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Applying Marine Protected Area Frameworks to Areas beyond National Jurisdiction

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Abstract: Marine protected areas (MPAs) can provide a range of ecological benefits. Frameworks—including the IUCN protected area categories and *The MPA Guide*—offer tools towards evaluating an MPA's objectives, types, Level of Protection, and potential effectiveness. However, the majority of MPAs exist in national waters, raising the question of how these frameworks apply in areas beyond national jurisdiction (ABNJ). We evaluated the existing ABNJ MPAs in the Antarctic designated through the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) using the two above mentioned frameworks. The newly released *The MPA Guide*, which complements guidance from the IUCN protected area categories, provides perhaps the most exhaustive framework as it seeks to evaluate implementation, enabling conditions, and outcomes. The CCAMLR MPAs ranged from Category 1A (for IUCN)/Highly Protected (for *The MPA Guide*) to Category IV (for IUCN)/Lightly Protected (for *The MPA Guide*) due to differences in management objectives and activities occurring within the zones of the MPAs. Given ongoing negotiations for a new international, legally binding treaty for high seas biodiversity, evaluating an MPA using these existing frameworks will prove useful to allow for a full comprehensive picture of an MPA and what it can expect to achieve.

Keywords: marine protected areas; areas beyond national jurisdiction; BBNJ; CCAMLR; Antarctica; level of protection

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1. Introduction

Marine protected areas (MPAs) are an area-based management tool (ABMT) meant for conserving the marine environment through the limitation of extractive and destructive human activities [1–3]. The marine environment and its associated biodiversity is a highly interconnected, complex system and is highly threatened by human activities [4–6]. When designed and implemented effectively, MPAs can maintain, protect, and restore marine biodiversity [5,7]; benefit highly mobile marine species such sas whales, sharks, turtles, and straddling fish stocks [8,9]; assist in maintaining habitat [10]; and increase ecosystem resiliency [11], among other benefits.

MPAs pose a promising conservation tool for areas beyond national jurisdiction (ABNJs), which is also referred to as the high seas, and international seabed Area (defined within UNCLOS as the seabed, ocean floor, and subsoil beyond national jurisdiction within the marine environment), which together comprise ~60% of the surface and 90% of the

volume of the global ocean [3]. The high seas and seabed Area contain unique natural structures not found in any other ecosystems, provide breeding, feeding and migratory routes for charismatic megafauna, and house genetic resources that may be of scientific and commercial importance [12–16]. Other features that contribute to biodiversity within ABNJ include seamounts that provide habitat for cold-water corals, as well as unique features such as hydrothermal vents [17,18]. Yet, marine biodiversity in ABNJ remains highly threatened by overfishing, mining interests, pollution, climate change, lack of data, and fragmented governance [16,19]. In recent years, the number and overall size of MPAs have increased, including a small number in ABNJs. However, not all MPAs are created equal, nor do all MPAs effectively conserve biodiversity [20–23]. Edgar et al. (2014) outlined that MPAs with the greatest conservation benefits share five key features: no-take, well-enforced, old in age, large in size, and isolated. Additionally, MPAs can suffer from poor governance structures and management [24]. For example, Gill et al. (2017) found that out of 433 MPAs, 65% reported that their budget was not meeting their basic management needs. Additionally, 91% reported that their staff capacity did not meet their basic management needs either—and that these two characteristics were the strongest predictors of positive ecological outcomes [25].

Several frameworks have been developed by experts to provide clear tools for designing protected areas as well as assessing the strength and efficacy of MPAs from designation through active management. Two main frameworks for understanding and categorizing MPAs are Guidelines for Applying the IUCN Protected Area Management Categories to Marine Protected Areas (herein called IUCN MPA guidelines) [26] and *The MPA Guide* [22].

This article utilized these two frameworks for MPAs, applying them to the currently existing MPAs in ABNJ under the Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention), which is a multilateral, legally binding agreement that guides the conservation of marine living resources within the Southern Ocean. Given that the vast majority of MPAs globally exist within national waters, we sought to assess the applicability of the IUCN protected area categories and *The MPA Guide* for MPAs within ABNJs, using the example of the CCAMLR MPAs. While the IUCN categories have been widely applied (see, e.g., [27–29]), including to some degree in international waters (see, e.g., [30]), *The MPA Guide* was recently published [22], and has not yet been applied widely. Focusing on CCAMLR MPAs, we applied the IUCN MPA guidelines and *The MPA Guide*. We further considered these frameworks for their relevance in high seas conservation. This work provides insight into implementing the emerging United Nations agreement for the conservation and sustainable use of marine biodiversity in ABNJs, the so-called Biodiversity Beyond National Jurisdiction (BBNJ) Agreement. We further hope this work helps support the ongoing movement towards effective MPAs in ABNJs.

