been caught. Thresholds depend on gear type and the indicator species (CCAMLR, 2013). Once this threshold is met, a VME Risk Area is declared, which provides limited protection through spatial closures to bottom fishing activities of one nautical mile surrounding the location of the VME. VMEs can also be identified and designated using photo and video footage and are registered and protected by CCAMLR through the provisions of Conservation Measure 22-09.

In addition, interactions between fishing activity and VMEs can be limited by introducing spatial gear restrictions, such as those in the toothfish fisheries, which prohibits the deployment of gear in waters shallower than 550 m and deeper than 2,250 m.

However, not all VMEs are protected under existing conservation measures. The most effective way to ensure full VME protection is through their incorporation within the boundaries of MPAs. For example, VME locality was a key component in the development of the Ross Sea Region MPA, with VME risk areas predominantly protected in areas of no fishing activity (Adams et al., 2021).

Ross Sea Region MPA

The Ross Sea Region MPA was established in 2016, after more than five years of negotiations. It created the world's largest MPA at over 2 million km^2, protecting one of the planet's most productive and healthy stretches of ocean.

Within the confines of the Ross Sea Region MPA, over 80% is no-take for commercial fishing and the remaining 20% is a Special Research Zone open to pre-planned commercial research fishing.

Members agreed the Ross Sea Region MPA by consensus, but only for a limited period. In 2052, 35 years after its enactment, the MPA will cease to exist unless it is renewed by consensus. This is problematic for a number of reasons. Firstly, it can take decades of MPA enforcement for observable benefits to protected species and biotypes to be detected. For an MPA to 'expire' runs contrary to the long-term conservation objectives of protected areas. Secondly, the inclusion of sunset clauses in Southern Ocean MPAs is counter to the ambition of the global 30x30 goal, which calls for 30% of the planet to be permanently protected.

While CCAMLR's success in implementing two high seas MPAs within the Convention Area is admirable, progress on the remaining proposals is currently being held up by a small number of CCAMLR Members. This is holding up progress towards global 30x30 targets and other marine biodiversity commitments.

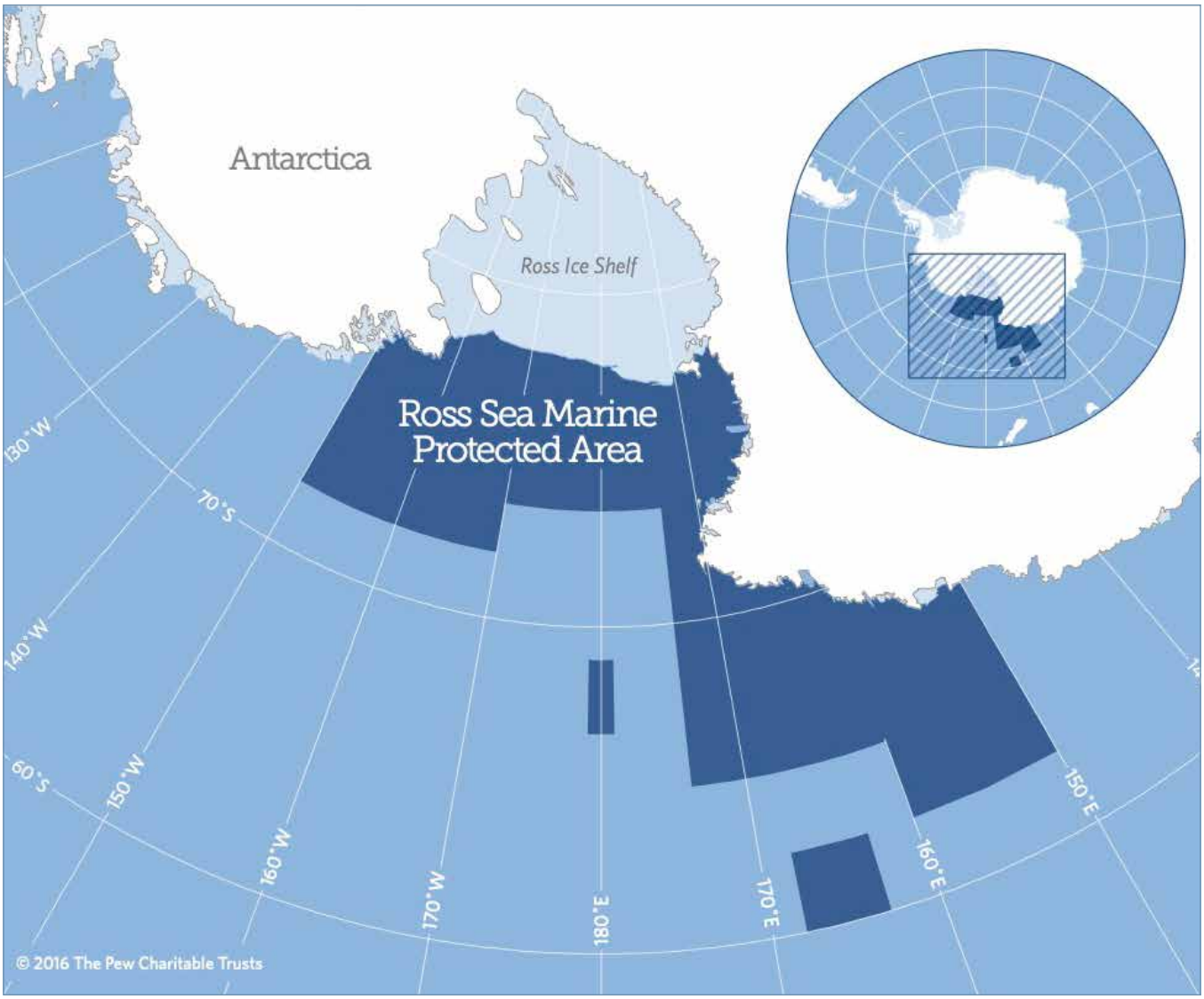

Figure 5: The extent of the CCAMLR-adopted Ross Sea Region MPA. Source: The Pew Charitable Trusts, 2016.

6 MPA Recommendations

Since 2016, CCAMLR has made little progress towards establishing a representative system of MPAs. One reason for this is the increasing mismatch between the scientific evidence demanded to support MPA proposals and the scientific evidence required to enable fishing activity.

Realizing the vision of a circumpolar network of MPAs depends on enacting meaningful protection in each of the planning domains that surround Antarctica. These domains are distinct regions based on the Southern Ocean bioregions that were established to coordinate MPA planning and management (Boothroyd et al., 2024).

CCAMLR must urgently return to its original objective and adhere to the precautionary principle in conserving the Southern Ocean. MPA proposals that have been approved by SC-CAMLR are supported by far more scientific evidence than is currently required for fishing activity. Furthermore, they do not significantly displace current fishing activity while retaining high conservation value.

At present, only 13% of the Southern Ocean is protected in MPAs, with only approximately 5% encompassed in no-take areas. Rapid MPA implementation is needed if CCAMLR is to support the achievement of the 30x30 target by the 2030 deadline. Fortunately, the tools to meet the GBF target and protect the Southern Ocean are at hand, they just need political will to be implemented.

MPA Proposals

WEDDELL SEA PHASE 1 & 2 MPAs

The Weddell Sea is the most southerly part of the Atlantic sector of the Southern Ocean. It forms the basis of CCAMLR's Domain 3 management area, as well as parts of Domain 4. The Weddell Sea is significant on a global scale as it generates a considerable amount of Antarctic Bottom Water, which plays a key role in global thermohaline circulation and ventilating the global abyssal ocean (Hempel and Hempel, 2009).

At the end of the austral winter, sea ice covers more than 75% of the Weddell Sea area. This shrinks to only one third of the maximum winter extent during the short austral summer. Multi-year sea ice occurs predominantly in the southwestern Weddell Sea and covers approximately 13% of the Weddell Sea. As a result of resilient ice cover and favorable ocean currents, the Weddell Sea is expected to be one of the last regions of the Southern Ocean where the consequences of climate change will manifest (Teschke et al., 2021).

The Weddell Sea is home to an incredible variety of biodiversity: a third of known emperor penguins, half the Antarctic petrel population, and a benthic ecosystem so complex and diverse as to be comparable to that of coral reefs (Brey et al., 1994; Brandt et al., 2007; Teschke et al., 2021).

