Stockholm Environment Institute

Opportunities for applying spatial management approaches in the Antarctic marine space

SEI Report
June 2023

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Layout: Olesia Polishchuk
Cover photo: Sailing through huge icebergs near the Melchior Islands
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DOI: https://doi.org/10.51414/sei2023.039

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Contents

Abbreviations

ABNJ – Areas Beyond National Jurisdiction
ABMT – Area-Based Management Tools
ARK – Association of Responsible Krill harvesting companies
ASMA – Antarctic Specially Managed Area
ASOC – Antarctic and Southern Ocean Coalition
ASPA- Antarctic Specially Protected Areas
AT – Antarctic Treaty
ATCM – Antarctic Treaty Consultative Meetings
ATS – Antarctic Treaty System
BBNJ – Biodiversity Beyond National Jurisdiction
CAMLR Convention – Convention on the Conservation of Antarctic Marine Living Resources
CBD – Convention on Biological Diversity
CCAMLR – Commission for the Conservation of Antarctic Marine Living Resources
CCAS – Convention for the Conservation of Antarctic Seals
CEMP – CCAMLR Ecosystem Monitoring Program
CEP – Committee for Environmental Protection
CM – Conservation Measure
COMNAP – Council of Managers of National Antarctic Programs
EBSA – Ecologically or Biologically Significant Marine Areas
EIA – Environmental Impact Assessment
EP – Environmental Protocol / Protocol on Environmental Protection to the Antarctic Treaty
EU – European Union
FAO – Food and Agriculture Organization of the United Nations
ICRW – International Convention for the Regulation of Whaling
ILBI – International Legally Binding Instrument
IMO – International Maritime Organization
IPCC – Intergovernmental Panel on Climate Change
IUCN – International Union for Conservation of Nature
IUU – Illegal, Unreported and Unregulated
MPA – Marine Protected Area
MSP – Marine Spatial Planning
Polar Code – IMO International Code for Ships Operating in Polar Waters
SC-CAMLR – Scientific Committee of CAMLR
SCAR – Scientific Committee on Antarctic Research
SDG – Sustainable Development Goal
SEI – Stockholm Environment Institute
SISO – CCAMLR Scheme of International Scientific Observation
SwAM – Swedish Agency for Marine and Water Management
UN – United Nations
UNCLOS – UN Convention on the Law of the Sea
UNEP – UN Environment Programme
UNESCO-IOC – Intergovernmental Oceanographic Commission of UNESCO
UNFCCC – United Nations Framework Convention on Climate Change
UNFSA – United Nations Fish Stocks Agreement
UNGA – UN General Assembly
VME – Vulnerable Marine Ecosystem
WG-ASAM – Working Group on Acoustics, Survey and Analysis Methods
WG-EMM – Working Group on Ecosystem Monitoring and Management
WG-FSA – Working Group on Fish Stock Assessment
WG-IMAF – Working Group on Incidental Mortality Associated with Fishing
WG-SAM – Working Group on Statistics, Assessments and Modelling

Preface

This report was commissioned in 2022 by the Swedish Agency for Marine and Water Management (SwAM). The terms of the assignment were set out by SwAM during the Swedish Chairmanship from 2021 to 2022 of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). The objective of this analytical work was to apply a broader marine spatial management framework analysis, which encompasses marine protected areas, as a tool to enhance regional governance within the Antarctic Treaty and the Convention for the Conservation of Antarctic Marine Living Resources.

The content and views expressed in this report are those of the authors associated with Stockholm Environment Institute (SEI) and not necessarily those of SwAM or the Government of Sweden. The report is published independently by SEI as a contribution to the knowledge base and discussions surrounding Antarctic regional governance and marine spatial management.

Jakob Granit

Director General, Swedish Agency for Marine and Water Management

Executive summary

The purpose of this paper is to enhance a dialogue within the Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR) and the Antarctic Treaty system (ATS), focusing on spatial management approaches to help achieve agreed-on objectives and related management instruments. The discussion covers the status of the existing area-based management framework in the marine space within the ATS, CCAMLR conservation measures and the use of marine protected areas (MPAs). The paper builds on a review of key white and grey literature and 14 interviews with experts carried out in July and August 2022.

The Antarctic Treaty (AT) which came into force in 1961, now has 55 Parties, of which 29 are consultative (Secretariat of the Antarctic Treaty, 2022). It stipulates that the Antarctic is to be used for peaceful purposes only and for scientific investigation. The Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention) came into force as an independent agreement within the ATS in 1982 to deal with conservation and the rational use of krill, finfish and other marine living resources in the Convention area, covering the same marine geographic area of the AT plus the area between 60° South latitude and the Antarctic Convergence. CCAMLR is an international commission with 27 members and an additional 10 acceding states. Article II of the CAMLR Convention is the backbone of the Commission's work. It is built on the need for conservation in the marine areas surrounding Antarctica, also known as the Southern Ocean, using precautionary principles and is science- and ecosystem-based.

Conservation including rational use is the primary objective of CCAMLR. Over the past 40 years, fisheries management has been a major success, while conservation measures have remained central and steadfast. Fisheries management has, however, tended to overshadow the outer image of the CCAMLR. The lack of consensus among member states on new MPAs is a cause for concern and may require alternative strategies for the CCAMLR to achieve agreed-on conservation measures. Scientific work has generated new knowledge on the ecosystem approach and calls for conservation in both coastal zones and the high seas stressing further land-sea integration.

Multilateral work outside the ATS such as the Intergovernmental Panel on Climate Change (IPCC), the network of Ecologically or Biologically Significant Marine Areas (EBSA) under the Convention on Biological Diversity (CBD), marine spatial planning (MSP; UNESCO-IOC/European Commission, 2021a) and the negotiations on an international instrument tackling Marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ) under the UN Convention on the Law of the Sea (UNCLOS) contribute with other approaches for the ATS and CCAMLR to consider. The paper highlights the following key messages:

- **The founding purpose of CCAMLR as a conservation regime with rational use of marine living resources is the basis for consensus-building among the member states. The nature of the organization should not be up for reinterpretation.**
- **Science has been a defining feature of successful diplomacy within the ATS. The scientific method and the knowledge generated by scientific research need to continue to underpin policy options.**
- **Consensus-based decision-making needs to be retained to ensure inclusiveness and robustness of the governance regime. It requires mutual forbearance, tolerable compromise and commitment to cooperation, as well as creative and patient diplomacy.**
- **Strengthening coordination and integration between Antarctic Treaty Consultative Meetings (ATCMs), the Committee for Environmental Protection (CEP) and CCAMLR by applying spatial management approaches can improve land-sea integration incorporating conservation, rational use and climate change response.**
- **Progress on MPA proposals within a broader marine spatial management approach can turn current reputational risks of poor performance on conservation into leadership opportunities.**

1. Introduction

The purpose of this paper is to take both historical and future-oriented perspectives to explore the Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR) as an integral part of the Antarctic Treaty system (ATS), its accomplishments, current challenges and possible future pathways, with a focus on area-based marine management approaches including marine protected areas (MPAs). This first section introduces the objectives and structure of the report, as well as the methods used to gather data. The second section provides a short historical overview to set the scene of this report, and then moves on to provide an overview of the current state of affairs. A more reflective discussion is provided in the third and fourth sections, where we examine key challenges facing CCAMLR and potential ways forward.

1.1 Methods

This report is based on two data collection approaches. The first is a review of key white (peer-reviewed papers) and grey (reports and official communications) literature. Papers were selected through a snowball approach, starting with key benchmark papers, then inductively identifying key topics from the papers, then moving on to searching for additional sources that addressed the identified topics. All papers were coded according to three broad categories, each containing several inductively generated sub-categories: “CCAMLR in review”, “global developments”, and “CCAMLR in transition”. These categories are used to organize the rest of the report. Coding these topics ensured a systematic approach when extracting the text, which also helped flag potential gaps in the topics, which then led to an additional search for sources addressing the specific topic.