1.1. MPA Frameworks: IUCN MPA Guidelines and The MPA Guide

The IUCN categories originated in 2008 to provide clear descriptions of management objectives of different types of protected areas [31]. Follow-up guidelines were published in respect to protected areas specifically in the marine environment [4,26]. Through the IUCN's framework, protected areas are categorized based on their management objectives and types of governance—i.e., what the management authority intends for a site—ranging from category I (strict nature reserve) to category VI (protected area with sustainable small-scale use of natural resources) [4]. Even within a category VI MPA, sustainable use still requires meeting key criteria, as it requires that the use is done in a manner that does not lead to the long-term decline of biodiversity in order to meet the needs of future generations, and does not include large-scale industrial harvest [31]. Therefore, the conservation objective and the management body must strive for highly controlled activities that allow for human use without undermining the overall conservation objective [31]. For example, if the primary management objective is biodiversity conservation with little to no human impact, then category IA applies. If the maintenance of sustainable local small-scale fisheries that are compatible with nature conservation is one of the listed objectives of an MPA, then a

category VI would likely be the most appropriate. For example, the Nazca-Desventuradas Marine Park established by the Chilean government is considered a category 1A, fully protected MPA [28]. The Rapa Nui Multi-Use Marine Park, also established by the Chilean government, is considered a category VI MPA, which allows for locals to utilize the marine park for traditional fishing practices, cultural activities, and a place for tourism [28].

The MPA Guide is a science-based framework used to discuss, categorize, track, and evaluate the real-world ecological and social outcomes of MPAs [22]. It is a tool to help design new and modify existing MPAs to better achieve their goals. *The MPA Guide* organizes different types of MPAs by their Level of Protection and Stage of Establishment, details the principles and processes that are required for an MPA to be effective (the Enabling Conditions), and connects these different types of MPAs with the outcomes they are expected to achieve. The *MPA Guide* Levels of Protection range from fully protected, with no or minimal impact from extractive and destructive activities, to minimally protected, where impacts of activities are significant, but the site still provides some biodiversity benefit [22]. To evaluate these activities, *The MPA Guide* incorporates and builds from another framework called the Regulations-Based Classification System (RBCS), and indeed was created by many of the same scientists [22,32]. In *The MPA Guide*, the activities and associated impacts were revised and expanded in a wide collaborative effort (see [22]). *The MPA Guide* takes into account not only regulations but also the real-world impacts of different extractive and destructive human activities on biodiversity and ecosystems within areas that are historically defined as MPAs but may not in fact meet their stated objectives because of the levels of allowed use. Stage of Establishment describes the degree to which an MPA is operational in the water—i.e., the degree to which it is working actively to protect biodiversity or exists only on paper or in an announcement. Finally, *The MPA Guide* links the Stage of Establishment and Level of Protection of an MPA, or zone within a multizone MPA, to clarify the expected social and ecological outcomes, assuming the Enabling Conditions are in place.

These frameworks work in conjunction with each other to provide a comprehensive snapshot of an MPA (Figure 1). Other protected area criteria exist that reflect the highest conservation standard, such as the Blue Parks Award through the Marine Conservation Institute (see [33]) or the IUCN's Green List (see [34]). No high seas MPAs have yet met these strict criteria, and thus these two frameworks were not applied in this study. However, they are worth further consideration as incentives for aiming for the highest level of protection for biodiversity and ecosystems. Since the emerging BBNJ Agreement will include text related to MPAs, it will be important for MPAs in ABNJ to achieve the same biodiversity goals as national MPAs. This will ensure consistency of usage and promote high levels of protection for species and ecosystems shared and valued across the global commons.