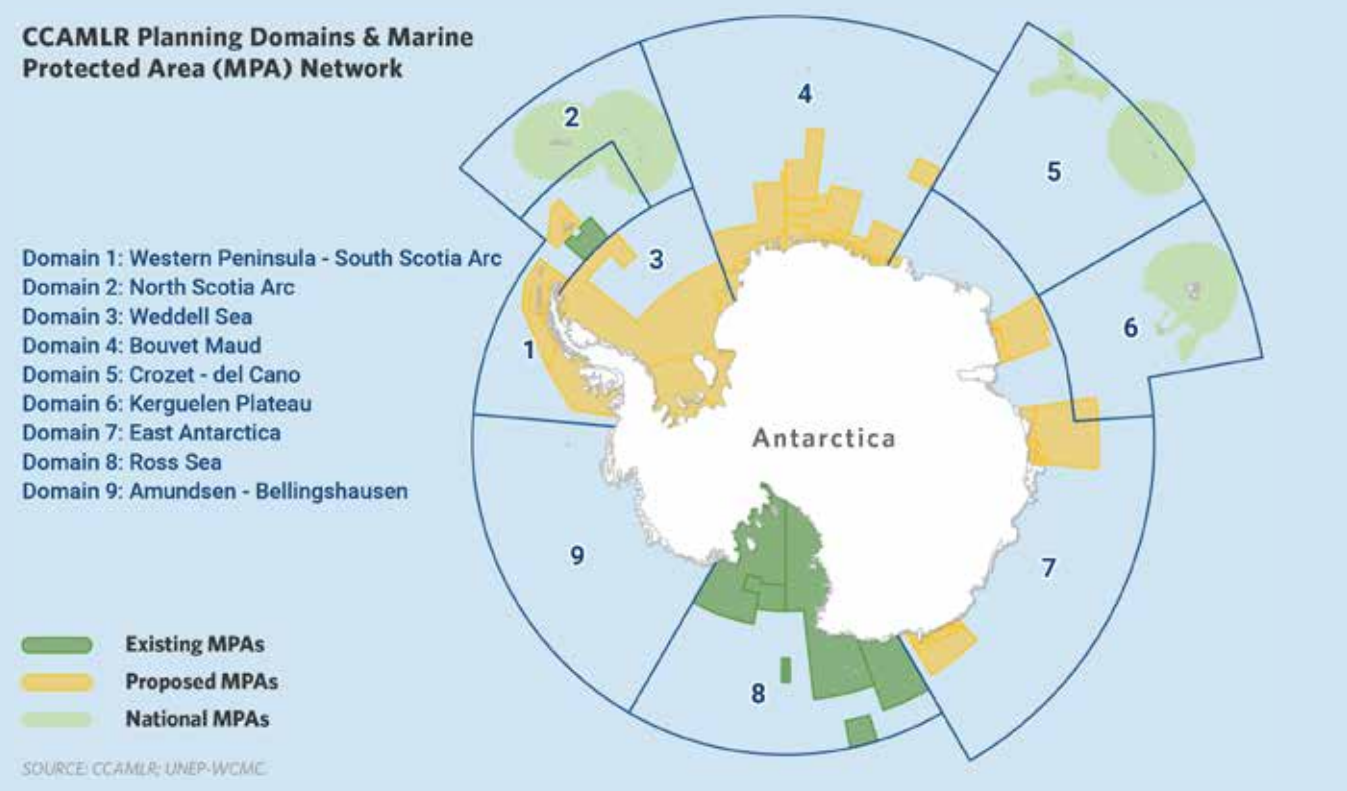

Figure 6: Map showing existing MPAs and proposed MPAs in the Southern Ocean. Credit: Michael Wissner, The Pew Charitable Trusts.

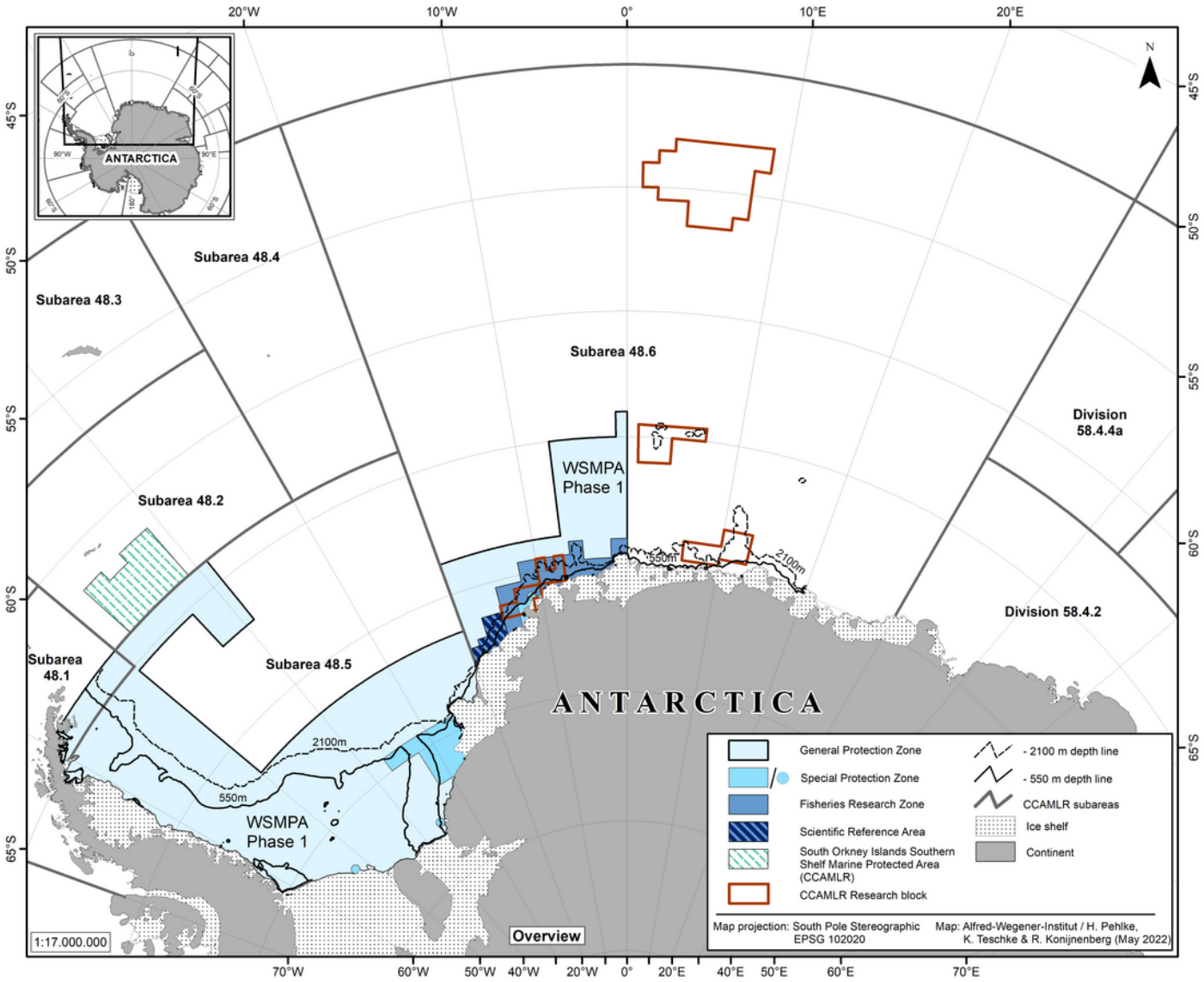

Figure 7: Proposed Weddell Sea MPA (WSMPA) Phase 1 (in blue). Source: Alfred Wagner institute Weddell Sea MPA proposal status 2023

To underscore just how biodiverse the Weddell Sea is, in 2022 the largest recorded fish nesting area anywhere in the world was discovered there. The Jonah's icefish colony is estimated to cover at least ~240 km^2 and contains an estimated total of ~60 million active nests (Purser et al., 2022).

The threats

The Weddell Sea is one of the last pristine areas of the Antarctic, having largely been spared from the impacts of industrialized fishing.

At present, fishing in the Weddell Sea region is limited to an exploratory fishery for Antarctic toothfish (*Dissostichus mawsoni*). This fishery is situated in the eastern part of the region and is regulated under Conservation Measure 41-04. Despite previous interest from the fishing sector, so far, no commercial or exploratory fishing for krill has occurred in the Weddell Sea.

Alongside the threat of potential fisheries emerging is the growing evidence that the Southern Ocean is now responding dramatically to climate change. In February 2023, the lowest sea ice extent was recorded around Antarctica since satellite observations began, surpassing a record that had been set just the year before. However, even during these record lows, sea ice in the Weddell Sea region remained comparatively stable, indicating increased resilience to climate change.

The Weddell Sea region is likely to serve as a refuge for cold adapted and sea ice-dependent organisms, further highlighting the importance of designating this region for protection.

Climate change will impact the distribution and abundance of species differently, based on factors such as latitude occurrence, baseline ecosystem stability, and species life-history strategy (Wege et al., 2021). Krill are responding to climate change in Antarctica with observable retractions in their range.

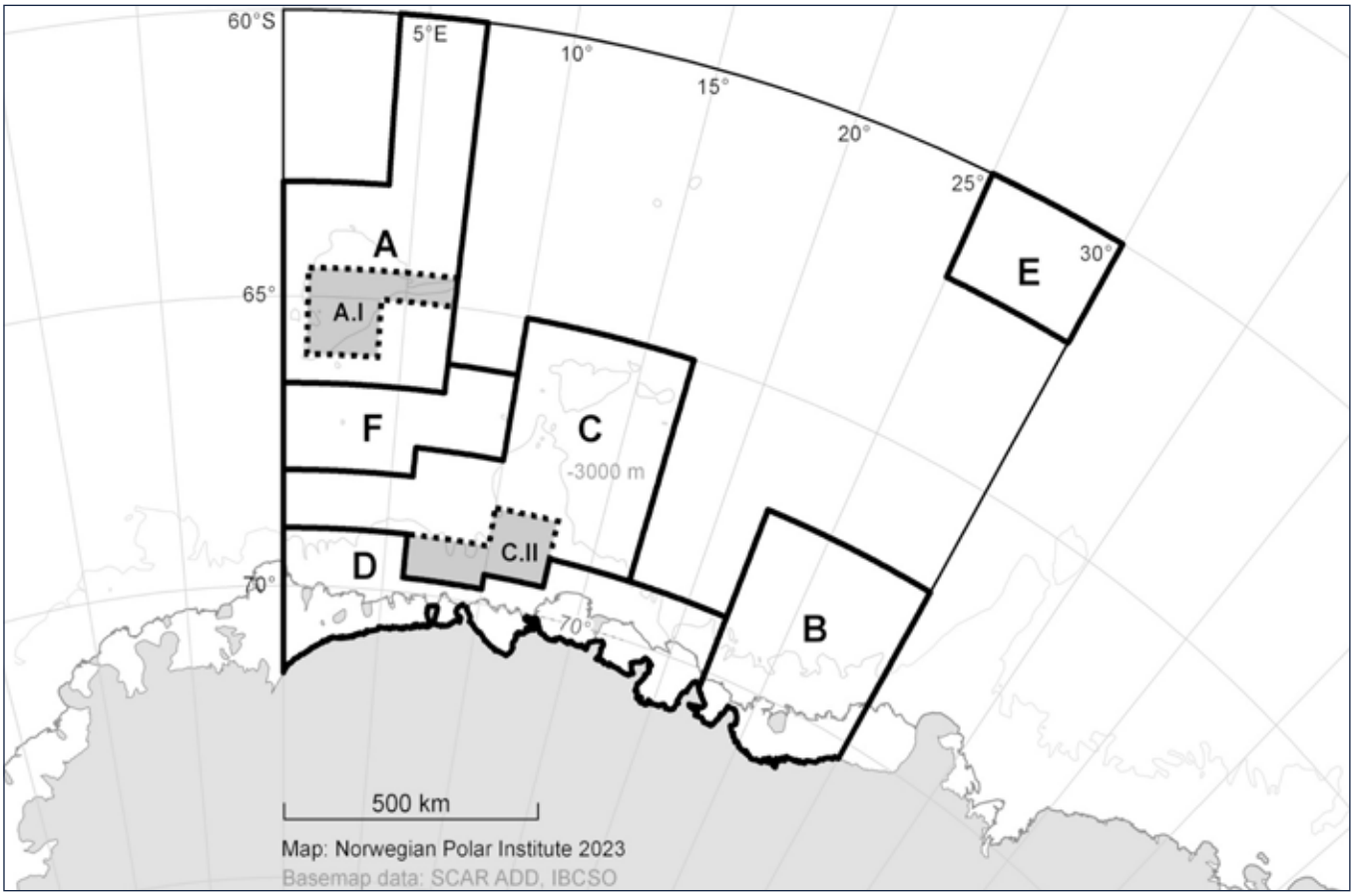

Figure 8: Proposed Weddell Sea MPA (WSMPA) Phase 2. The draft Conservation Measure 91-XX for WSMPA Phase 2 has two categories of management zones; General Protection Zones (Areas A, B, C, D, E & F) and Special Research Zones (Shaded grey Subareas, A.I and C.II) for inclusion under CCAMLR Conservation Measure 91-04. Credit: Norsk Polarinstitutt.