The second approach entailed semi-structured interviews with key informants. Following the scope of the task and mindful of the sensitivity of the discussion, all actors and the information provided have been kept anonymous. To ensure that the information cannot be tracked back to the individuals we do not use direct citations; rather, all statements have been paraphrased and merged with the text. In order to ensure accuracy of the information, after processing the statements, all informants received a copy of the messages gathered through the interviews and had the possibility to adjust the information. Insights from the interviews were used to triangulate the information gathered through the literature reviews and further helped define the key topics. These topics were then used to structure this paper.

1.2 Limitations

A full account of CCAMLR’s history and legal status is beyond the scope of this report. For a historical overview of CCAMLR and the ATS, see CCAMLR (2019a,b). In this paper, we provide a snapshot of events and focus instead on discussing key challenges of what we consider a transition phase that can impact the management of marine areas surrounding Antarctica.

While the report identifies some options for member states to consider as CCAMLR moves forward, a more in-depth process to reflect on the potential implications of these options is necessary but outside the scope of this report. Such a process should aim to involve the range of actors, many of whom may have different views as to what CCAMLR is or ought to be, in identifying a future path of action.

2. CCAMLR in review

2.1 The Antarctic Treaty system

The creation of the Antarctic Treaty (AT) was a result of an increased interest to carry out scientific investigations in the region, while also addressing global geopolitical concerns at the time. The AT was agreed on during the Cold War and entered into force in 1961, setting aside political opposition and devoting the Antarctic region to peaceful and scientific purposes. The AT currently has 55 signature member countries, of which 29 are Consultative Parties that jointly make decisions (Secretariat of the Antarctic Treaty, 2022). The AT is the core of the ATS, which in addition, consists of the Protocol on Environmental Protection to the Antarctic Treaty (Environmental Protocol), the Convention for the Conservation of Antarctic Marine Living Resources (CAMLR Convention), and the Convention for the Conservation of Antarctic Seals (CCAS; Antarctic Treaty, n.d.).

While CCAS and the CAMLR Convention are independent agreements, they are bound to the AT through provisions, for example, Article IV dealing with territorial claims and their legal status. The ATS provides a legal and institutional framework for the governance of the Antarctic region, with the goal of achieving peaceful use and international cooperation. Decision-making is based on consensus and best available science, consistent with the Environmental Protocol and the CAMLR Convention. In practice, consensus is reached in absence of formal objection (Arpi et al., 2022).

2.2 CCAMLR's objectives

Originating from the AT and forming an integral part of the ATS, the CAMLR Convention came into force in 1982 in response to the increasing commercial interests for Antarctic krill and the potential effect of krill fishing on predators. For clarity, CAMLR Convention refers to the international agreement itself, while CCAMLR is the commission responsible for implementing and overseeing the elements of the convention. The CCAMLR has 27 member states, including the EU, and 10 acceding states (CCAMLR, 2022b).

The marine areas surrounding Antarctica host 8200 species, represent 10% of the global ocean, and are some of the most untouched areas in the world (Jacquet et al., 2016). According to Article I, the CAMLR Convention applies to the Antarctic marine living resources of the area south of 60° South latitude and the area between that latitude and the Antarctic Convergence. Antarctic marine living resources refer to "the populations of finfish, molluscs, crustaceans and all other species of living organisms, including birds, found south of the Antarctic Convergence". The CAMLR Convention does not cover seals and marine mammals, which are covered by the CCAS and the International Convention for the Regulation of Whaling (Wendebourg, 2020).

The objective of the CAMLR Convention, defined under Article II, is conservation, including rational use, of Antarctic marine living resources, introducing a science-based, precautionary and ecosystem-based conservation approach to fisheries (Haward, 2021; Liu & Brooks, 2018). The precautionary approach is applied to minimize the risk of long-term and irreversible effects and was, at the time, considered to be the most appropriate approach given data uncertainty and ecosystem complexity (CCAMLR, 2019b; Kock, 2000). The CAMLR Convention's conservation principles as well as its relationship with the AT and the Environmental Protocol are examples of key features distinguishing CCAMLR from regional fisheries management organizations (CCAMLR, 2012, 2019b; UNESCO-IOC/European Commission, 2021a).

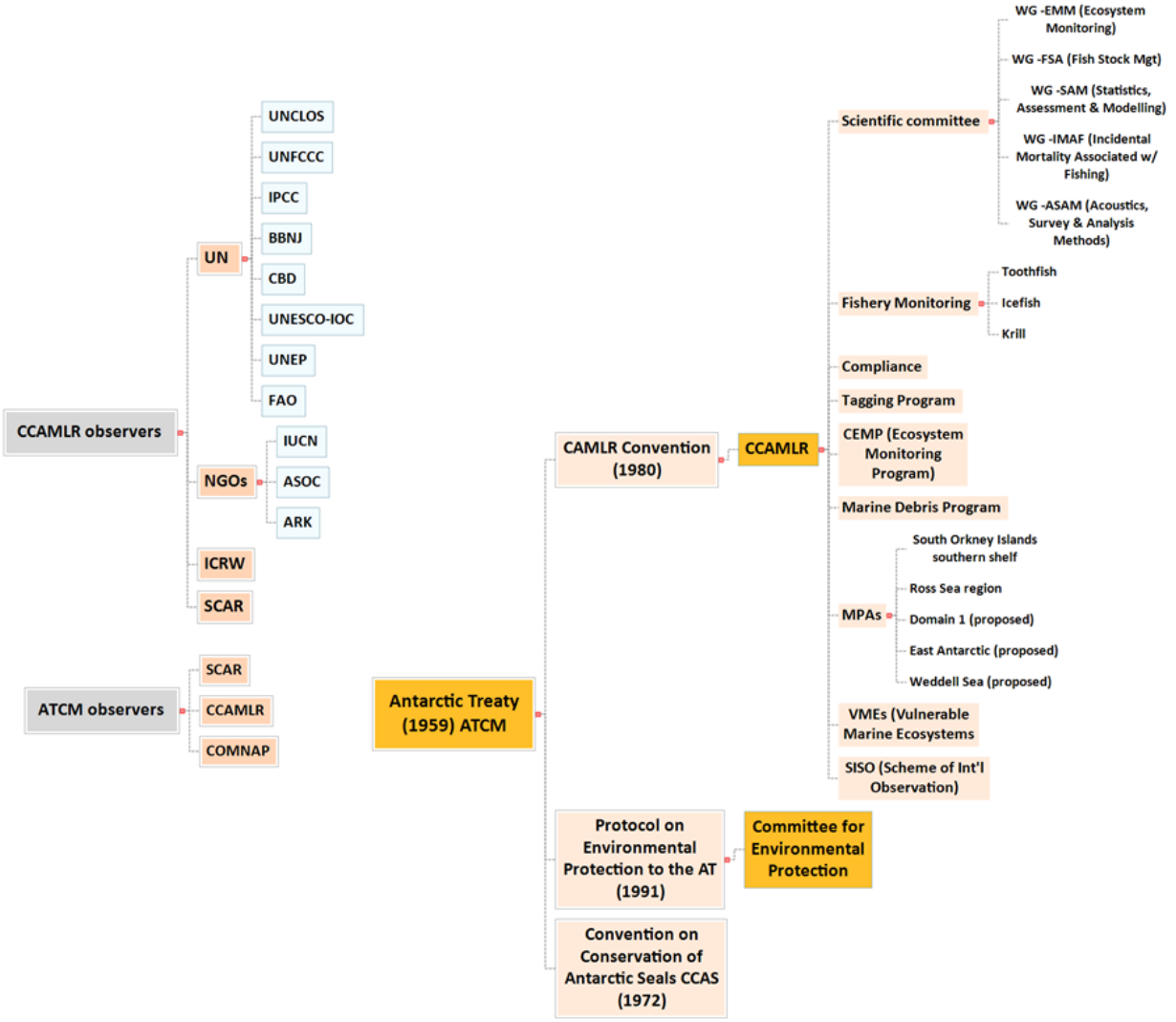
Governance aspects and observers

With regard to the ATS, the now annual ATCMs are attended by its 29 consultative party member countries plus the additional 26 non-consultative countries that are party to the ATS. Observers to the ATCMs include CCAMLR, SCAR (Scientific Committee on Antarctic Research), COMNAP (Council of Managers of National Antarctic Programs) and invited experts such as ASOC (Antarctic and Southern Ocean Coalition) and IAATO (International Association of Antarctica

Tour Operators). The SCAR is a thematic organization of the International Science Council. SCAR was instrumental in the formation of the CAMLR Convention, initially providing the scientific basis and support for a convention that could manage krill in the marine areas surrounding Antarctica. At present, SCAR's mission is to advance international research in the region and to provide independent and objective scientific advice to the ATS and CCAMLR. The SCAR has formal observer status on the Scientific Committee of CAMLR (SC-CAMLR) and CCAMLR.