1.2. Defining MPAs for this Study

Both the IUCN MPA guidelines and *The MPA Guide* apply the IUCN definition of a protected area ([31], p. 8) which is as follows:

> *"A protected area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values."*

This definition clarifies that the primary objective of any MPA is the conservation of nature. Several activities are incompatible with this objective and exclude areas from being considered as MPAs, such as industrial fishing, mining, and oil/gas extraction [26]. Additionally, the IUCN is opposed to vertical zoning of the MPA, as it does not capture important linkages between the benthos and the water column [26]. Studies on linkages between the seabed, the various oceanic zones, and the sea surface have shown the importance of maintaining such linkages (see [24,35,36]).

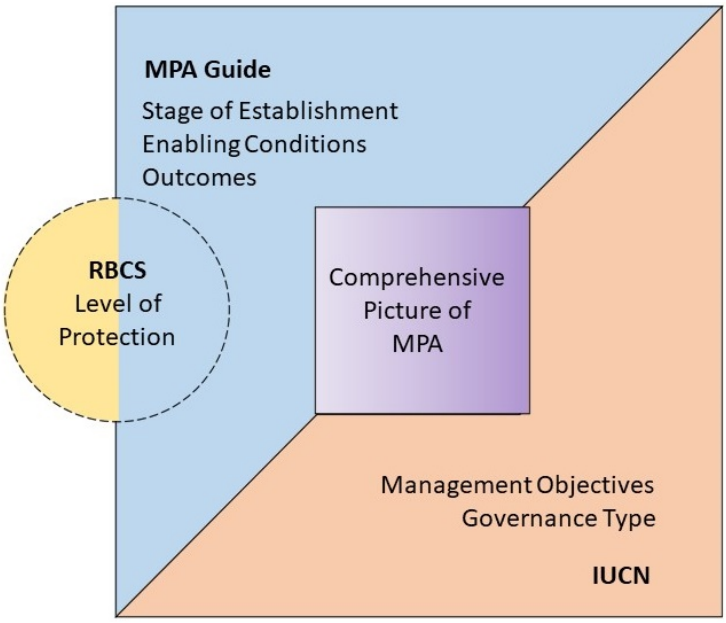


Figure 1. Existing MPA frameworks. The IUCN MPA guidelines and *The MPA Guide* are meant to be complementary to each other to provide a comprehensive picture of an MPA. The IUCN MPA guidelines focus on management objectives and governance type, while *The MPA Guide* focuses on Level of Protection, Stage of Establishment, Enabling Conditions, and the expected ecological and social outcomes. Note that *The MPA Guide* incorporates an additional tool within it, the Regulations-Based Classification System (RBCS).

1.3. Governance of ABNJ MPAs

The United Nations Convention on the Law of the Sea (UNCLOS) provides the recognized international legal framework governing the rights and obligations of States in the marine environment. It is within UNCLOS that the jurisdictional divide between national and international waters (exclusive economic zones out to 200 nm vs. high seas) and seabed (extended continental shelf vs. the Area) is codified [37]. UNCLOS also establishes or recognizes key bodies to regulate activities within the high seas and the international seabed Area. These include the International Seabed Authority (ISA), which is tasked with regulating mineral-related activities in the Area and the International Maritime Organization which regulates international shipping. Additionally, in 1995, UN Member States adopted the Fish Stocks Agreement to strengthen the cooperative management (via Regional Fisheries Management Organizations, or RFMOs) of highly migratory and straddling fish stocks within the high seas [38]. Though there are multiple decision-making centers at different jurisdictional levels within ABNJs, the governance is still fragmented and has yet to reach a level of functional polycentric governance [39].

While UNCLOS contains a clear obligation to protect and preserve the marine environment in Article 192, and specifically mentions the need to protect rare or fragile ecosystems and the habitat of threatened, endangered, or depleted species in Article 194.5, the legal mechanisms and processes to adopt MPAs and other ABMTs for conservation purposes in ABNJ are currently disjointed due to the fragmented nature of high seas governance (e.g., [27,40–42]). Due to the increasing human pressures on the marine environment, and specifically the threats to biodiversity in the high seas and deep seabed ecosystems, in 2017, an informal working group of the United Nations recommended that the United Nations General Assembly initiate a process for creating a new legally binding instrument under UNCLOS [43]. The overarching goal of this new instrument is to better address the "conservation and sustainable use of the marine biological diversity of areas beyond national jurisdiction" [43]. This BBNJ Agreement is being developed under UNCLOS and in a manner so as not to undermine existing agreements or bodies. It thus presents an opportunity to enhance cooperation and coordination between these bodies, to strengthen

them where necessary, and to enable States Parties to the BBNJ Agreement to adopt more stringent measures binding directly on the Parties while encouraging and working through existing bodies to adopt compatible Conservation Measures [44]. The BBNJ Agreement process is still ongoing due to postponements caused by the COVID-19 pandemic.