In time, climate change may shift krill's optimal habitat into the Weddell Sea (Teschke et al., 2022).

Where the krill go, the fishing fleet will undoubtedly follow and this will result in increased competition with krill-dependent predators, as they too will be on the move. It is important to implement effective protection on a precautionary basis, as mandated by the CAMLR Convention, in order to mitigate any future fishery impacts.

The proposed protection and its benefits

The need to protect this vital part of the Southern Ocean was first proposed by the European Union and its Member States, with Germany leading on the scientific work. The original Weddell Sea MPA (WSMPA) proposal was introduced in 2016 and spanned across Domains 3 and 4.

Following feedback from CCAMLR Members, the initial proposal has since been divided in two phases: WSMPA Phase 1 and WSMPA Phase 2. WSMPA Phase 1 was submitted in 2018 by the EU and its Member States and has since gained the support of Australia, Chile, India, the Republic of Korea, Norway, New Zealand, Ukraine, the United Kingdom, the United States, and Uruguay. It covers approximately 2.2 million km^2 and has a contiguous boundary with WSMPA Phase 2.

WSMPA Phase 2 is a concurrent rather than a successive MPA, being developed in coordination with the WSMPA Phase 1. Phase 2 extends the original WSMPA east of the zero-meridian line, with the division determined by data availability (Teschke et al., 2021).

WSMPA Phase 2 was introduced by Norway at CCAMLR 42 in 2023 and has the United Kingdom as a co-proponent. Its extension out to 30°E means the MPA will cover approximately 780,000 km^2. It allows for the inclusion of the priority areas for protection identified by scientists in the original WSMPA proposal, while also expanding connectivity to sensitive areas further east (Teschke et al., 2021).

Within the two Weddell Sea MPA proposals lie areas of known biological and oceanographic importance, including the Maud Rise. The proposals also encompass some of the most pristine natural regions in the world, with connective oceanographic pathways that transport nutrients and species' larvae to support ecosystems both within and beyond the MPA boundaries. The spillover effect of this MPA could therefore potentially support fisheries elsewhere.

Within the proposals, there are areas of mixed use that allow for research fishing in support of stock assessments, which are key to understanding toothfish dynamics. The inclusion of these areas, known as Fisheries Research Zones (FRZs), counters previous criticism that argued for a need for information to compliment "future rational use for dominant fish species and krill" (CCAMLR 38, 6.48, 2019).

The vast majority of CCAMLR Members – including most fishing nations – deem that the information presented within the proposal remains the best available scientific evidence. Despite this, to date CCAMLR has not reached consensus on the WSMPA Phase 1 proposal.

As pointed out by many Members at CCAMLR 42 in 2023, we should not wait for "an identifiable risk from fishing to determine an MPA" (CCAMLR 42, 5.15, 2023). By designating the Weddell Sea Phase 1 & 2 MPAs, an area larger than Kazakhstan would be protected in the Southern Ocean. This would more than double current protection in the Southern Ocean and deliver another large MPA towards the system of representative MPAs that CCAMLR agreed to install.

The region's apparent resilience to climate change means that MPAs situated in the Weddell Sea will act as a place of refuge for ice and extreme cold adapted species. MPAs themselves cannot address the profound threat that is climate change, but they can mitigate against it, and provide time and space for a number of species at their geographic and phenological extent to adapt.

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DOMAIN 1 MPA

The Antarctic Peninsula and South Scotia Arc is one of the most biodiverse places on the planet. It is home to millions of pairs of Adélie, chinstrap and gentoo penguins, significant populations of crabeater, Weddell, leopard, fur and elephant seals, as well as populations of cetacean species still rebounding after generations of overexploitation.

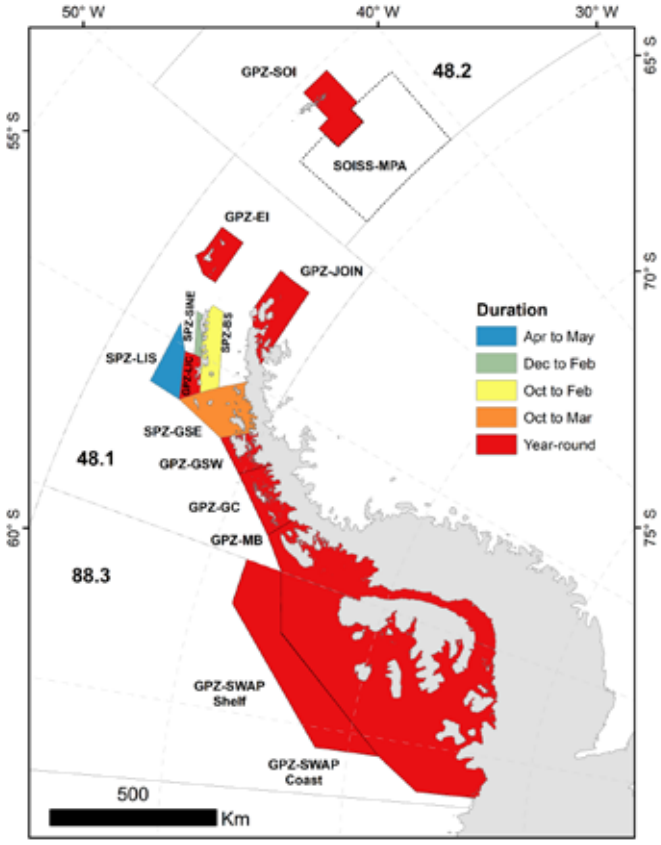

Figure 9: The Domain 1 MPA: General protection zones and seasonal protection zones with colors representing the periods of closure. Source: CCAMLR, 2024c.

The Peninsula extends for approximately 1,500 km into the Southern Ocean, with the Weddell Sea to the east and the Bellingshausen Sea to the west. The Peninsula was the last piece of Antarctica to disconnect from the other continents, creating the Antarctic Circumpolar Current (ACC) and initiating a cooling of the entire continent (Elliot, 1985; Antarctic Ocean Alliance, 2012).

The coalescence of deep channels and complex benthic geomorphology transport nutrients and heat into the shelf area, making the region one of the most productive areas of the Southern Ocean. This complex coastal circulation plays a key role in hosting an estimated 75% of the circumpolar population of the Antarctic krill (CCAMLR-42/26). These large swarms of krill draw large aggregations of birds and cetaceans in the austral summer and autumn and forms the foundation of the entire Antarctic Peninsula marine ecosystem.

The threats

Antarctic krill fishery activity began in 1961, predominantly in East Antarctica. After an exploratory period, since the early 1990s it has become concentrated almost entirely in and around CCAMLR's Atlantic sector (CCAMLR-42/26). Recent reductions in sea ice, coupled with an expansion of the krill fleet catching capacity, has resulted in greater overall effort and a southerly concentration of the fishery towards the Peninsula.

The vast majority of captured krill is processed into fish feed or nutraceuticals, and is not directly consumed by humans. The krill fishery has become more spatially concentrated over the past decade and record high catches are now primarily taken from just three localities: the Bransfield Strait/Mar de la Flota, the northwest of Coronation Island, and the north of Statistical Subarea 48.3 (CCAMLR Krill Fishery Report, 2021). This is having ramifications for krill-dependent species (Watters et al., 2020). With demand for krill expected to increase, the disturbances caused by this fishery are also likely to grow.

The Western Antarctic Peninsula (WAP) is among the most rapidly warming regions on Earth. Since the 1950s, the warming trend has been most observable in the northern and northwestern regions, with the Faraday–Vernadsky station registering an average 3.12°C of warming between 1951-2018 (Gorodetskaya et al., 2023).

The threats to the Peninsula and South Scotia Arc region also differ from those faced in other areas due to the growing tourism sector that frequents there each austral summer. Over 100,000 people visited this area in the 2022-2023 austral summer season (IAATO, 2023). There are likely to be cumulative impacts from these activities, including damage to vegetation, changes to microbial communities, disruptions to the food web, ship strikes of marine mammals, and introduction of non-native species and diseases (Tejedo et al., 2022).

The Peninsula region is therefore subject to multiple threats, with climate change, fishing activity and a growing tourism industry all affecting this sensitive area.

The proposed protection and its benefits

Designed through an extensive and scientifically rigorous process, the Domain 1 MPA (D1MPA) proposal covers an area of approximately 670,000 km^2 and references 143 spatial data layers. The proposal adheres to the precautionary principle, is based on best available science, and still allows for other sectoral activities. It represents the best hope for the Domain 1 region.

The MPA proposal includes both no-take areas where fishing is prohibited and areas where fishing is limited but still allowed. Importantly, the MPA would give new protections to two extremely biodiverse and ecologically rich areas: the Bransfield and Gerlache Straits, and parts of the Bellingshausen Sea.

These regions are important areas for iconic Antarctic species such as emperor penguins, chinstrap penguins, and Adélie penguins, all of which are showing decreasing trends in most of their populations in the WAP. The D1MPA would also protect nursery and other areas critical to the early life stages of krill, which are primarily located off the tip of the Antarctic Peninsula in the South Scotia Sea and Marguerite Bay.