Membership of CCAMLR is open to any Contracting Party that is engaged in research or harvesting activities in relation to the marine living resources to which the Convention applies. Members take part in the decision-making processes of the CCAMLR and the SC-CAMLR, which has five Working Groups covering various focus areas (Figure 1). Figure 1 also depicts CCAMLR's position within the ATS and includes linkage to external stakeholders including non-governmental organizations (NGOs) and UN organizations and instruments. It also lists the various programme components dealing with conservation of marine life in the CAMLR Convention area, including management of fisheries, monitoring of ecosystems, marine debris and development of MPAs.

Figure 1. CCAMLR governance "mind map" illustrating how CCAMLR and the Committee for Environmental Protection (CEP) are part of the Antarctic Treaty System (ATS). CCAMLR along with the Council of Managers of National Antarctic Programs (COMNAP) and the Scientific Committee on Antarctic Research (SCAR) are formal observers to the Antarctic Treaty Consultative Meetings (ATCM). Observers to CCAMLR meetings include SCAR, the International Convention for the Regulation of Whaling (ICRW), three NGOs [Antarctic and Southern Ocean Coalition (ASOC), International Union for Conservation of Nature (IUCN) and Association of Responsible Krill harvesting companies (ARK)], and a host of UN organizations/instruments (UNCLOS, UNFCCC, IPCC, BBNJ, CBD, UNESCO-IOC, UNEP and FAO; note that the BBNJ is a legally binding instrument under UNCLOS).



Source: Authors' own

2.3 Decision-making and conservation measures within CCAMLR

CCAMLR's consensus-based decision-making approach was inherited from the AT and is commonly used in multilateral arrangements, at least for some parts of the decision-making process (Goldsworthy, 2022). The AT values of peace, scientific cooperation and environmental protection trickle down to CCAMLR as well, and they are bound together by Articles III, IV and V in the CAMLR Convention (CCAMLR, 2019b). In fact, Article IV of the AT is replicated in the CAMLR Convention (Nilsson et al., 2016), and it neither denies nor accepts territorial claims from states (Liu, 2020; Miller & Slicer, 2014).

In accordance with Article XII of the CAMLR Convention, decision-making for substantial matters is to be consensus-based. This relies on active participation and proposals are approved if there is no formal objection (Goldsworthy, 2022; Miller & Murray, 2019). The SC-CAMLR provides information and recommendations for conservation measures that must be considered by CCAMLR (Wendebourg, 2020). Member states implement adopted conservation measures.

Article IX describes the functions of CCAMLR, stating that it shall "give effect to the objective and principles set out in Article II" of the Convention. Conservation measures shall be formulated, adopted and revised based on the "best scientific evidence available" [Article IX.1(f)]. They include "the designation of the opening and closing of areas, regions or sub-regions for purposes of scientific study or conservation, including special areas for protection and scientific study" [Article IX.2(g)].

CCAMLR's conservation measures are divided into four categories: compliance, general fisheries matters, fishery regulations and protected areas (CCAMLR, 2021b). According to Goldsworthy (2022), proposals related to management and compliance have been most likely to be found acceptable. Meanwhile, proposals linked to restriction on fisheries, strongly held national policy, or broader conservation are less likely to be adopted.

CCAMLR does not have an institutional enforcement regime per se but relies on control from individual Flag States and action from Contracting Parties to guarantee compliance with conservation measures (Miller & Murray, 2019). The same authors pointed out that according to Article IX.6(c) and (d), withdrawal from adopted conservation measures is not appropriate unless there is a persuasive reason, for example that technical implementation is beyond the capabilities of a party.

2.4 Review of spatial management procedures and tools within CCAMLR

Under the ATS, management of marine areas surrounding Antarctica has been seen as a global success of marine Areas Beyond National Jurisdiction (ABNJ; Gardiner, 2020). Over the 40 years of its existence, CCAMLR has effectively delivered on its central objective (Article II) through its science- and ecosystem-based, and precautionary approaches. CCAMLR has been the frontrunner for the collective management of conservation, including rational use, in the marine areas surrounding Antarctica and has many achievements dealing with ecosystem-based fisheries management. Since the Convention entered into force, there is no documented collapse in any commercial fishery managed by CCAMLR and toothfish stocks have been improved towards sustainable levels (Goldsworthy, 2022).

According to Nilsson et al. (2016), CCAMLR is seen as a leader in fisheries management due to its science-based decision-making approach which focuses on monitoring indicator species while also addressing Illegal Unreported and Unregulated (IUU) fishing and incidental catch (especially of seabirds). Beyond managing fisheries in the area, CCAMLR has also committed to measures targeting a broader conservation of the Convention Area. Examples of such measures include: first, a commitment to a marine protected area (MPA) network and the framework for MPA development (CM 91-04) and the two approved MPAs (Goldsworthy & Brennan, 2021); second, a major achievement was the establishment of the CCAMLR Ecosystem Monitoring Program

(CEMP), responding to concerns on the potential effects of krill fishing on krill predators (Kock et al., 2007); third, the identification and protection of Vulnerable Marine Ecosystems (VMEs) outlines conservation measures addressing impacts of bottom trawling and fishing (CCAMLR, 2020).

Some 30 years ago, MPAs were introduced to manage marine conservation and to help restore decimated fish populations (Jacquet et al., 2016). Prior to this development in the late 1980s, CCAMLR had closed down certain fishing zones that were no longer economically viable, e.g. 12 finfish fisheries in five FAO Sub-Areas set under CCAMLR's jurisdiction. CCAMLR began discussing MPAs in 1996 and the topic became more prominent in the early 2000s, once research indicated that MPAs had positive impacts on targeted fisheries. Globally, MPAs have become more prioritized, increasing in number and size within Exclusive Economic Zones.

CCAMLR, however, only adopted its first MPA (CM 91-03) in 2009 (south of the South Orkney Islands), which did not interfere with the then current or prospective fishing. The South Orkney Islands MPA was adopted after removing a small geographic area to allow information collection on crabs as part of an exploratory fishery, but no fisheries have been conducted to date (Trathan & Grant, 2020). Reviewing of the MPA occurs at subsequent five-year periods. A framework for MPA development (CM 91-04) was adopted in 2011. In 2016 the Ross Sea MPA (CM 91-05) was adopted after revising China's claims of a new krill fishing zone in the MPA as well as an expiration date (Liu & Brooks, 2018). The Ross Sea MPA will be reviewed every 10 years (Brooks et al., 2020). Other proposed MPAs have not been adopted, and over the course of negotiations, their proposed delimitations have reduced the MPAs in size, in part to accommodate fishing interests. Many of the CCAMLR MPA proposals are multipurpose where fishing, scientific and other human activities can be included. Even in MPAs prohibiting fishing, i.e. so-called no-take-zones, other activities may be allowed (Raspotnik & Østhagen, 2020). See Table 1 for a summary of relevant proposals for conservation measures and MPA proposals.