To date, two regional bodies have been successful in designating ABMTs in the high seas of the North East Atlantic and the Southern Ocean. The 1998 Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention) covers both waters within national jurisdiction and beyond national jurisdiction in the North East Atlantic. The CAMLR Convention is the arm of the Antarctic Treaty System (ATS) which governs marine living resources in the Southern Ocean. We chose to focus on CCAMLR due to their efforts in recent years towards leading on MPAs in ABNJ and their clear jurisdictional boundaries (e.g., the CAMLR Convention applies to the whole Southern Ocean, governs fishing activities, and includes provisions for closed areas). The CAMLR Convention, and subsequent rules regarding management of Antarctic marine living resources, is under the competency of the Commission for the Conservation of Antarctic Marine Living Resources, which currently has 25 Member States (Argentina, Australia, Belgium, Brazil, Chile, China, France, Germany, India, Italy, Japan, South Korea, Namibia, Netherlands, New Zealand, Norway, Poland, Russia, South Africa, Spain, Sweden, Ukraine, United Kingdom, United States, and Uruguay) plus the European Union.

1.4. CCAMLR's Governance Structure

The CAMLR Convention's explicit objective is to conserve marine living resources [45]. While conservation includes "rational use", scientific and commercial exploitation of marine life are subject to clearly articulated conservation principles that strive to avoid significant changes in harvested, related, and dependent populations, or significant adverse effects on their associated ecosystems that are not reversible in 20–30 years [44]. Article IX of the CAMLR Convention provides a legal basis for MPAs by allowing for the designation of closed areas for the purposes of science or conservation. Furthermore, CCAMLR has agreed that MPAs, as an ecosystem-based management tool, can help implement the requirements of Article II [46]. The rules of the CAMLR Convention, including the designation and management of MPAs, are carried forward by CCAMLR via Conservation Measures, which must be agreed to via consensus of all CCAMLR Member States. CCAMLR meets once a year in Hobart, Australia to make policy decisions, including the adoption or modification of new and existing Conservation Measures. Meetings of CCAMLR, and policy decisions, are preceded by a week-long meeting of CCAMLR's Scientific Committee, a scientific advisory body. Subsidiary scientific working groups of the Scientific Committee meet throughout the year and further provide scientific advice via the Scientific Committee to CCAMLR. Thus, there is a well-established science-policy process for decision-making.

While CCAMLR's jurisdiction is limited to marine living resources in the Southern Ocean, it is part of the larger ATS regime, which governs all human activities in the Antarctic south of 60° S, including the seafloor, ice shelves, and islands. The Antarctic Treaty bans military and nuclear activities, suspends sovereignty claims, and grants freedom of science. The Environmental Protocol to the Antarctic Treaty further bans mining and has provisions for protected species and areas, waste management, preventing marine pollution, environmental impact assessments, and designates Antarctica a natural reserve devoted to peace and science. Indeed, the Environmental Protocol explicitly states that "the protection of the Antarctic environment and dependent and associated ecosystems and the intrinsic value of Antarctica, including its wilderness and aesthetic values and its value as an area for the conduct of scientific research, in particular research essential to understanding the global environment, shall be fundamental considerations in the planning and conduct of all activities in the Antarctic Treaty area" [47]. All proposed activities in the Treaty Area are subject to the Environmental Impact Assessment required under the Environmental Protocol [47]. Importantly, the CAMLR Convention, in its Article III, binds CCAMLR to the provisions of the Antarctic Treaty and its Environmental Protocol,

even for CCAMLR Member States who are not party to the Antarctic Treaty [45]. The Convention on the Conservation of Antarctic Seals (CCAS) is also part of the ATS and governs commercial activities regarding seals [48]. CCAS sets precautionary catch limits and mandates specific seasonal, geographic, and species prohibitions. However, it is worth noting that sealing has not occurred since the 1960s, nor is there any indication of current or future commercial interest.