More broadly, enacting protection around the Peninsula region will help safeguard krill and rebounding cetacean populations, whose breeding success is linked to krill availability. Cetacean conservation will be a direct gain from enacting the D1MPA, and their improved conservation in the Southern Ocean will also provide subsequent conservation gains elsewhere as the cetaceans migrate around the global ocean.

In addition to protecting biotic components, the D1MPA would safeguard several important benthic and pelagic bioregions. These include canyons, cross shelf valleys, and polynya margins, which are important areas for birds and marine mammals.

The Association of Responsible Krill Harvesting Companies (ARK) has implemented Voluntary Restricted Zones (VRZs) around the Peninsula, but this has been inadequate and has resulted in the displacement of fishing effort into other sensitive areas. Evidence suggests that VRZs have accentuated the spatial concentration of catches and fishing efforts in Subarea 48.1 and led to an increase in catches around the South Orkneys (ARK report, 2022).

The vast majority of CCAMLR Members recognize that the D1MPA proposal is clearly backed by science, and that arguments against its delivery on the basis of “lacking best scientific evidence” do not hold true. With 143 data layers, the fact that this proposal has not been adopted reveals a clear disparity emerging within CCAMLR between the amount of information that is requested for conservation initiatives to be adopted versus the minimum scientific and monitoring requirements for fishing activities to proceed.

CCAMLR needs to return to its founding objectives, which means focusing on conservation rather than extraction. In a region changing as quickly as the Peninsula, it is vital to act fast and implement conservation measures that will help build resilience in the region. The continuation of current activities will not only be to the detriment of iconic Antarctic species, but is counter to the Convention which CCAMLR was established to uphold.

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EAST ANTARCTIC MPA

East Antarctica is a vast expanse of ocean. Extending from 30°E to 150°E, it hosts areas containing an array of unique benthic and pelagic features, including continental shelf pelagic ecosystems, a continental ridge, seamounts, canyons, and presumed nursery grounds for young krill (Antarctic Ocean Alliance, 2012).

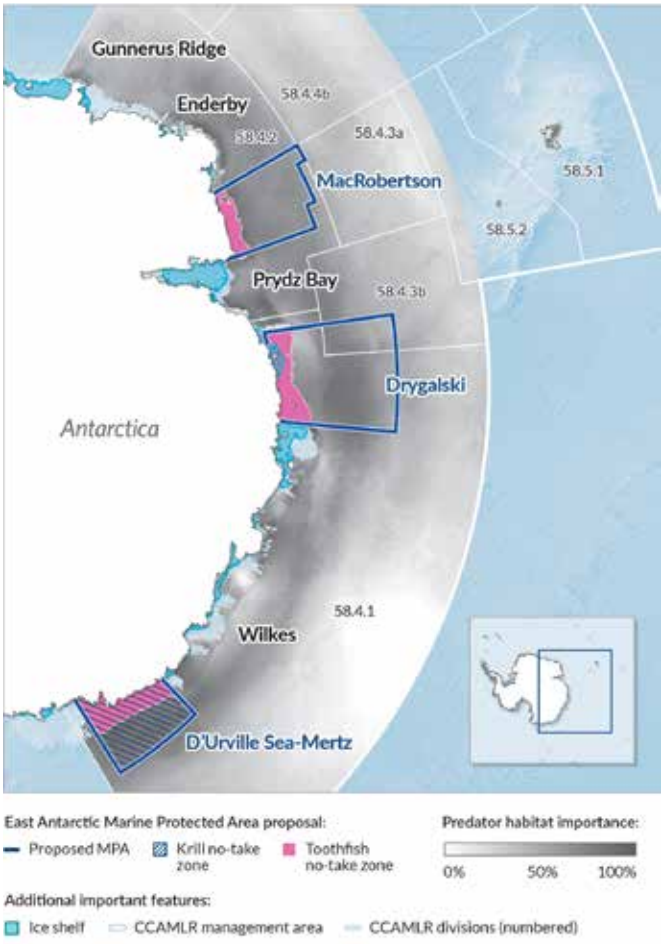


Figure 10: Extent of the East Antarctic MPA proposal. Source: The Pew Charitable Trusts, 2024a.

East Antarctica's proximity to a number of sub-Antarctic islands means that there are complex spatial-temporal ecological processes existing across huge ranges, adding to the uniqueness of the region. Some of this complexity is protected within MPAs implemented outside of the CCAMLR Area, but the vast majority remains exposed to present and future risks that are in urgent need of addressing.

The threats

The duality of climate change and fishing is ubiquitous across the Southern Ocean, with the two stressors affecting one of the most remote corners of our planet. Commercial fishing for both krill and toothfish is currently permitted in the waters of East Antarctica.

A responsive krill management system has not yet been implemented in East Antarctica, or the wider Southern Ocean, and the impacts of climate change on krill distribution in East Antarctica are poorly understood. Allowing the continued harvesting of such a key ecosystem species, when what little data we do have is showing declines, is counter to the objectives of the CAMLR Convention.

The proposed protection and its benefits

The East Antarctic is less studied than other areas of the Southern Ocean, but the information that is available shows that it is a place of extreme biodiversity and varying oceanographic conditions. For example, in a survey of the Cosmonaut Sea (30°~60° E), approximately 32% of the taxa observed were VME. These include sponges and cold-water corals, which provide an important habitat for a diversity of marine organisms (Mou et al., 2014).

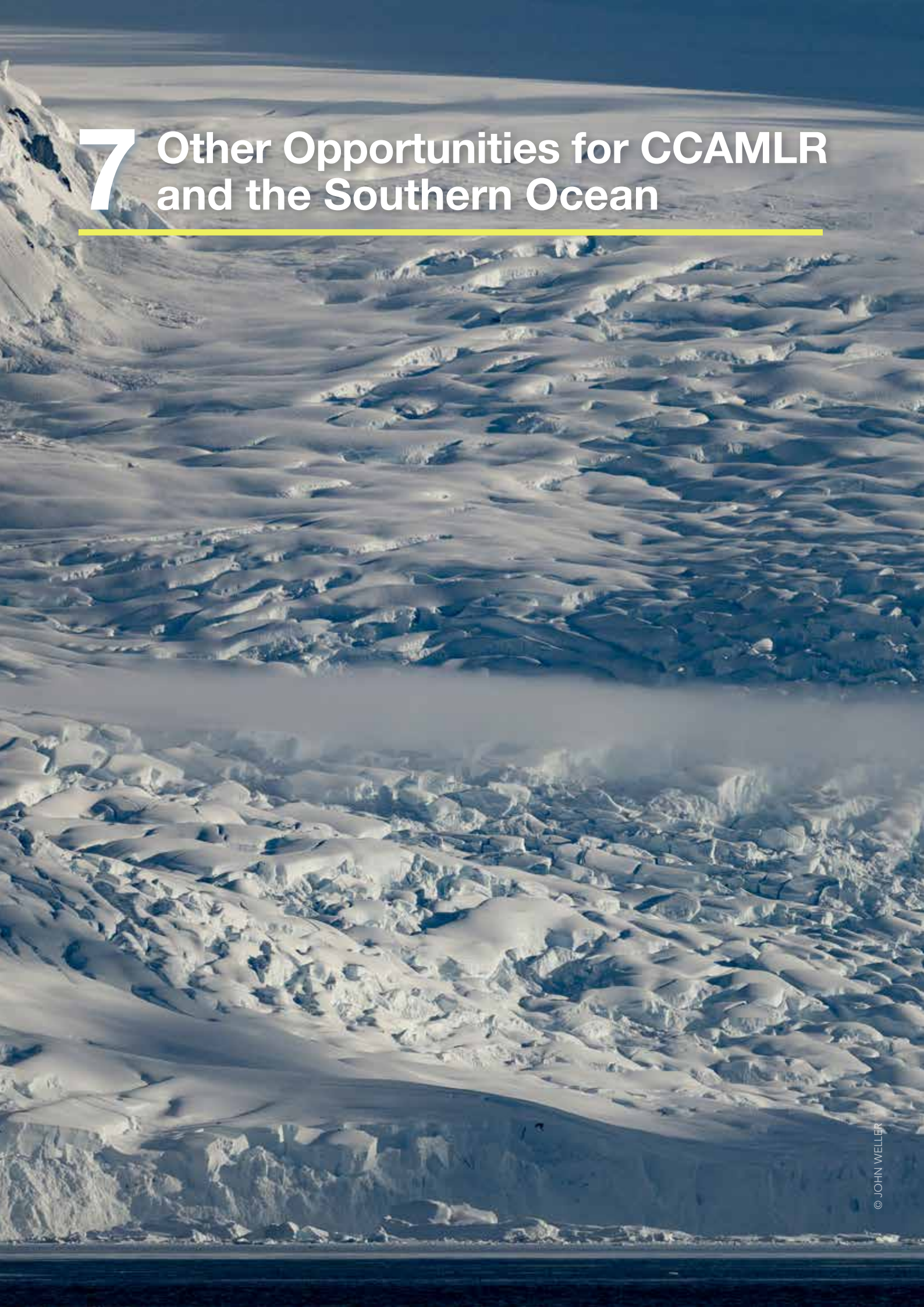
The East Antarctic MPA was initially proposed to cover a much broader area, divided into seven different blocks. The revised proposal currently being considered focuses on the areas where the best available information is present. It represents a compromise to CCAMLR Members whose interests are more vested in exploitation than conservation.

Designating this MPA would protect approximately 970,000 km^2 of biodiverse and heterogenous ocean space, falling into three areas: the MacRobertson, Drygalski, and D'Urville Sea-Mertz.

This MPA was first introduced over 10 years ago, making its designation even more urgent. Some CCAMLR Members have argued that the area is not a priority for protection as there is little fishing activity there. However, given CCAMLR's precautionary and ecosystem-based approach to management, threats do not need to be present for MPAs to be established (para 4.118, CCAMLR-42).

Given the adoption of the CBD's Global Biodiversity Framework, ASOC urges CCAMLR Members to give effect to the commitments made at the Kunming-Montreal Summit in 2022. Enacting the East Antarctic MPA will help ensure these promises will not ring hollow. The Southern Ocean is a part of the world that is rapidly changing in the face of climate change and action is needed now.