Table 1. Summary of conservation measures and MPA proposals relevant to spatial management and protection in the marine space surrounding Antarctica

Conservation measure number or proposal	Detail and year
CM 22-06 to 22-09	Restriction of longlines at depths less than 500 m (2009–2019)
CM 91-01	Procedure for protection of CEMP sites (2004); The designation of special areas for research
CM 91-02	Protection of Antarctic Specially Protected Areas (ASPAs; 2012); Commission is consulted on designation of Antarctic Specially Managed Areas (ASMAs) and ASPAs with a marine component
CM 91-03	South Orkney Islands Southern Shelf MPA (2009)
CM 91-04	General framework for the establishment of MPAs (2011)
CM 91-05	Ross Sea Region MPA (2016)
CM 24-04	Protection of areas for research following ice-shelf retreat (2017)
Proposed MPA (Australia, EU and its member states, India, New Zealand, Norway, Korea, Ukraine, UK, US and Uruguay)	East Antarctic (2012), updated 2022 (CCAMLR, 2022a)
Proposed MPA (EU and member states, Norway, Uruguay, Australia, UK, New Zealand, US, Korea, India and Ukraine)	Weddell Sea (2016), updated 2022 (CCAMLR, 2022a)
Proposed MPA (Argentina/Chile)	Western Antarctic Peninsula and South Scotia Arc – Domain 1 (2017), updated 2022 (CCAMLR, 2022a)

The three proposed MPAs have, however, not progressed towards approval to date. Nor has there been agreement yet on the Research and Monitoring Plans (RMPs) for the South Orkney Islands Southern Shelf and Ross Sea MPAs. There are disagreements on how CM 91-04 is to work, and since 2020, Russia and China have argued for further revisions. In addition, international initiatives such as EBSAs under the CBD and MSP guided by UNESCO, Intergovernmental Oceanographic Commission (IOC) and EU and the negotiations on an international instrument in BBNJ under UNCLOS will impact in different ways the discourse within the CCAMLR management regime.

Moreover, the fact that there is an agreed-to expiry date for the Ross Sea MPA creates a new management challenge within CCAMLR and the ATS that will need to be resolved. This is because conservation measures require consensus to enact expiry, rather than if they are to be continued (Liu & Brooks, 2018).

2.5 Spatial management in collaboration with CEP

The Committee for Environmental Protection (CEP) was created from the Environmental Protocol and is an advisory body to ATCM. It is tasked to provide recommendations for area protection and compliance insurance of the Protocol. The Environmental Protocol area extends to the ocean south of 60° South, while the CCAMLR Convention Area in addition extends to the Antarctic Convergence. Another difference is that conservation in the CCAMLR Convention includes "rational use", while in the ATCM/CEP, conservation and sustainable use are dealt with separately. This leads to a differing nexus and complicates instrument-crossing actions for marine protection within the ATS (Cordonnery et al., 2015).

Spatially protected areas within the ATS were introduced in 1964 in the Agreed Measures for the Conservation of Antarctic Fauna and Flora but were later replaced by the Environmental Protocol and its Annex V. Adopted in 1991, and entering force in 2002, Annex V on Area Protection and Management provides guidelines for the designation of Antarctic Specially Protected Areas (ASPAs) and Antarctic Specially Managed Areas (ASMAs). To assist Parties in the selection of designation sites and preparation of the management plans, the ATCM has also adopted certain guidelines (Secretariat of the Antarctic Treaty, n.d.).

According to Article 5.1 in Annex V of the Environmental Protocol, proposals for ASPAs and ASMAs may be made by any Party, the CEP, SCAR or CCAMLR through the submission of a proposed Management Plan to the ATCM. ASPAs and ASMAs are valid for an indefinite time unless the management plan states otherwise, and a review of the management plans should at minimum be initiated every 5 years (Annex V, Article 6.3). An area of Antarctica, "any area, including any marine area" (Annex V, Article 2) south of 60° South may be designated as an ASPA or ASMA. They are hence the Environmental Protocol's main instruments for marine spatial protection, although Annexes I-IV and VI also deal with aspects relevant to marine protection such as environmental impact assessments (EIAs; Annex I, Article 8) and prevention of marine pollution from ships (Annex IV) (Roura et al., 2018). ASPAs may be designated to "protect outstanding environmental, scientific, historic, aesthetic or wilderness values, any combination of those values, or ongoing or planned scientific research" (Annex V, Article 3.1). ASMAs may be designated to "assist in the planning and coordination of activities, avoid possible conflicts, improve cooperation between Parties or minimize environmental impact" in any area where activities are, or may be, conducted (Annex V, Article 4.1). While ASPA designation is more of an obligation, the ASMA designation is optional according to Annex V, Article 3.2 and 4.2 (Roura et al., 2018).

The tools for spatial management within the Environmental Protocol, ASMAs and ASPAs, are generally applied to land-based areas, although they may include any marine area. In fact, these marine areas only represent 0.02% of the CCAMLR area (Gardiner, 2020). Thus, they do not measure up to the aspirations of a MPA network. Roura et al. (2018) identified a lack of an integrated approach and a need for increasing consistency between CCAMLR and ATCM/

CEP in the application of Annex V of the Environmental Protocol regarding the designation of ASMAs, ASPAs and MPAs. All adopted and tabled MPAs are located inside the Environmental Protocol marine area and overlap (fully or partly) or are adjacent to adopted ASPAs and ASMAs. In addition, Annex V, Article 6, having regard to provisions in Articles 4 and 5, states that marine areas cannot be designated as ASMAs or ASPAs without CCAMLR approval. However, ATCM Decision 9 (2005) specifies criteria for ASMAs and ASPAs that should be submitted to CCAMLR. In 2022, CCAMLR could not come to a consensus regarding the combination of two ASPAs (152 and 153) into one increased marine area. Most members supported the proposal, but some noted it did not meet the ATCM Decision 9 criteria (CCAMLR, 2022a).

In the joint SC-CAMLR/CEP workshop in 2009[1], areas of common interests were identified, including climate change, biodiversity, non-native species, species protection, spatial management and area protection, and monitoring. Fisheries were not identified to be a common interest, as the CEP does not have authority to manage fisheries. The SC-CAMLR was identified to generally best lead marine spatial protection and management, noting that this does not preclude CEP's development of ASMAs and ASPAs with marine components. In fact, paragraph 7.2 of the workshop states that it "agreed on the importance of a systematic approach to marine spatial protection and management and noted that CEP and SC-CAMLR had agreed to taking a harmonised approach to the development of a representative system of marine protected areas".

Article VII of the Environmental Protocol forbids all mining except for scientific purposes (Wilson Center/Polar Institute, 2022). In 2048, any party can raise the question of reviewing this ban. However, an opening for mining in the Antarctica has been deemed unlikely (Cordonnery et al., 2015), as it would entail a complex process requiring a consensus decision. This leaves the Environmental Protocol with a focus on regulation of mainly scientific and logistic issues but also tourism. Before any human activities regulated by the Environmental Protocol can proceed, an environmental impact assessment is required (Hemmings & Kriwoken, 2010). However, fishing activities within the AT area have not been subject to this assessment, or any other Environmental Protocol requirements (Cordonnery et al., 2015).

It is noted that the measures and proposals by CCAMLR in the high seas and the Environmental Protocol along the coasts and in marine areas can be seen as contributing to a framework of spatial planning and management in the Convention Area and within the ATS as a whole.

3. CCAMLR in a changing context

The Cold War geopolitics were reflected at the outset of the AT 60 years ago. At the time, countries with stakes in the marine areas surrounding Antarctica were able to transform these dynamics into scientific cooperation using conservation and environmental protection as a starting point for the establishment of CCAMLR and CEP (Jayaram, 2022). While the ATS is designed to maintain Antarctica as a region for peaceful, environmental and international scientific cooperation purposes (Jayaram, 2022), the impacts of climate change coupled with a new geopolitical reality increasingly put into question CCAMLR's ability to achieve its objectives of conservation and rational use of marine living resources (Goldsworthy & Brennan, 2021). The current understanding of climate change and its impacts in the Antarctic and Southern Ocean region with policy recommendations was provided in 2022 by SCAR (Chown et al., 2022).

Table 2 provides a snapshot of some key management challenges for CCAMLR along with the potential implications if these are not sufficiently addressed. The table also outlines possible solutions. These deal with the Commission's identity as an organization responsible for conservation of the marine living resources and their (sustainable) rational use, the influence

1 http://www.ats.aq/documents/ATCM32/wp/ATCM32_wp055_e.doc

of international high seas agendas on conservation (e.g. BBNJ and CBD), and international pressures surrounding climate change and geopolitical tensions. In addition, there is the issue of disagreements and impasses surrounding MPAs, their implementation, fishery catch limit compliance and other conservation issues.