For more than a decade, CCAMLR has worked towards adopting a representative system of Southern Ocean MPAs and has successfully adopted two. The first was the South Orkney Islands Southern Shelf MPA, established in 2009 (Figure 2) through Conservation Measure 91-03 [49]. The South Orkney Islands Southern Shelf MPA was the first MPA fully in the high seas, and protects ~94,000 km^2 of the maritime area, including the continental shelf [48]. This MPA is fully protected from fishing, with the exception of research fishing, as permitted throughout the Convention Area under Conservation Measure 24-01 [49,50]. In 2011, CCAMLR adopted a legal framework (Conservation Measure 91-04) to provide guidance for future MPAs. This framework included requirements for MPAs to establish specific conservation objectives, activity restrictions, spatial boundaries, and period of designation, as well as to have a management plan, research and monitoring plan, 5-year reporting, and a 10-year review [51]. CCAMLR then established the >2 million km^2 Ross Sea region MPA in 2016 through the adoption of Conservation Measure 91-05 (Figure 2) [52]. The MPA contains three zones: a General Protection Zone (GPZ), Special Research Zone (SRZ), and Krill Research Zone (KRZ). The GPZ is off limits to fishing with the exception of research fishing being allowed under Conservation Measure 24-01 so long as it supports the objectives of the MPA and meets certain specific criteria [53], (see also section on Research Fishing below). Both the SRZ and KRZ allow for exploratory commercial fishing for Antarctic krill, and the SRZ also allows for limited and controlled commercial fishing for toothfish. Fishing in these zones is permitted under specific fishing Conservation Measures (41-09 for toothfish, 51-04 for krill), and must also meet the requirement of not jeopardizing the conservation objectives of the Ross Sea region MPA [52,53]. All provisions of the Antarctic Treaty and its Environmental Protocol apply to the current MPAs in place, which all fall south of 60° S (though note that some of CCAMLR's jurisdictional boundaries extend north of 60° S; see Figure 2).

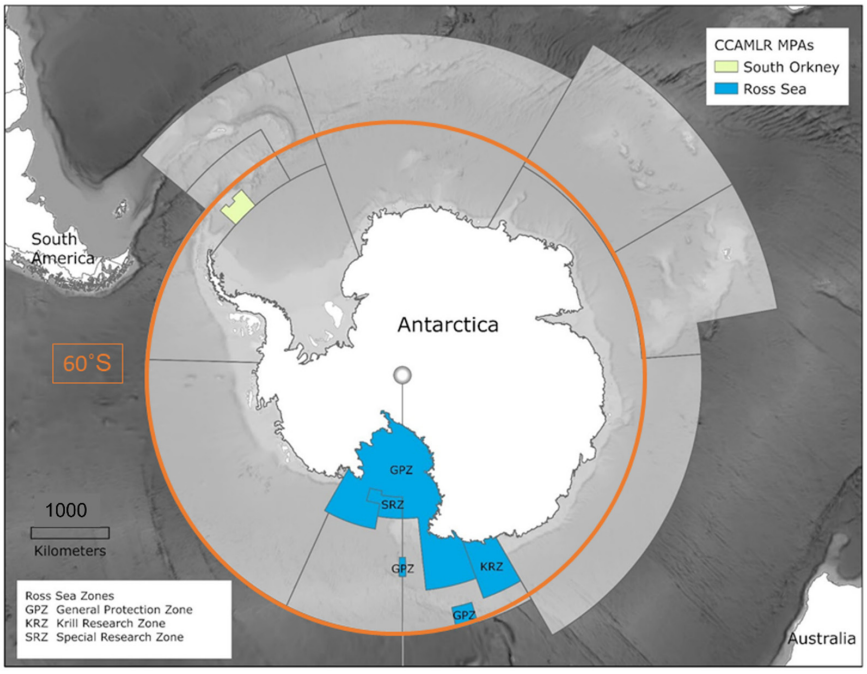


Figure 2. Map of current CCAMLR MPAs in the Southern Ocean, including zoning delineations in the Ross Sea region MPA. Orange line roughly indicates 60° S.