7 Other Opportunities for CCAMLR and the Southern Ocean



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CCAMLR and nations with sub-Antarctic territories in the Southern Ocean have the unique opportunity to meaningfully contribute towards global 30x30 ambition. CCAMLR and its Member States have responsibility for managing approximately 10% of the global ocean, covering an area with huge biodiversity, minimal human habitation, and a disproportionate risk of impacts from climate change and other anthropogenic stressors.

Enacting the four, large-scale MPAs discussed previously in this report would be a sea change in protection and a monumental achievement. Combined with the existing Ross Sea Region MPA and the SOISS MPA, the total area of protection would be over 6.8 million km^2, or approximately 26% of CCAMLR's jurisdictional area.

Adopting these four MPAs would still leave some CCAMLR planning domains without protection. With enough ambition and cooperation, CCAMLR and its Members could enhance protection to the Domain 9 region and achieve the protection of 30% of the Southern Ocean by 2030, a true embodiment of the global commitment to 30x30.

Domain 9 MPA

Domain 9 is a vast region, comprising the Amundsen and Bellingshausen Seas, and is home to unique and globally significant ecological features and species (Adams et al., 2021). Importantly, Domain 9 is a region with little to no management planning, leaving a critical area of the Southern Ocean unprotected.

Based largely in the Pacific-facing section of the Southern Ocean, Domain 9 contains over 55 known seamounts and seamount ridges. As seamounts rise from the seafloor, they drive ocean currents, altering nutrient-rich flows into shallower water and creating highly productive, diverse communities of marine life (Adams et al., 2021).

Domain 9 has a number of polynyas, which are areas of persistent open water surrounded by sea ice. The Amundsen Sea Polynya is, on average, the most productive polynya in the Antarctic, with the highest interannual variation (Adams et al., 2021). Adding to Domain 9's significant oceanographic and biological diversity is Peter I Island. Formed through previous volcanic activity, the benthic region surrounding Peter I Island has an incredibly high level of species abundance and diversity, notably among marine invertebrates.

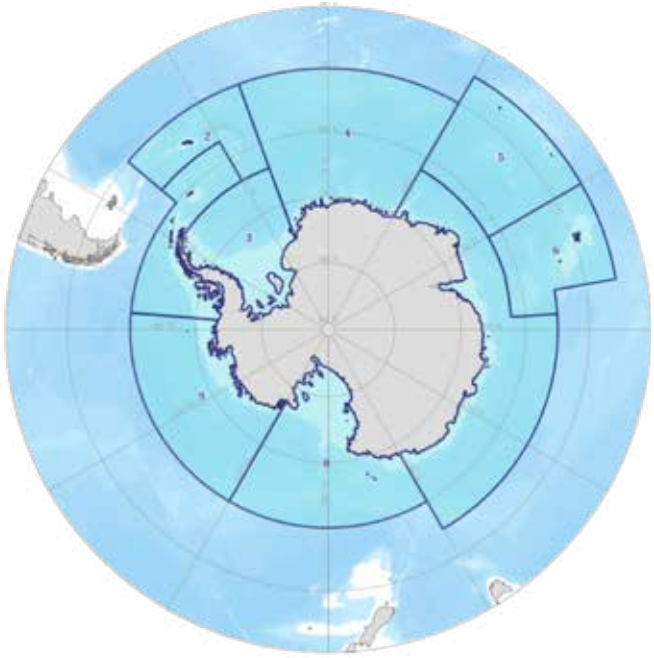


Figure 11: CCAMLR MPA Planning Domains. Source: CCAMLR, 2021b.

The threats

Domain 9 is arguably the least well known of CCAMLR's management areas and the one most noticeably lacking in any proposed protection. The development of an ecosystem as diverse as Domain 9's takes time and minimal disturbance, two things the region is now running short on.

The Amundsen and Bellingshausen Seas were once characterized by persistently lower temperatures than other parts of Antarctica, with vast sea ice cover and far distances from ports preventing fishing vessels from accessing the area (Adams et al., 2021). However, climate change is beginning to rapidly change the region. Observable warming is creating some of the most noticeable shifts in ice shelf dynamics in the Antarctic, rendering the region increasingly accessible to fishing activity (Adam et al., 2021).

Ice shelf retreat is most apparent in Domain 9. The Thwaites and Pine Island glaciers are undergoing rapid retreat, the latter being Antarctica's fastest melting glacier and responsible for approximately 25% of total Antarctic ice loss (Adams et al., 2021). The water input from these glaciers will have local and global ramifications, ranging from emerging fishing opportunities as new areas become accessible, to rising sea levels and changing weather patterns. At CCAMLR, the United Kingdom has consistently recommended that areas on the seafloor exposed because of retreating ice shelves be automatically protected as no-take areas, on the precautionary basis of ice shelf collapse, but this has been repeatedly blocked.

How these changes in the cryosphere are impacting local ecosystems is now becoming more apparent. Within Domain 9, there are a number of ice-breeding emperor penguin colonies now at risk due to sea ice instability. In late 2022, an early sea ice breakup caused the emperor penguin colonies in the Bellingshausen Sea to experience total breeding collapse, with an estimated 9,000 chicks dying (WWF, 2023).

The duality of climate change interacting with other human activities is also at play in Domain 9. There is exploratory toothfish fishing in the Amundsen Sea and research fishing for toothfish in the Bellingshausen Sea (Adams et al., 2021). The impacts of this fishing on the wider ecosystem in Domain 9 is still poorly understood, and any attempt at management is further complicated due to research fishing blocks having high overlap with known areas of high biodiversity (Boothroyd et al., 2024).

The proposed protection and its benefits

Despite the region's remoteness, there is information available on Domain 9's geomorphology, apex predators, special features, and fisheries habitats (Boothroyd et al., 2024). It is known that Domain 9 has a productive shelf and a number of polynyas, which have created suitable conditions for VME taxa to exist.

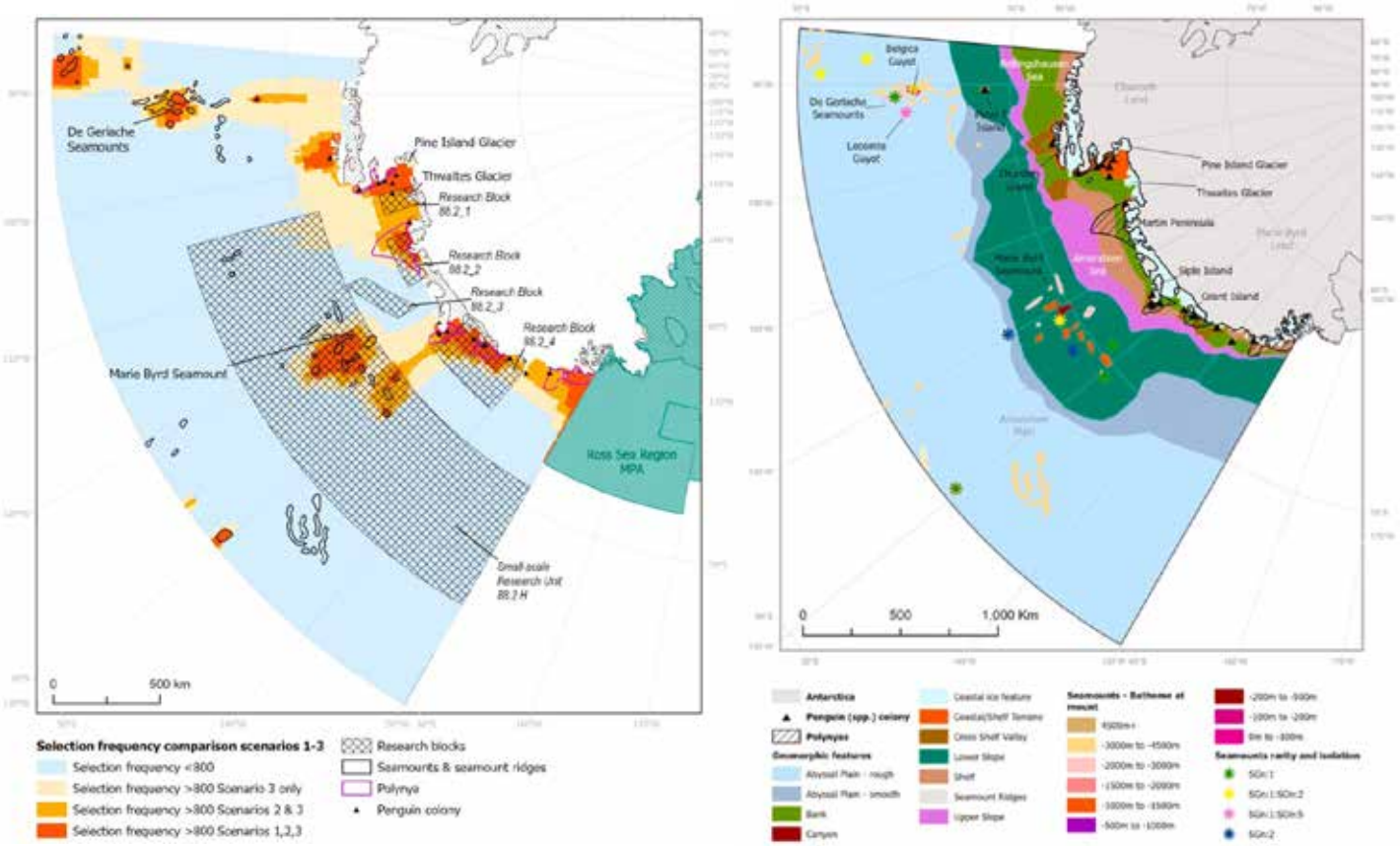
Currently, CCAMLR provides limited spatial protection for some VMEs, including cold-water corals, seamounts, and hydrothermal vents, but only a very small proportion of known VMEs in Domain 9 are provided protection under existing conservation measures (Adams et al., 2021).

It is essential that CCAMLR acts with precaution and implements measures that will conserve Antarctic marine ecosystems in Domain 9. An MPA will offer VMEs permanent protection and would also represent globally inspiring progress towards CCAMLR's commitment to establish a representative system of MPAs.

Although CCAMLR has yet to begin the formal process for developing a Domain 9 MPA proposal, a suite of information from scientific surveys and research outside the usual CCAMLR process from which to draw on is available (Boothroyd et al., 2024).

Today, the noticeable absence of formal domain planning in Domain 9 undermines CCAMLR's ambition to create a circumpolar network of MPAs. This will not be possible without representative protection of the Southern Ocean bioregions and biodiversity contained in Domain 9.