Table 2. A compilation of challenges, implications and solutions surrounding CCAMLR in relation to marine spatial management and marine protected areas (MPAs) in the marine space surrounding Antarctica based on reviewed literature and expert interviews.

Challenges	Implications of not acting	Pathways towards solutions
Different interpretations on the nature of the Commission and the meaning of "rational use".	Failure in implementing MPAs and broader conservation measures.	Staying true to CCAMLR's objective defined in Article II and unify the interpretation of "rational use".
Losing the spirit of consensus-building and trust in the SC-CAMLR demonstrated by failing to agree on a representative system of connected marine protected areas.	Increased tendency of political positioning instead of science-based argumentation. Geopolitical positioning taking an increased role in the process of decision-making within SC-CAMLR.	Retain the spirit of the SC-CAMLR as a science-based advisory body where consensus is reached through mutual commitment and cooperation. Geopolitical tensions affecting the decision-making process in SC-CAMLR extend beyond its scope and require higher level political attention and discussions.
International pressure concerning climate change adaptation in the marine areas surrounding Antarctica, to focus more on ecosystem resilience and biodiversity.	Lack of action to address these challenges could question the relevance of CCAMLR and the ATS in adapting to global climate change, taking on the agenda of the CBD and the global push for increased ocean protection.	A new "MPA agenda" where CCAMLR uses a marine spatial management approach to create greater congruence and mutual reinforcement between the ATS, and UNFCCC and the CBD.
International pressure to take on the BBNJ Treaty under UNCLOS and support development of the UNESCO-IOC-EU initiative on MSP.	Possible global isolation of the ATS and CCAMLR due to lack of alignment with UN instruments.	Retain the global autonomy of the ATS but with strengthened linkages with international and UN instruments. Consider a broader MSP approach in geographic areas with most disagreement to find regenerative and multifunctional solutions that can benefit species and ecosystems while providing economic gains for member states.
Calls for increased harmonized collaboration and coordination between the different ATS instruments.	Poor management of the grey areas where responsibility is not well delineated between CCAMLR, CEP and ATCM will inhibit a representative system for an ecosystem-based approach to spatial management and land and sea connections.	Harmonized collaboration and coordination between the different parts of the ATS to align conservation tools and ensure a more holistic management that connects land, coast and sea, while allowing for greater alignment with international instruments.
Reputational risk to the organization if it does not achieve its objectives.	The organization may be regarded as irrelevant if conservation objectives are not broadened beyond management of fisheries in the Antarctic marine space which may call for change to the CCAMLR management regime and the ATS as a whole.	A greater focus on demonstrating the value added by CCAMLR within the ATS over time, focusing on achieving agreed to conservation measures and developing new ones, and turning reputational risk into leadership opportunities.

3.1 Staying true to the objectives of the CAMLR Convention

Although the 40th meeting of the Commission (18–29 October 2021) adopted a declaration to reaffirm its commitment to achieve its objectives (Annex 7; CCAMLR, 2021a) and in the 31st meeting of the Commission (23 October–1 November 2012) the nature of the CCAMLR as a conservation organization was clarified (CCAMLR, 2012, para. 9.17), both in the literature and the SEI interviews, experts describe a divide in member states interpretation of the objective of the Convention. Some members mainly see it as a fisheries regime, including the designation of areas for fisheries management while at the same time protecting fish habitat and spawning areas. Others see it as a conservation and management regime that allows ecosystem-based and precautionary rational use. To address this, we review two key aspects of the Convention: the first is the precautionary principle in relation to the ecosystem approach; the second, is the concept of rational use in Article II.

The precautionary principle and ecosystem approach within CCAMLR

It is worth analysing the two main principles underlying CCAMLR's approach: the application of the precautionary principle and the ecosystem approach (Trouwborst, 2009). Generally speaking, both concepts call for a reduction of anthropogenic pressures on ecosystems and often they are used interchangeably. However, Trouwborst (2009) reminds us of the differences between the two concepts: the scope of the precautionary principle is wider than that of the ecosystem approach, as "environment" has a broader meaning than "ecosystems". The role and importance of socio-economic considerations is largely implicit in the case of the precautionary principle, and explicit in the case of the ecosystem approach. In international legal and policy instruments, the precautionary principle has hitherto been endorsed by states rather more extensively, explicitly and formally than the ecosystem approach. For CCAMLR, precautionary catch limits, e.g. for krill, have been implemented, whereby management measures are adjusted in response to comparing unexploited populations to those exploited after a 20-year period of fishing (Parkes, 2000). The impact of fishing should not exceed 75% of the median unexploited biomass (Hewitt et al., 2002). This has resulted, for example, in harvesting rates of about 9% in the Scotia Sea.

The application of the precautionary principle in international law appears to be more advanced than that of the ecosystem approach. The extent of this gap depends on the benchmark used to define "the ecosystem". With regard to the marine environment, the ocean is one ecosystem with a series of connected systems which have been divided into arbitrary jurisdictional zones. This has produced a "mismatch of jurisdictional zones and ecosystems", particularly in the marine areas surrounding Antarctica, where CCAMLR has given increased attention to area-based management (Haward, 2021). The holistic management of the ocean would imply a merger of instruments and institutions which today deal separately with marine pollution, fisheries, etc. But merging all these instruments at the global scale, is too challenging (Molenaar, 2007).

Moreover, when it comes to the ecosystem approach, understandings of the concept differ between the different instruments. For example, the CBD (2000) defines the ecosystem approach as a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. The expectation is that application of the ecosystem approach will help reach a balance of the three objectives of the CBD, based on the application of appropriate scientific methodologies focused on levels of biological organization which encompass the essential processes, functions and interactions among organisms and their environment. Similar to UNCLOS and the UNFSA, the CBD advocates cooperation between states in the context of conservation in ABNJ (Article 5). Protected areas and impact assessments (Articles 8 and 14 respectively) are key instruments for the protection of biodiversity and the application of an ecosystem-based approach (Wendebourg, 2020). CBD recognizes that humans, with their cultural diversity, are an integral component of ecosystems (UNESCO-IOC/European Commission, 2021a).

By contrast, CCAMLR's ecosystem approach considers the marine areas surrounding Antarctica to be a suite of interlinked systems. According to Kock (2000), this means not only considering the species fished, but also avoiding situations in which fisheries have a significant adverse effect

on “dependent and related species”. However, in the application of this ecosystem approach, and due to the enormous size and complexity of the Southern Ocean, CCAMLR’s approach has been to regulate fishing and other human activities to avoid deleterious changes in Antarctic ecosystems. This has directed focus to indicator species central to food chains and by monitoring fish stocks within pre-set defined management areas (Kock, 2000).

Returning to Article II – rational use as a focal point for CCAMLR

Although the primary objective of the CCAMLR Convention is conservation, it includes rational use with an ecosystem-based and precautionary approach. These are important elements of “rational use” in order to not jeopardize the long-term sustainability of fisheries and the respective supporting ecosystems. However, including “rational use” in Article II of the Convention opens for a second interpretation of the objective that is currently a cause for most disagreements within CCAMLR (Sykora-Bodie & Morrison, 2019). The historical interpretation of the term is that preservation of ecosystems is the primary objective of the Convention. While most members see CCAMLR as a conservation regime, through the term rational use, some states have been able to find support for “the right to fish” (Jacquet et al., 2016; Sykora-Bodie & Morrison, 2019). This has evoked opposition to conservation measures such as gill net regulations and MPAs (Jacquet et al., 2016).

According to Jacquet et al. (2016), the first draft of the Convention provides evidence of what rational use means, i.e. in the case of overexploitation, fishing limitations would be imposed. The text is publicly available and was presented during the ninth ATCM meeting in 1977. While it is understandable that member states who view CCAMLR as a fisheries regime oppose conservation measures relating to marine spatial management, the objective of the Convention together with the clarification of rational use and Article IX.2(g) further proves that CCAMLR is a conservation regime, that includes rational use in accordance with Article II.3. Article IX.2(g), Article II.3 and the precautionary and ecosystem-based management approach at the same time provide support for a designation of a representative network of MPAs to protect marine ecosystems from potential irreversible changes.