2. Methods

2.1. Data Gathering

All pertinent, publicly available documents for all CCAMLR MPAs were gathered, including management plans and Conservation Measures. Documents pertaining to the IUCN protected area guidelines and *The MPA Guide* were downloaded in 2021 and represent the most updated publicly available versions [22,26].

2.2. Application of MPAs Frameworks and Criteria to Existing High Seas MPA

To assess each MPA zone, the activities table in Day et al. (2019) was consulted (see Table 5 in [26]). This allowed a more streamlined process to ensure that only viable MPA categories were used. Then, the IUCN MPA guidelines description of categories and primary objective(s) for categories based on Table 5 in Day et al. (2019) were listed and compared to the primary objective(s) of each MPA zone to ensure best fit.

To determine the Stage of Establishment and Enabling Conditions for each MPA per *The MPA Guide*, the relevant management plans, Conservation Measures, and reports were reviewed. To determine *The MPA Guide* Level of Protection (fully, highly, lightly, or minimally protected), we evaluated the impact of the seven activities considered in *The MPA Guide*: (1) Mining/Oil and Gas Extraction, (2) Dredging and Dumping, (3) Anchoring, (4) Infrastructure, (5) Aquaculture, (6) Fishing, whether it is subsistence, professional, or recreational fishing; and (7) Non-extractive activities, including recreational, traditional, and cultural [22]. The cumulative impact of these activities—none, minimal, low, moderate, or high—corresponds to the Level of Protection of fully, highly, lightly, or minimally protected [22].

3. Results and Discussion

3.1. IUCN Category (2019 MPA Guidelines)

The zones of the Ross Sea region MPA (GPZ, KRZ, and SRZ) received two types of IUCN categorizations (Table 1) 1A: Strictly Protected Area and IV: Habitat/Species Management Area. The GPZ aims to conserve the natural ecological structure of the Ross Sea region and to protect large-scale ecosystem processes that are key to conserving the biodiversity of the Antarctic environment. These objectives align with IUCN category 1A, which outlines the primary objective "to conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/or geodiversity features" with the allowance of "scientific research involving collection may be permitted if that collection cannot be conducted elsewhere" ([26], p. 8). Within the GPZ all fishing is prohibited except for research fishing under Conservation Measure 24-01 which also meets the conservation objectives of the MPA (research fishing is described in further detail below).

Some of the conservation objectives of the SRZ are to "provide reference areas for monitoring natural variability and long-term change, . . . in which fishing is limited to better gauge the ecosystem effects of climate change and fishing, to provide other opportunities for better understanding the Antarctic marine ecosystem, to underpin the Antarctic toothfish stock assessment by contributing to a robust tagging program, and to improve understanding of toothfish distribution and movement within the Ross Sea region" ([52] p. 3). This species-specific focus aligns well with IUCN category IV, a habitat/species management area. Management objectives of a category IV MPA will reflect the need to protect a particular species or habitat, which in this case is for Antarctic toothfish and their surrounding ecosystem. The SRZ allows for toothfish fishing under pre-existing Conservation Measures regulated by the Ross Sea fishery but with a reduced catch rate and increased tagging efforts for scientific research. It also allows for exploratory krill fishing under an existing Conservation Measure, so long as the fishing is in accordance with the conservation objectives of the MPA. As with the SRZ, the KRZ aligns with the objectives of a category IV MPA, which is dedicated to maintaining and conserving species and habitats [26] (Table 1). The KRZ allows for krill fishing under the same exploratory

fishing Conservation Measure, with the objective of promoting the research and scientific understanding of krill [51].

Table 1. IUCN category and *The MPA Guide* Level of Protection for CCAMLR MPAs and zones therein.