Enacting an MPA in Domain 9 would narrow the gap in domain planning and strengthen the representative system of MPAs promised by CCAMLR 15 years ago.



Figures 12 and 13: Geomorphological and likely sensitive sites in the Domain 9 area, that could be incorporated in a proposed MPA for the planning domain. Source: Douglass 2012, Boothroyd et al., 2024.

Nationally Determined MPAs

While CCAMLR continues to struggle in its implementation of MPAs in domains across the Southern Ocean, opportunities exist to rapidly expand marine protection within the Exclusive Economic Zones (EEZs) of several nations that are Members of CCAMLR.

Australia, France, Norway, South Africa, and the United Kingdom all have jurisdiction over islands in the Southern Ocean. Fully protecting large areas of the waters surrounding these islands would help safeguard marine life and strengthen the proposed system of Southern Ocean MPAs.

Research from across the globe shows that networks of interconnected and ecologically representative MPAs are among the most effective ways to preserve and restore marine ecosystems and make them more resilient to the impacts of climate change.

AUSTRALIA

Macquarie Island & Heard and McDonald Islands

Macquarie Island and its surrounding smaller islands sit approximately halfway between New Zealand and Antarctica. As one of only three ridges that impede the eastward flow of the Antarctic Circumpolar Circulation (ACC) across the Southern Ocean, they are oceanographically very important. This unique current in the region creates significant differences in physical and biological oceanography to the west and east of the ridge. The islands' EEZ is divided by two major fronts, the Sub-Antarctic Front and the Polar Front (Creswell et al., 2023).

The Macquarie Island group is ecologically diverse and known to contain significant benthic and pelagic ecosystems. The islands form 'stepping stones' linking sub-Antarctic and polar faunas (Creswell et al., 2023). Within the pelagic realms, the island group supports a huge diversity of marine life, including 57 species of seabirds (including four species of penguin and four of albatross) and 13 species of cetacean (Cresswell et al., 2023).

In 2023, the Australian Government announced an expansion of the marine park around Macquarie Island. This enhances protection by encompassing 93% of the EEZ in fully protected areas, while still allowing for a discrete fishery for Patagonian toothfish to occur (The Pew Charitable Trusts, 2024b).

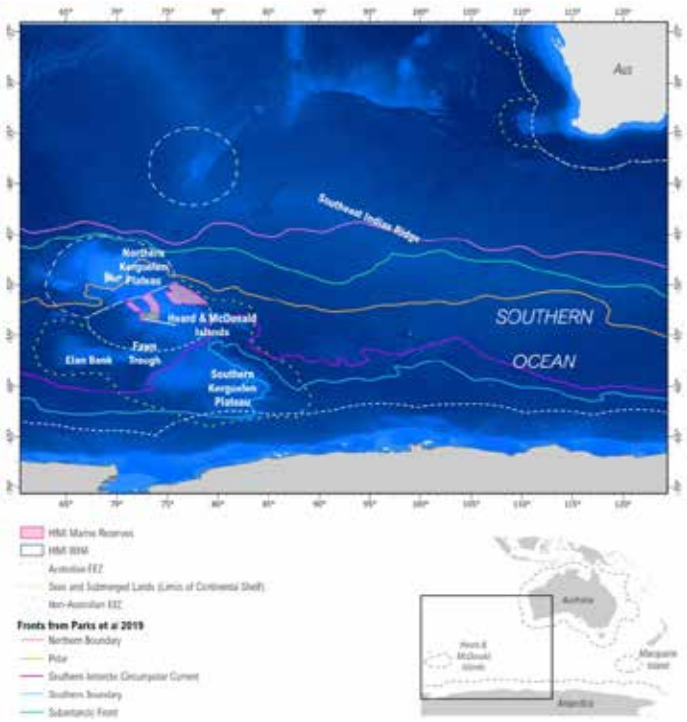


Figure 14: Overview map of Heard Island and McDonald Islands (HIMI) in the Southern Ocean. Credit: M. Davey. Source: Constable et al., 2024.

This expansion in protection is a welcome change from the glacial pace occurring in CCAMLR. ASOC urges Australia to be similarly ambitious and expand protection in the Heard and McDonald Islands EEZ.

The Heard and McDonald Islands (HIMI) are surface exposures of the Kerguelen Plateau (Quilty, 2005) and possess an incredibly dynamic natural environment dominated by volcanism, glacial action, and major ocean currents (Commonwealth of Australia, 2014). HIMI, and the area around the Kerguelen Plateau, host a range of unique ecosystems: from benthic communities that include rarely sighted, cold adapted species, to highly productive pelagic ecosystems that support a diverse range of marine species, including fish, seabirds, marine mammals, and invertebrates (Constable et al., 2024).

The HIMI area currently has two fisheries operating within its EEZ, a longline toothfish fishery and a small demersal trawl fishery for mackerel icefish. Bottom trawling is well known to have deleterious effects on benthic habitats and produces large amounts of bycatch (Stiles et al., 2010; Steadman et al., 2021). CCAMLR has deemed bottom trawling on the high seas to be incompatible with rational use activity (CM 22-05). A major impact of these fisheries in HIMI is the large bycatch of numerous protected species, including skates, sharks and rays. Skates are of particular concern, given their high percentage of bycatch and the lack of a fishery independent assessment for deepwater species (Constable et al., 2024).

Recognizing the importance of this region, a 65,000 km^2 marine reserve was enacted in 2002. In 2014, it was expanded to incorporate an additional 6,200 km^2 of protection (Commonwealth of Australia, 2014).

At the time of writing, the HIMI marine reserve is undergoing another review. Constable et al. (2024) illustrates the most recent scientific information available to inform a change in management for the marine reserve. Species tracking indicates that increased southwards and eastwards protection would have the greatest conservation gains, while still permitting the fisheries to continue operating. From a management perspective, enlarging and increasing the connectivity between the different management polygons would also make enforcement easier.

This is an opportune time to add further protection in the Southern Ocean and to reflect the importance of the HIMI marine reserve to the proposed MPAs in CCAMLR's planning domains.

FRANCE

Terres Australes et Antarctiques Françaises: Crozet Islands, Kerguelen Islands, and Saint Paul and Amsterdam Islands

France has the second largest marine estate in the world, measuring over 10 million km^2, with 2,163,558 km^2 of this located in the Southern Ocean (Terres Australes Françaises, 2024). To put that in perspective, the total EEZ of the French Islands in the Southern Ocean is greater than the entire EEZ of the Philippines.

France is a committed champion of ocean protection, with President Macron pledging to protect 10% of French waters by 2022 and subsequently reaffirming France's ocean commitments by being an early signatory to the GBF.

The Terres Australes et Antarctiques Françaises (TAAF), meaning French Southern and Antarctic Lands, are a diverse grouping of islands that host an array of wildlife. They are recognized as Important Marine Mammal Areas (IMMAs) due to the importance the region has for many cetacean and pinniped species. Moreover, the Crozet and Kerguelen islands provide refuge to the world's largest king penguin colony and second-largest southern elephant seal colony. Saint Paul and Amsterdam Islands are home to the 30 remaining breeding pairs of Amsterdam albatross (The Pew Charitable Trusts, 2022).

Like many other sub-Antarctic islands, the TAAF region contains unique oceanographic properties that make their protection paramount. In 2022, the French Government finalized a review of the TAAF, building on the management measures already in place, and determined further protection was warranted. They expanded protection in the TAAF EEZ by approximately 1 million km^2 (The Pew Charitable Trusts, 2022), increasing the total area that prohibits human activity to 375,000 km^2. This is approximately 23% of the TAAF EEZ (Terres Australes Françaises, 2024).

However, the protection offered is not homogenous across the TAAF EEZ, with Saint Paul and Amsterdam Islands accounting for much of this recent increase in protection. By contrast, Crozet Islands remains largely open to human activities, including fishing.

While this huge expansion in protection is rightly celebrated, it still falls short of 30x30 target to which France is committed.

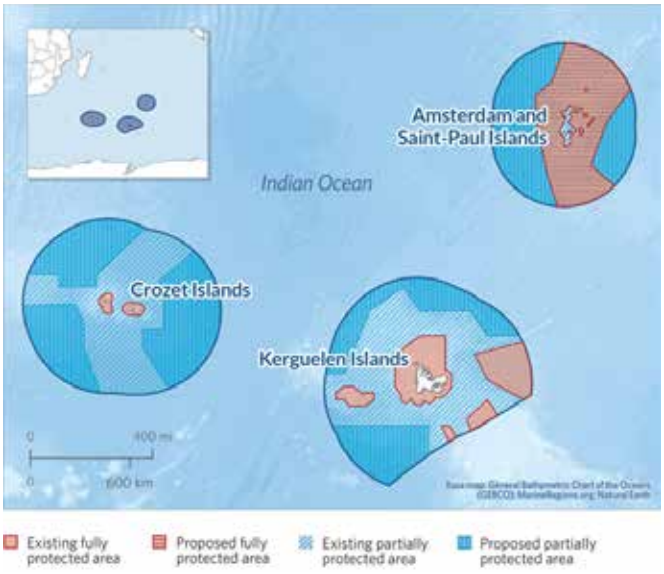


Figure 15: MPA extent in the TAFF region and the spatial distribution of protection across the island group. Source: The Pew Charitable Trusts, 2022.

Figure 16: The Southern Ocean with reference to Bouvet Island (top right of image) and its marine reserve. Source: UNEP-WCMC, 2024.

NORWAY

Bouvet Island (Bouvetøya)

Situated at the Southern limit of the Atlantic Ocean, Bouvet Island (Bouvetøya) is one of the most isolated islands on Earth and a global hotspot for marine mammals. The island's isolation accentuates its importance as a breeding haul out for pinnipeds, and it serves as a rich feeding ground for whales as they forage on dense swarms of krill (IMMA, 2024).

In recognition of Bouvet Island's importance, in 1971 the Norwegian Government declared the territorial waters surrounding the island as a nature reserve. However, outside of the reserve, commercial fishing targets both species of toothfish.