Legal authority for the implementation of area-based closures for both scientific studies and conservation is justified in Article IX. Despite that, some fishing states have shown reluctance towards such area-based management measures and argue that this falls outside the scope of CCAMLR. This is based on the argument that it would be better managed under the Environmental Protocol, although the Protocol does not have authority to manage extractive fisheries. Further, opponents of the MPA proposals argue that there is a need for additional guidance for MPA proposals and that proponents should justify the need for establishment of MPAs. Meanwhile, proponents argue that this is not necessary according to the adopted CM 91-04 and that MPAs are precautionary measures rather than measures to respond to direct threats (Sykora-Bodie & Morrison, 2019).

To move beyond the impasse on measures concerning MPAs, it is important for CCAMLR members to find a common interpretation of the objective of the Convention. Even more important is to define what “rational use” is rather than what it is not and to find a common process to move forward.

3.2 Erosion of consensus-building within CCAMLR and the need to retain the spirit of science-based consensus

The consensus-based approach – one of the foundations of CCAMLR – has contributed to the Convention's success and entails benefits related to legitimacy and the development of a collective commitment (Goldsworthy, 2022). However, the eroding spirit of consensus-building has been noted by several experts (Arpi et al., 2022). Another factor that frequently was highlighted during the SEI interviews is that CCAMLR member states are divided regarding the question of rational use. As a result, there have been no new MPAs adopted since the 2016 decision on the Ross Sea MPA and RMPs for the two adopted MPAs remain under negotiation. In 2022, CCAMLR decided to hold a Special Meeting in 2023 to discuss the entire issue of MPAs and RMPs (CCAMLR, 2022a).

While the proposed MPAs and RMPs are accepted by the SC-CAMLR, member states blocking approval argue about what is the best available science behind the proposals. Moreover, the fact that the CM 91-04 framework was adopted after the Southern Orkney Islands MPA designation and during the development of other MPA proposals has been argued to lead to confusion in the MPA and RMP designation process (Brooks et al., 2020; Gardiner, 2020). Currently, the fisheries management and the safeguarding of high standard compliance are also experiencing challenges (Wilson Center/Polar Institute, 2022). For instance, blockage of the toothfish conservation measure in 48.3, though based on what is regarded by most members as being best available science, awakens the issue of the how to interpret "best scientific evidence available". The challenges in reaching consensus raise concerns about the future of the marine areas surrounding Antarctica and how CCAMLR is equipped to take on a changing geopolitical and environmental landscape (Goldsworthy, 2022).

Issues of broader international concern, such as MPAs and fisheries management, tend to occur more within CCAMLR than the ATCM. Change in the geopolitical context may be one of the reasons behind the impasse on MPAs – these may go beyond the governance and management scope of ATS and CCAMLR. Similar issues can be observed in, for example, the CBD and the BBNJ process, according to the interviews.

Several experts emphasized that the lack of progress on tabled MPA and RMP proposals and the challenge in achieving consensus are issues that also require attention from a higher political level. This was the case for the Ross Sea MPA, where both internal and external political drivers came into play in the adoption process (Sykora-Bodie & Morrison, 2019). In addition to crucial leadership within CCAMLR, high-level engagement by political leaders was found to be critical for adoption even if these were mainly bilateral in nature.

CCAMLR is highly reliant on transparency, trust, and dialogue to reach consensus (Sykora-Bodie & Morrison, 2019). However, the SEI interviews highlighted various limitations with regards to transparency in CCAMLR. Informants, for example, highlighted how the working group meetings are not open to the public and are limited to a small group of observers. Insufficient transparency also extends to the meeting papers and reports, whereby the latter are overly aggregated and hard to read from a decision point of view, making it difficult for the outside world to understand what has been discussed and how agreements are made. Similarly, Roura et al. (2018) identified that due to the commercial sensitivity, the public availability and accessibility of information discussed within CCAMLR and its related bodies is limited.

Challenges in the decision-making process within CCAMLR are confirmed by Goldsworthy (2022), who described a "lack of commitment to collaborative actions to find ground for consensus", which in turn affects the ability to face key challenges. In her study, there seems to be a trend parting from the original principles of mutual commitment and cooperation in the development of management measures based on the best science available. This suggests there might be a need to review the decision-making process and its norms and practices, as well as a recommitment to the mutual obligation to cooperate.

In their investigation of the drivers for consensus-based decision-making in the establishment of a network of MPAs, Sykora-Bodie & Morrison (2019) provided a set of four recommendations:

- a more open process towards consensus-building that is inclusive and transparent
- a "small win" or stepwise approach to meet the large spread of management challenges
- clear planning objectives, in intersessional workshops, to guide decision-making
- establishment of a spatial management working group to develop scientific standards, threat assessments and RMPs, employing CCAMLR Secretariat staff to assist in developing proposals.

3.3 Taking the bigger picture of the marine areas surrounding Antarctica

The Antarctic region is huge and the science behind how its various biophysical components interact is very much still evolving. Indeed, the complexities surrounding ocean currents, nutrient and carbon budgets, global climate change, glacier retreat, coastal and open water ecosystems, populations of tooth- and icefish species, seabirds, penguins, seals and whales all make the management of this remote region an enormous challenge, justifying the precautionary approach in its management.

When it comes to discussing possible reforms or prescriptive developments within the ATS and CCAMLR, knowledge about the larger systems perspective is necessary to create more resilient and relevant governance and management structures. With the AT reaching 60 years and CCAMLR 40 years of good governance and management, the question can be raised what reforms need to be taken to match the high level of sophistication that scientific knowledge has reached especially when it comes to conservation of vulnerable ecosystems in a changing climate and geopolitical space.

Beyond conservation with MPAs and towards multifunctionality

Both the CAMLR Convention and the Environmental Protocol contain explicit mandates for the designation of protected areas in the marine areas surrounding Antarctica. To date, CCAMLR has adopted two MPAs: the South Orkney Islands Southern Shelf and the Ross Sea. However, there is a strong push from the international community for greater efforts towards marine conservation, including in the high seas (Liu & Brooks, 2018). A recent study, reviewing more than 22 000 scientific publications, shows that MPAs can be an effective tool for mitigating climate change, through significantly increasing carbon sequestration. Other co-benefits from protected areas, such as increased biodiversity, reproductive capacity of marine organisms and fish catch, are reliant on the area to be highly or fully protected and these co-benefits also improve with the age of the MPAs (Jacquemont et al., 2022).

CCAMLR has achieved the 10% area target for MPAs in accordance with the CBD Aichi Target 11[2] and Target 14.5[3] of the UN Global SDGs. But the goal of a representative and coherent network of MPAs, which is part of these global goals, has not yet been met (UNEP-WCMC & IUCN, 2021). Scientists have pointed out that the current protected areas do not constitute a representative sample of Antarctic biodiversity. The establishment of additional proposed but not decided MPAs in the Weddell Sea, East Antarctica, and Domain 1 (Antarctic Peninsula) would increase this representativeness of the Antarctic protected area network (SwAM, 2020).

2 The CBD created The Aichi Biodiversity targets to address and mitigate biodiversity loss. Twenty targets cover biodiversity loss in connection to global food security, health and clean water. These targets are part of their Strategic Plan for Biodiversity for the 2011–2020 period https://www.cbd.int/sp/. Target 11: "by 2020, ...10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures and integrated into the wider landscapes and seascapes." https://www.cbd.int/aichi-targets/target/11.

3 The Sustainable Development Goals (SDGs) are part of the UN Agenda 2030, "a plan of action for people, planet and prosperity". It consists of 17 interlinked goals and 169 targets. https://sdgs.un.org/2030agenda. SDG 14 deals with oceans and marine resources and SDG Target 14.5 was "by 2020, to conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information." https://unstats.un.org/sdgs/metadata/?Text=&Goal=14&Target=14.5.

However, the expansion of MPAs is not without problems and even the existing MPAs have some embedded weaknesses. For instance, agreement has yet to be reached on RMPs for both the South Orkney Islands Southern Shelf and the Ross Sea. Additionally, there is an ambiguity in the management of the Ross Sea, which should allow for "research fishing" in its Special Research Zone and Krill Research Zone. It is not clear what exactly research fishing means, and such ambiguity could be misinterpreted or misused (Liu, 2020) potentially leading instead to "paper parks". Proposals for a network of MPAs of East Antarctica, and in the Weddell Sea off the Antarctic Peninsula, have yet to gain consensus.