MPA Name and Zone	Conservation Objective(s)	IUCN (2019) Category	MPA Guide Level of Protection
Ross Sea ***General Protection Zone***	"To conserve natural ecological structure, dynamics and function throughout the Ross Sea region at all levels of biological organization, by protecting habitats that are important to native mammals, birds, fishes and invertebrates" (CCAMLR, 2016, p. 3)	1A: Strictly Protected Area	Highly Protected
Krill Research Zone	Objective of the GPZ and additionally "to promote research and scientific understanding of krill, including in the Krill Research Zone in the northwestern Ross Sea region" (CCAMLR, 2016, p. 3)	IV: Habitat/Species Management	Lightly Protected
Special Research Zone	Objective of the GPZ and additionally "to provide reference areas for monitoring natural variability and long-term change, and in particular a Special Research Zone, in which fishing is limited to better gauge the ecosystem effects of climate change and fishing, to provide other opportunities for better understanding the Antarctic marine ecosystem and to underpin the Antarctic toothfish stock assessment by contributing to a robust tagging program, and to improve understanding of toothfish distribution and movement within the Ross Sea region" (CCAMLR, 2016, p. 3)	IV: Habitat/Species Management Area	Lightly Protected
South Orkney Islands	"Protection of representative examples of pelagic marine ecosystems, biodiversity and habitats; Protection of representative examples of benthic marine ecosystems, biodiversity and habitats; Protection of critical life history stages for penguins; Protection of key ecosystem processes associated with the southern shelf region" (Delegation of the EU to CCAMLR, 2014, pp. 4–6)	1A: Strictly Protected Area	Highly Protected

The South Orkney Islands Southern Shelf MPA is singularly zoned as no-take, with a primary objective of conservation, and with only research fishing occurring under Conservation Measure 24-01 [49,50]. This leads to an IUCN categorization of a 1A MPA aligning with the GPZ in the Ross Sea region MPA. There are those who, however, argue that "research fishing" in MPAs, without showing that such research can only be conducted in this site, and without specific limits placed on the spatial footprint of such research fishing, may be inconsistent with the IA MPA characterization.

3.2. The MPA Guide

3.2.1. Stage of Establishment

The MPA Guide was developed to be used for areas that are considered by the IUCN MPA guidelines as MPAs [22]. The Stages of Establishment of the MPA are as follows: (1) Proposed/Committed, (2) Designated, (3) Implemented, and (4) Actively Managed. Both the Ross Sea region MPA and the South Orkney Islands Southern Shelf MPA fall into the category of Actively Managed. They were already proposed [49,54], designated [49,52], and implemented [49,55], and are now actively managed. Per Grorud-Colvert (2021), actively

managed MPAs must have active/ongoing monitoring, management evaluation, and community engagement. The South Orkney Islands Southern Shelf MPA is reviewed every five years (per Conservation Measure 91-03) and the Ross Sea region MPA is reviewed every ten years with an additional requirement for five-year reporting (per Conservation Measure 91-05). Conservation Measure 91-05 for the Ross Sea also includes a management plan which identifies management and administrative arrangements, delegating responsibility. The CCAMLR Secretariat is responsible for many of the administrative aspects of work (e.g., supporting monitoring and compliance). CCAMLR Member States are collectively responsible for other technical aspects including research, monitoring, assessment, and enforcement. However, thus far, these activities tend to be led and supported by specific Member States with scientific or other interests in the area. For example, the United Kingdom largely leads on research and monitoring activities in the South Orkney Islands Southern Shelf MPA [56] and the United States and New Zealand (along with Italy and South Korea) lead in the Ross Sea region [53]. Extensive research has been conducted in both MPAs (see e.g., [54,56]).

Research and monitoring, which will feed into the review process in both MPAs has been guided by scientific research and monitoring plans. In the case of the South Orkney Islands Southern Shelf MPA, a draft research and monitoring plan was developed and presented to CCAMLR's Scientific Committee in 2014 and again in 2019, both aligning with the required five-year review [55]. A draft research and monitoring plan for the Ross Sea region MPA was developed and was endorsed by the Scientific Committee in 2017 [57].

While these research and monitoring plans serve to guide research in the MPAs, they have yet to be formally adopted by CCAMLR due to lack of consensus [53]. Within CCAMLR, there continues to be disagreement among a few Member States about MPA research and monitoring plans in general (e.g., what their goals are, how specific they must be), as well as disagreement around the specifics proposed for the current MPAs (e.g., [58]). Thus, while the MPAs are demonstratively Actively Managed, the research and monitoring plans should be formally adopted by CCAMLR so that they are supported and implemented by all Member States. Further, the 2019 review of the South Orkney Islands Southern Shelf MPA was not endorsed by CCAMLR, related to criticisms about the research and monitoring plan [58]. However, some of this criticism stems from the fact that the South Orkney Islands Southern Shelf MPA was adopted *before* Conservation Measure 91-04. Thus, the MPA was not required to, nor did it have, all the specifications outlined in CCAMLR's Conservation Measure 91-04 framework for MPAs. Therefore, while active monitoring and evaluation is ongoing, there is no consensus among all CCAMLR Members States that the MPAs are actively managed.