The marine reserve is a good first step but, in light of new evidence and a changing climate, additional protection needs to be implemented. Current protection does not encompass important large-scale features. Bouvet Island is geographically isolated, but oceanographically connected, with a host of ridges and seamounts connecting it more broadly to the rest of the Southern Ocean (Antarctic Ocean Alliance, 2012).

Tracking studies show that Antarctic fur seals that pup at Bouvet Island forage in an area spanning 200 km around the island, ranging from over the mid-Atlantic ridge to the north of the island, to roughly equidistant regions west and south (Biuw et al., 2009; Blanchet et al., 2013; Lowther et al., 2014). More tracking information shows that Bouvet Island's EEZ is an important foraging ground for Ross seals, which breed in ice habitats along coastal Queen Maud Land (Blix and Nordoy, 2007).

Given the information available on species movement around Bouvet Island, and its importance as a global hotspot for marine mammals, a unique opportunity exists for Norway to rapidly expand the current marine reserve from its present boundary out to 200 nautical miles from the coast.

By creating an IUCN Category 1 MPA, Norway would protect key oceanographic features and the local ecosystem from the impacts of human activity. This would safeguard Bouvet Island and strengthen the protection of the Southern Ocean.

SOUTH AFRICA

Prince Edward Islands

The sub-Antarctic islands of Marion Island and Prince Edward Island are part of South African territory. Situated approximately 2,000 km southeast of Cape Town, the islands are of global importance.

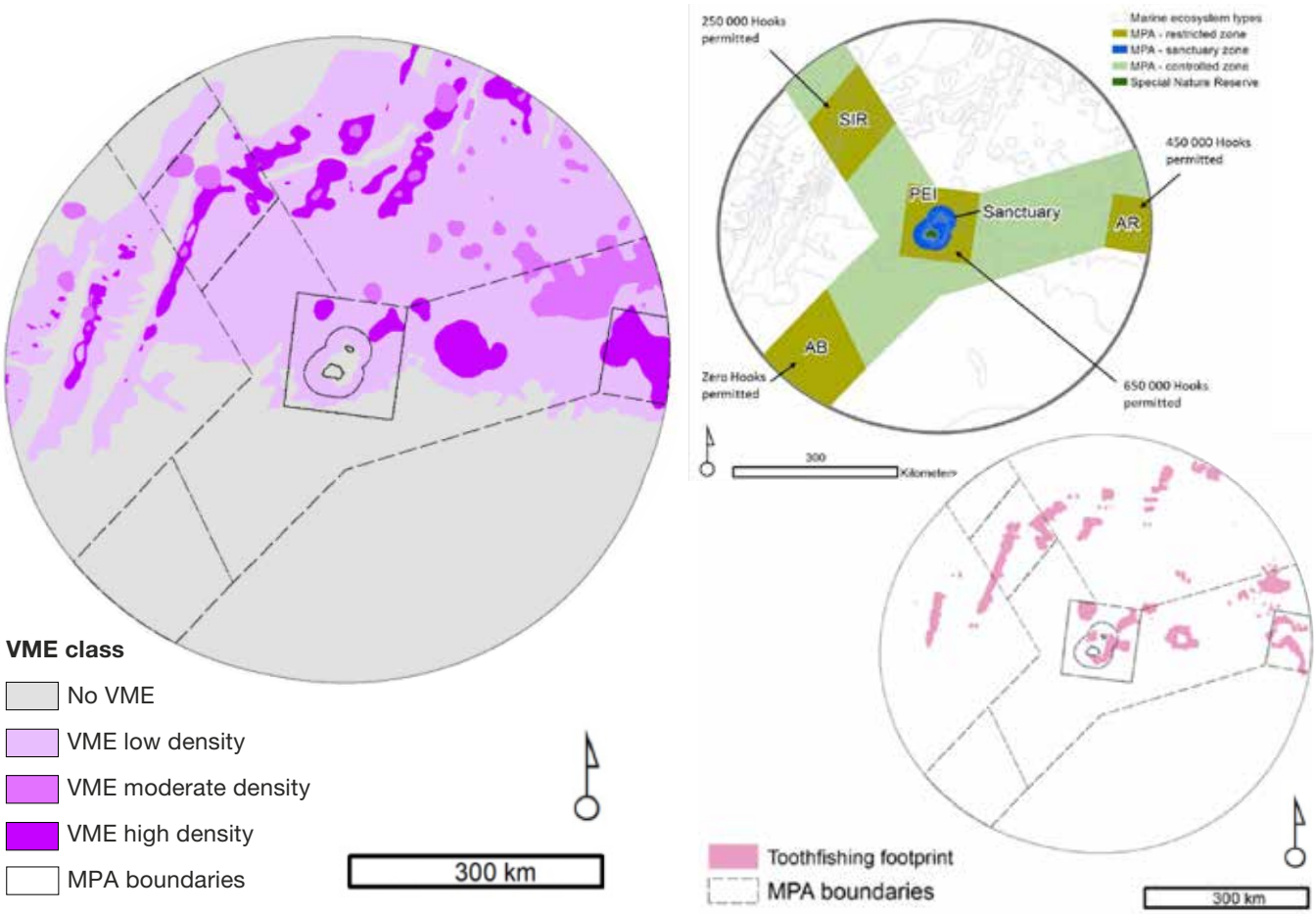
Like many other sub-Antarctic islands, the scarcity of land masses in the Southern Ocean acts as a concentrator of marine life, with the Prince Edward Islands group hosting vast populations of seabirds and pinnipeds. The aggregation of such biodiversity makes them vulnerable to disturbance and requires the highest level of protection.

To date, longline fishing for Patagonian toothfish has been the main threat to the marine ecosystem and biodiversity around the islands (WWF, 2013). The Prince Edward Islands MPA was designed in 2007, offering 180,000 km^2 of protection. The proposed MPA had a varied approach to allowable activity and protection, with four IUCN Category 1a reserves (13% of EEZ), two Conservation Zones (21% of EEZ), and three Category IV reserves (remainder of EEZ) (Lombard et al., 2007).

However, the initial ambition of the proposed MPA was subsequently constrained and the implemented protected area has less than 5.5% of the EEZ under full protection. Moreover, since much of the fishing effort occurs in the north of the EEZ, the implemented measures allow fishing activity to continue uninterrupted.

Much has changed since the MPA was designed (2007) and implemented (2013), with far more data now available, including on climate change projections. The original authors of the MPA proposal encouraged a formal review of the MPA (once implemented) to “accommodate shifting processes” and take into account “new data becoming available” (Lombard et al., 2007).

The world, and the Southern Ocean in particular, is a very different place compared to when the Prince Edward Islands MPA was first implemented. New global commitments to 30% effective ocean protection means that all nations that have signed the CBD Global Biodiversity Framework, including South Africa, should seek ways to enhance the protection of the marine areas they are custodians of.



Figures 17, 18, 19: Left hand side showing VME localities in Prince Edward Islands EEZ; top right showing present MPA design; bottom right showing fishing footprint in the EEZ. Source: Whitehead et al., 2019.

UNITED KINGDOM

South Georgia and South Sandwich Islands

The South Georgia and South Sandwich Islands (SGSSI) are two separate island groups bound together in a management regime managed by the United Kingdom, although the islands' sovereignty remains contested by Argentina.

The SGSSI region is extremely diverse and home to unique species and fragile ecosystems found nowhere else on Earth. Crucially, it is a part of the world in ecological recovery. The humpback whale population, which declined to just 450 individuals in the 1950s, has rebounded to 93% of its pre-exploitation size (Zerbini et al., 2019).

Climate change is exerting ecological and environmental perturbations in ways we are only just beginning to identify in the region.

There is an MPA in place in SGSSI, which is subject to review every five years to evaluate effectiveness and incorporate the most up-to-date research and data. The latest review occurred in 2024, and recognized the emergent and growing threats to the region. In response, the Government of SGSSI enacted an additional 166,000 km^2 of zero or extremely limited use areas in the waters surrounding these remote islands.

Fully protected areas within the MPA, which limit nearly all fishing activity, now encompass approximately 450,000 km^2, an area roughly twice the size of the UK. These additional measures result in approximately 36% of the SGSSI Maritime Zone being closed to fishing activity. This represents one of the few places on Earth which has already succeeded in reaching the 30x30 target.

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Recommendations for Nationally Determined MPAs

The past two decades have seen monumental progress towards conserving the Southern Ocean, with much of this protection stemming from nationally determined MPAs.

However, with climate change exerting huge pressure on the entirety of the Southern Ocean and increased anthropogenic interest in the region, efforts must be redoubled to ensure the beauty and magnificence of this area for future generations.

ASOC encourages all nations with the privilege of responsibility for areas of the Southern Ocean to ensure that they benefit from optimal protection by regularly reviewing their MPAs in light of the latest available scientific information.

In particular, ASOC:

1. Urges the Australian Government to significantly expand the marine reserve boundaries within the HIMI EEZ, accounting for new information on species distribution and foraging activity, to ensure that any activity within the marine reserve is extremely limited and aligns with IUCN Categories 1 and 2 requirements.

2. Encourages managers for the TAAF region and the French Government to build on the huge strides made in 2022 and safeguard more of the TAAF, particularly around Crozet Islands, thereby enabling France to continue its leadership role in global ocean protection and achieve the 30x30 target that France has agreed to.

3. Encourages the Norwegian Government to immediately expand the marine reserve boundary around Bouvet Island from its present boundary to 200 nautical miles and, in doing so, create an IUCN Category 1 MPA to protect key oceanographic features and the local ecosystem.

4. Urges the South African Government to begin a review process of the Prince Edward Islands MPA, utilizing new tracking data and a better understanding of climate change impacts to improve the MPA.

5. Supports the review of the SGSSI MPA every five years, or more frequently if data suggest urgent action is needed, since climate change is set to profoundly impact the region.

8 Recommendations

"Nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide."

This is the opening message of the 2019 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report, a landmark document that helped raise awareness of the plight of the environment globally and formed a foundational step towards the international adoption of the 30x30 target in 2022.

Urgent action is needed if we are to exist on a planet that can support the complex, unique and irreplaceable ecosystems that are present in regions such as the Southern Ocean. This report has flagged the threats facing the Southern Ocean, as well as the opportunities that exists to help mitigate them.

Once heralded as a shining light in international cooperation and conservation, CCAMLR is now lagging behind both the alarming rate of change the region is undergoing, and efforts being made globally to realize 30x30 ambitions.