Lack of progress in current negotiations for implementing CM 91-04 has led to suggestions for broader approaches that would imply embedding the designation and management of new areas within the broader framework of MSP. MSP can be used as a multisectoral decision-making framework delivering ecological, environmental and socio-economic objectives. It has its roots in integrated coastal zone management using an ecosystem-based management approach. MSP "provides a transparent, participatory approach for conservation and other objectives, including meeting conservation or environmental goals or targets associated with international conventions and agreements like the Convention on Biological Diversity" (UNESCO-IOC/European Commission, 2021a, p. 102).

The concept of MSP was first successfully deployed around the world mainly in local areas (Thomas, 2017). Since then, the concept is being explored in the high seas through the BBNJ process under UNCLOS (Zaucha & Gee, 2019). MSP involves a public process that takes a comprehensive, spatial and temporal approach, in contrast with other protection and management measures that typically focus on one place or activity at a time. The use of MSP is therefore diverse; the process can support in managing ocean areas at different geographical scales – local, national or transboundary. It can be applied at a local level for a specific area or as a tool to develop national policy into legally binding plans (UNESCO-IOC/European Commission, 2021a).

The European Commission's Directorate-General for Maritime Affairs and Fisheries together with the IOC of UNESCO have developed an extensive guideline for MSP. The guideline is a result of years of collected experience and knowledge from professionals working in different ways with MSP globally and is designed to be used at any level of governance. One key message from the guideline is the importance of bringing all relevant stakeholders and decision makers together in a participatory way. Another highlighted part is that MSP builds on an ecosystem-based approach, thus, knowledge and expertise about the ecosystem in question is crucial. MSP is usually a complement to already existing management structures and measures and can be a support in taking in both environmental, social and economic objectives (UNESCO-IOC/European Commission, 2021a). According to Thomas (2017), it consists of at least four planning stages: participatory MPA network planning, multisectoral area-based planning, comprehensive marine planning and ocean zoning.

Even in cases when protection is not the objective, MSP could help identify areas with a high-nature value that need to be considered according to different scenarios of development such as blue economy applications (Sumaila et al., 2021). The global ocean economy includes activities such as fishing, shipping, offshore wind, marine technology, and maritime and coastal tourism. The FAO definition of a sustainable ocean economy is "the Blue Growth Initiative", which "aims at supporting more productive, responsible and sustainable fisheries and aquaculture sectors by improving the governance and management of the aquatic ecosystems, by conserving biodiversity and habitats, and by empowering communities" (FAO, 2018).

MSP has been used to analyse and allocate such activities in areas where different sectors, e.g. offshore renewable energy and fishing, are suggested to coexist. These processes have not been without conflicts, but bringing together different actors (e.g. state agencies, academia, private companies and local communities) to collaborate and coordinate the allocation of use in the same space, while ensuring the resilience of marine ecosystems, can be a way to mitigate these conflicts and find a way forward in decision-making (UNESCO-IOC/European Commission, 2021b).

At the global level, independently of countries' decisions to sign/ratify UNCLOS, MSP has been adopted in the planning and management of the marine environment, as well as for the public process towards achieving Target 2 of SDG 14[4]. There are great expectations that MSP can thus contribute to increased economic and social benefits and help resolve some of the most concerning trade-offs between economic, social and environmental objectives that currently hinder decision-making in CCAMLR (UNESCO-IOC/European Commission, 2021a).

CCAMLR was seen already in 2017 by UNEP as a successful pioneer for protecting ABNJ based on an integrated management of marine living resources (Thomas, 2017). In many ways, CCAMLR is already developing MSP in the marine areas surrounding Antarctica. However, one of the challenges surrounding ABNJ is the lack of a coordinating process or body for the various sectoral management processes. Each sector currently working in ABNJ has its own management process. The new international instrument for conservation and sustainable use of BBNJ (15–26 August 2022; United Nations, 2022) includes ABMT and provides a potential future mechanism to support improved cross-sectoral coordination with stakeholder participation that may be considered in the future by CCAMLR when relevant.

Recent research on the effectiveness of spatial planning should be considered. For example, Teschke et al. (2022) highlighted how the most ambitious conservation targets may not be the best performing when considering a range of criteria beyond biodiversity. Their results for the Weddell Sea show that mixed-target scenarios (according to the Marxan model)[5] for conservation provides better balance between cost-efficient solutions and the spatial clustering necessary for habitat creation and connectivity. While such solutions may not offer full protection of species, from a decision-making point of view, this type of solution offers the greatest number of different approaches to the conservation problem.

Adaptation to a changing biophysical environment – climate change

Earlier it was noted in the 40th SC-CAMLR meeting, CCAMLR's pace in addressing climate change represented a mismatch with the rapidly changing ocean environment (SC-CAMLR, 2021, para. 5.10). In 2022 during CCAMLR 41 a resolution to sharpen CCAMLR's response was adopted (CCAMLR, 2022a). This was further stimulated with the release of the new SCAR report on climate change (Chown et al., 2022). Climate change entails ocean acidification and warming that will affect the especially vulnerable Antarctic krill, the key food source for many predators, impacting the marine areas surrounding Antarctica (Cavanagh et al., 2021; Wendebourg, 2020). CCAMLR has not adopted a climate change action work program, as members consider that there is no policy role for the Commission (Goldsworthy, 2022). While human activities within Antarctica are not the cause for these changes, CCAMLR could address the consequences by adopting measures to maintain ecosystem resilience (Goldsworthy & Brennan, 2021). Apart from potential biophysical changes to the region, climate change could create new geopolitical tensions centred around the range shifting of commercially valuable marine species from mid to high latitudes (Hobday & Pecl, 2014; McGee & Liu, 2019).

Developing scientifically defensible conservation strategies to respond to human impact is a critical challenge for CCAMLR scientists and policymakers (Miller & Slicer, 2014). Wendebourg (2020) describes how fisheries management has been managed by CCAMLR using stock-specific measures, and that implementation of the precautionary approach has previously not considered climate change effects. However, this has changed as the environmental changes have rapidly received the attention of the SC-CAMLR. Meanwhile, CCAMLR has not adopted conservation measures that are aimed directly at climate response since 2009 (Goldsworthy &

4 SDG Target 14.2 was *"by 2020, to sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans"*. https://unstats.un.org/sdgs/metadata/?Text=&Goal=14&Target=14.2

5 Marxan https://marxansolutions.org/ is the most widely used software in the world for creating marine and terrestrial protected area systems.

Brennan, 2021). CCAMLR has adopted two resolutions dealing with climate change, one in 2009 (Resolution 30/XXVIII) and more recently in 2022 during CCAMLR 41 (CCAMLR, 2009, 2022a). In addition, CCAMLR has adopted conservation measures that reference climate change, including guidance for MPA development (CM 91-04), the Ross Sea MPA and CM 24-04 that facilitates scientific studies in areas recently exposed to ice-shelf collapse. Cavanagh et al. (2021) described a lack of specific management and policies for ecosystem services under climate change in the marine areas surrounding Antarctica. They also point out that existing ATS measures for fishing, pollution, transport prevention of non-indigenous species, protection of benthic habitats and vulnerable marine ecosystems (VMEs) could possibly have influences on biological carbon storage, even if these are not the objective of the measures.

In response to the above management gaps, Jayaram (2022) highlighted a need for a more transformative Antarctic governance that is adaptive to change. During the SEI interviews, CM 24-04 was highlighted as an adaptive tool, designating time-limited Special Areas for scientific research in the case of ice-shelf collapse in Sub-areas 48.1, 48.5 and 88.3. Further investigations and introduction of similar conservation measures can be included in future management approaches; however, the new conservation measure proposed to expand CM 24-04 to the whole coastline of Antarctica was not approved at CCAMLR 41 (CCAMLR, 2022a).