The mechanism for designating MPAs under CCAMLR is established and proven effective. What is needed now is the political will to move forward.

Many scientists, conservation groups, tourism bodies, and even fishing organizations are raising their concerns about the rapidly changing nature of the Southern Ocean and Antarctica, and yet action is still not forthcoming.

Twenty-six Members of CCAMLR have signed onto to the CBD Global Biodiversity Framework (GBF), a ground-breaking agreement that was driven primarily by China. The adoption of the GBF was a moment the world came together, and the efforts of China and other CCAMLR Member States should be lauded. However, the actions in securing the adoption of the GBF by 196 countries are dichotomously opposed to the actions in CCAMLR. ASOC urges CCAMLR to return to its position of leadership in ensuring the planet is habitable for all.

Compounding the inertia in CCAMLR is the fact that climate change is already having an observable impact on marine life in the Southern Ocean, from genes to ecosystems. Climate change will continue to pose an increasing risk, driven by its accelerating pace and interactions with other human activities like fishing and tourism.

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Fortunately, the tools to help safeguard the marine environment already exist. Well-designed MPAs with strong levels of protection, which encompass all trophic levels of an ecosystem, have been shown to increase species' biomass and genetic diversity, which in turn enhances resilience to environmental impacts (Chavez-Molina et al., 2023). Moreover, while the main objective of MPAs is to promote the conservation and recovery of exploited species within their boundaries, they simultaneously produce benefits for adjacent areas via spillover effects (Ashford et al., 2022).

Today, approximately 13% of the Southern Ocean is effectively protected, with a mere 4.6% contained in no-take areas. This is significantly behind the global 30x30 target. A rapid response from CCAMLR is essential.

Time is not on our side and there is an urgent need to accelerate progress towards marine protection. Implementing the MPA proposals that have already been agreed by almost all CCAMLR Members is an essential step in the right direction. Other States should also follow the UK's and France's recent efforts and revisit MPA proposals in their national waters in the Southern Ocean, increasing their level and area of protection in light of growing pressures in the region and the rapidly changing climate.

RECOMMENDATION I

CCAMLR to implement the MPA proposals

There remain four MPA proposals yet to be adopted by CCAMLR. The Antarctic Peninsula (Domain 1), Weddell Sea Phase 1 and East Antarctic MPA proposals have been on the table for several years and are supported by high-quality science.

The gaps in CCAMLR's MPA domain planning means a representative system of MPAs is far from completion, leaving entire ecosystems unprotected.

Rapid designation of the proposed MPAs is critical. We encourage any CCAMLR Members which have opposed or blocked MPA adoption to consider the huge conservation benefit they stand to bring to the Southern Ocean, and to note the significant compromises that have already been made to each respective proposal since its initial presentation to CCAMLR.

ASOC urges CCAMLR to act under the precautionary principle, and to follow the advice provided by SC-CAMLR based on the best available science, by implementing the proposed MPAs across all its planning domains. The MPA proposals that have been endorsed by SC-CAMLR contain far more information than is currently required for the evaluation of fishing activities.

It is time to return to the reason the CAMLR Convention was conceived: to protect Antarctic marine living resources.

RECOMMENDATION II

CCAMLR to develop and implement a Domain 9 MPA

It is imperative that CCAMLR acts with precaution and begins the formal process of implementing measures that will conserve Antarctic marine life in Domain 9. The noticeable lack of a formal MPA proposal in this domain leaves CCAMLR's promise to establish a system of MPAs unfulfilled and lacking representative protection of Southern Ocean bioregions and the biodiversity they contain.

Twenty-six Members of CCAMLR are signatories to the GBF agreement and have made a clear promise to protect nature.

CCAMLR could contribute meaningfully to the global objective of 30x30 by adopting all current MPA proposals. Furthermore, CCAMLR could fully meet the 30x30 target in the Southern Ocean by 2030 by including additional protected areas, such as in Domain 9. No other region will have achieved comparable protection, a true feat of international ambition and a testament to the founding tenants of the Antarctic Treaty System.

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.

ASOC urges CCAMLR Members to come together and begin the necessary process to implement an MPA in Domain 9. This MPA would protect productive polynyas and the numerous VMEs, including cold-water corals, seamounts, and hydrothermal vents, that are known to exist in this region, particularly around Peter I Island.

RECOMMENDATION III

CCAMLR Members with nationally determined MPAs to review them to account for a changing climate

Given the rapid environmental changes in the region, ASOC recommends that all nationally determined MPAs within the Southern Ocean undergo review to strengthen marine protection in response to shifting conditions.

The recent enhancements to Southern Ocean MPAs made by France, Australia, and the Government of SGSSI is encouraging and serves as a model to others to follow suit in safeguarding the Southern Ocean. Specifically, ASOC urges:

a. The Australian Government to significantly expand the marine reserve boundaries within the Heard and McDonald Islands EEZ, and ensure that any activity within the marine reserve is extremely limited and aligns with IUCN Categories 1 and 2 requirements.

b. The French Government to revisit its marine spatial planning for Crozet Islands, which remains largely open to human activities such as fishing, to help France reach its commitment to conserve 30% of its marine environment through protected areas by 2030.

c. The Norwegian Government to immediately expand the reserve around Bouvet Island to 200 nm and in doing so create an IUCN Category 1 MPA to protect key oceanographic features and the local ecosystem.

d. The South African Government 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.

e. The SGSSI Government to continue the formal MPA review every five years, or more frequently if data is suggesting urgent action is needed.

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9 Conclusion

Implementing the recommendations in this report would fulfill CCAMLR's ambition of establishing a representative system of MPAs across the Southern Ocean. Moreover, it would send a clear signal that CCAMLR has returned to its place as a global leader in collaboration and conservation.

From polynyas to canyons, microscopic communities to incredible predator populations, the Southern Ocean hosts some of the most unique species and ecosystems on Earth. Having MPAs in place will directly lead to their safeguarding and help mitigate the observed and anticipated changes the Southern Ocean is facing.

Antarctica is exhibiting some of the most rapid responses to climate change on the planet. Extreme events are becoming more pronounced, with temperature anomalies and sea ice fluxes becoming increasingly unpredictable. Nature is responding with alarming results, from devastating penguin breeding failures to globally significant Antarctic krill range shifts.

Human activity in the region is also growing at an unprecedented rate. Tourism is in urgent need of increased management and fishing activity continues for species we have little knowledge about. Stock assessments for both krill and toothfish remain inadequate due to a paucity of data and understanding.

Various toothfish populations are showing general decline and yet catch limits have not decreased accordingly. Despite this, some CCAMLR Members continue to block progress on protection, based on unsubstantiated claims of a lack of scientific evidence.

The tools needed to help mitigate against many of these threats already exist. Studies across the global ocean have shown that MPAs are an effective tool for enhancing the ecological integrity of ecosystems and protecting key species. Well-designed MPAs that include areas of no human activity will both mitigate against climate change and benefit the very sectors that are often in opposition to MPA creation. Krill and toothfish populations are likely to respond positively to enhanced protection, benefiting fisheries in surrounding areas.

CCAMLR must remain cognizant of, and actively support, global commitments to protect 30% of the world's ocean by 2030. The commitments that 26 CCAMLR Members have agreed to through the CBD Global Biodiversity Framework also pertain to the Southern Ocean. In fact, the adoption of MPAs in the Southern Ocean is critical for 30x30 realization.

The adoption of the Weddell Sea Phase 1 & 2, Domain 1, and East Antarctic MPAs would protect an additional 4.7 million km^2. Coupled with the Ross Sea Region and SOISS MPAs, 26% of CCAMLR's jurisdictional area would be in MPAs. Furthermore, by creating additional protection in Domain 9, CCAMLR could protect 30% of its waters by 2030, a major contribution towards global 30x30 ambition and an unparalleled conservation victory.

Domain 9 represents a final link in the chain; a chain that weighs heavy as pressures mount and negative environmental impacts become more apparent.

Individual States that are both Members of CCAMLR and have nationally determined MPAs in the Southern Ocean have a further part to play. The shifting conditions and growing human activity require existing protections to be regularly revised and strengthened. Areas where protection can be enhanced, should be. There is not a moment to lose.

Time is not on the side of the Southern Ocean. CCAMLR needs to act as the guardian of Antarctic marine life that it was created to be. This report urges CCAMLR Members to work collaboratively for the benefit of Antarctica and adhere to the precautionary principle which is central to CCAMLR's mandate.

As the world becomes increasingly interested in Antarctica, the Southern Ocean grows steadily warmer. Decisions taken now will dictate how CCAMLR and its Members will be perceived in the future.

Future generations are watching.

Acronyms

ABMT	Area-based management tool
ABNJ	Areas Beyond National Jurisdiction
ACC	Antarctic Circumpolar Current
ARK	Association of Responsible Krill Harvesting Companies
ATCM	Antarctic Treaty Consultative Meetings
ATS	Antarctic Treaty System
ASOC	Antarctic and Southern Ocean Coalition
CAMLR Convention	Convention on the Conservation of Antarctic Marine Living Resources
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CBD	United Nations Convention on Biological Diversity
EEZ	Exclusive Economic Zone
FRZ	Fisheries Research Zone
GBF	Kunming-Montreal Global Biodiversity Framework
HIMI	Heard and McDonald Islands
HPAI	Highly Pathogenic Avian Influenza
IAATO	International Association of Antarctica Tour Operators
IMMA	Important Marine Mammal Areas
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUU	Illegal, unreported and unregulated
IUCN	International Union for the Conservation of Nature
MEASO	Marine Ecosystem Assessment for the Southern Ocean
MPAs	Marine Protected Areas
MPCA	Marine Protected and Conserved Areas
OECM	Other Effective area-based Conservation Measures
RCP	Representative Concentration Pathway
SCAR	Scientific Committee on Antarctic Research
SC-CAMLR	Scientific Committee on the Conservation of Antarctic Marine Living Resources
SGSSI	South Georgia and South Sandwich Islands
SROCC	Special Report on the Ocean and Cryosphere in a Changing Climate
TAAF	Terres Australes et Antarctiques Françaises
VME	Vulnerable Marine Ecosystems
VRZ	Voluntary Restricted Zone
WAP	Western Antarctic Peninsula
WSMPA	Weddell Sea MPA

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