An emerging research area that can support adaptive ocean governance is digital monitoring of the ocean. Combining real-time multiple technologies like ocean sensors and remote sensing satellites, together with artificial intelligence processing, can enable dynamic or mobile marine protected areas (MMPAs), i.e. protected areas with mobile boundaries. This is a way to respond to changing conditions caused by climate change, where habitats may shift and species ranges change. Such MMPAs can function as a complement to static protected areas or creating a safe pathway between areas for migrating threatened species (Bakker, 2022).

Harvesting would need to be in accordance with the specific principles outlined in Article II.3, and account for changes (direct or indirect) related to harvesting itself, introduction of alien species and environmental changes (CCAMLR, 2019b), striving to prevent or reduce risk for irreversible changes (Miller & Murray, 2019). Hence this suggests that CCAMLR should consider climate change impacts on other species and habitats beyond those specifically targeted for current fishing activities (Goldsworthy & Brennan, 2021).

4. Discussion

As one of the world's most successful governance regimes for marine conservation and resource use management in the ABNJ, CCAMLR has, nevertheless, been in the spotlight in recent years, due largely to lack of progress on its own ambitious conservation measures of establishing a network of representative MPAs. There is a growing reputational risk for the Commission if alternative pathways are not developed. More importantly, a wide range of underlying causes raise questions on how the Commission can be more adaptive and continue its functionality at a time of transformative changes, driven not the least by new global geopolitical developments and rapid climate change.

The purpose of this background paper was to take both a historical and future-oriented perspective to review CCAMLR as an integral part of the ATS, its accomplishments, current challenges and possible future pathways, with a particular focus on area-based marine management approaches including MPAs. This background paper reflects diverse views that highlight the current challenges facing the Commission (and indeed ATS at large) on the one hand, and areas for attention, caution and improvement on the other.

Historically, the ATS has been viewed as a successful international governance regime able to maintain its core values even when pressured, externally or internally, and with CCAMLR addressing marine conservation and rational use. To remain relevant and influential, it is crucial for CCAMLR to rediscover its core values and find roadmaps to meet current and emerging challenges in a changing global context. When it comes to MSP, this may entail diversifying the currently used MPA tool.

In summary, we flag six issues:

The founding purpose of the Commission as a conservation regime with rational use of marine living resources is the basis for consensus-building among the member states. The nature of the organization should not be up for reinterpretation. CCAMLR, an integral part of the ATS, is a progressive conservation regime mandated to fulfil the objectives of the CAMLR Convention. Successful fishery management has been an outstanding legacy of CCAMLR and will always be a prominent part of its function and operation. Fishery management, however, should not overshadow the primary objective of the Convention, where regulating rational use is an integral part of the overall conservation mission. While there are different views on the nature of the organization, some are confusions while others might be deliberate reinterpretations. Maintaining the clarity of CCAMLR as a conservation regime that includes rational use of marine living resources should reinforce the very foundation for consensus-building among member states.

Science has been a defining feature of successful diplomacy in the ATS. Science needs to continue underpinning policy options rather than be used for political gains. Science and peace are the heart and soul of the ATS. At the same time, science is not the same thing as "truth". Science increases understanding and knowledge, leading to societal learning and adaptive management. Antarctic science is needed more than ever, not only foundational for governance and peaceful use but also central to the conversation about the southern continent and its environment including surrounding marine spaces, but also crucial for understanding global changes. As the last global frontier, the pristine state of the marine areas surrounding Antarctica provides an ideal natural laboratory to understand the impacts of climate change and human activities at large. Science is also instrumental for interstate cooperation and consensus-building. Over the decades, scientific research activities have remained a key qualifying feature for participation in Antarctic governance, and "listening to science" has formed the basis and defining feature of successful diplomacy. Yet when science meets policy and politics, their relationship is never straightforward. They differ largely on intentions – the former (science-policy) targets best available science to underpin policy options that can be negotiated, whereas

the latter often involves using "science" for political gains. For example, the application of the precautionary principle on management polices is to accept that there are uncertainties surrounding specific threats. To reverse this logic stating uncertainties justify rejection of precautionary principles is politics.

Consensus-based decision-making will ensure inclusiveness and robustness of the governance regime. Consensus-building has been the cornerstone of the ATS and CCAMLR and remains essential for an inclusive and robust Antarctic governance. At the same time, building and realizing consensus among a growing number of participating member states has never been trouble-free, nor was it always possible. Managing frustrations at times of high tension and sensitivity is therefore strategically and tactically critical to avoid erosion of trust, which is the most fundamental capital for sustaining cooperative governance. This requires the spirit and practice of mutual forbearance, tolerable compromise and the commitment to cooperation. And resolution lies in not only the willingness of all participants for cooperation and open negotiations, but also creative and dedicated diplomacy to find political solutions at all levels. For this to flourish requires strong leadership from within the ATS and a more streamlined governance linkage between the ATCM and CCAMLR. At the same time, parties need to understand that negotiations take time and require an element of constructive patience.

Strengthening the coordination and integration between ATCM, CCAMLR and CEP in applying spatial management approaches. The ATCM, CCAMLR and CEP form the core operational "management" components of the ATS. From the literature and the SEI interviews, there are consistent views that better harmonization is required among those core management branches to ensure that ATS has a strong adaptive governance structure, especially when it comes to spatial management. The best available science needs to include an integrated land-ocean approach. This integrated approach calls in turn for more coordination and integration between SCAR, SC-CAMLR and CEP to build the scientific knowledge in a mutually enforcing manner and a harmonized approach to govern spatial management on land (ASMAs and ASPAs) and seas (MPAs).

CCAMLR can retain its key role within the ATS in area-based marine management by moving from the single focus on "MPA designation" towards a transformed common vision on "Southern Ocean" conservation and sustainability. High seas (i.e. marine ABNJ) represent 60% of the global ocean. Although 8% of the global ocean is protected in MPAs, only 1.2% of the high seas are protected as noted by UNEP-WCMC[6]. It is hard to imagine a 30-by-30 target – protecting 30% of the planet's land and sea area by 2030 – that can be realized without substantial increase of the protection of the high seas, marine areas surrounding Antarctica included.

Here the ATS and CCAMLR have been seen as global leaders and can continue to take a lead. While MPA designation seems to have reached a deadlock, the structure and function of the Commission remains solid. Following the principle of area-based management tools (ABMTs) including MPAs as fundamental for conservation of the global ocean, the specific proposals and designation need to be handled with pragmatism, collaboration and science diplomacy, as well as political solutions. Such *principle-pragmatism* may require, for example, that the Commission moves away from the single focus on MPA designation towards a transformed common vision on conservation and sustainability of the marine space surrounding Antarctica, with common objectives and specific conservation measures to realization of those objectives. At the same time, and going beyond CCAMLR, this transformation would actively seek higher level political solutions. Such common objectives, driving an ABMT approach within the ATS and spearheaded by CCAMLR when it concerns the marine space, could include outcomes like biodiversity protection, fishing, tourism, navigation and research.

6 UN Environment Programme World Conservation Monitoring Centre, www.protectedplanet.net/en/thematic-areas/marine-protected-areas

Turning reputational risk into leadership opportunities at a time of planetary crises and heightened geopolitical tensions. CCAMLR enjoys many successes and a legacy of collective management and conservation of the global commons. This has been accomplished through a wide range of spatial management approaches that are science- and ecosystem-based, with a collaborative governance approach. While it faces considerable challenges – including the difficulties of building consensus for realizing its own vision of establishing a network of representative MPAs – those challenges, as consistently reflected in the literature as well as by the experts interviewed, are by no means unique to CCAMLR.

The CCAMLR and the ATS are at a crossroads, beckoning elements of transformation to respond to needs surrounding multifunctionality in MSP and by selectively applying under an ATS banner the internationally available instruments (MSP, BBNJ, CBD EBSAs, UNFCCC). This can be accomplished in part through strengthened global harmonization within the ATS, placement of CCAMLR centrally within the ATS, and provision of a robust platform to host international stakeholders that remain engaged to protect and conserve the marine space surrounding Antarctica and the region as a whole. The agreed extraordinary meeting in 2023 for the Commission on Spatial Planning and Marine Protected Areas provides an avenue for the Commission to re-establish its commitment to conserve the marine living resources in Antarctica and agree on a road to achieve this objective (CCAMLR, 2022a).

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