Community engagement is another requirement of active management. The CCAMLR MPA community is composed of government officials, scientists, industry representatives, conservation organizations and other intergovernmental organizations. Community engagement occurs largely through CCAMLR's annual meetings; here, representatives from all CCAMLR Member States gather along with their scientific advisors and observer organizations (which include industry, conservation, science, and other community groups). The CCAMLR community also engages throughout the year through online intersessional work, scientific working groups, and MPA workshops, which fulfills the need for ongoing efforts towards building trust and partnerships of the community [22]. While community engagement is occurring, it is largely hierarchical in that Member States have decision-making power, while observers are limited to submitting papers and making oral interventions which seek to influence decision-making. Furthermore, CCAMLR has been criticized for its need to improve transparency [59]. Observers cannot attend scientific working group meetings, detailed fisheries data is not publicly available, and CCAMLR papers are also not publicly available.

3.2.2. Level of Protection

The MPA Guide Level of Protection for the GPZ of the Ross Sea region MPA is highly protected since the only fishing that occurs is for research purposes (Table 1; Figure 3). The Ross Sea region MPA has a primary conservation priority, with a Stage of Establishment as Actively Managed (see [22]). The Level of Protection for both the KRZ and the SRZ of the Ross Sea region MPA is Lightly Protected (Table 1; Figure 3), due to the impact of the non-research fishing that is permitted to occur within both zones. While the SRZ does have active toothfish fishing occurring, at the time of publication, there has been no krill fishing occurring within the KRZ due to lack of interest by the Member States. The South Orkney Southern Shelf MPA, which is singularly zoned as no-take, is Highly Protected and Actively Managed according to its primary conservation priority because fishing in that zone is meant for research only (Figure 3).

Mining and Oil Extraction

Under the ATS, the Environmental Protocol to the Antarctic Treaty prohibits mining and prospecting south of 60° S [47], which encompasses the large majority of CCAMLR's jurisdiction (see Figure 3), including both the entire Ross Sea region MPA and the South Orkney Islands Southern Shelf MPA. These prohibitions result in no mining or oil extraction occurring in any CCAMLR MPAs (Figure 3). These prohibitions will be in place and are actively banned under the Environmental Protocol for the foreseeable future. This ban resulted in 'no' being selected in the Level of Protection decision tree for mining, oil, and gas prospecting (Figure 3).

Dredging, Dumping, and Discharges

In CCAMLR, Conservation Measure 26-01 explicitly prohibits discharge and dumping from fishing vessels, including plastics, oil, fuel, garbage, and offal, which is derived from the Environmental Protocol's Annex IV [47,60]. In addition, dumping of any type of waste from fishing vessels is similarly prohibited in the South Orkney Islands Southern Shelf MPA [49]. In the Ross Sea region MPA, dumping or discharge is mandated to be avoided with further reference to applications of Conservation Measure 26-01 [52]. Furthermore, IMO's International Code for Ships Operating in Polar Waters (Polar Code) applies, and includes a wide range of safety and environmental protective measures [61]. In addition, Annex IV of the Environmental Protocol has explicit provisions prohibiting discharges which align with the International Convention for the Prevention of Pollution from Ships (MARPOL), and which would apply to any ship operating in the current MPAs, as well as the entire Antarctic Treaty Area [62]. These provisions prohibit any discharge of oil (or oily mixture), dirty ballast, tank washing waters, and noxious liquids or chemicals. The discharge of plastics and any nonfood wastes (including paper, rags, glass, metal, incineration ash, packing materials, etc.) is also prohibited [62]. Food waste and sewage dumping may be permitted, but only under certain conditions (e.g., ground up, a distance from shore, and not all dumped in the same location). For any MPA in the CCAMLR area that might extend further north and 60° S, MARPOL provisions would still apply. If dredging was to occur within the CCAMLR area, it would be subject to the same measures as any infrastructure per the Environmental Protocol (see below). These protections against dumping, dredging, and discharges resulted in 'no' being selected on the Level of Protection decision tree for those activities (Figure 3).

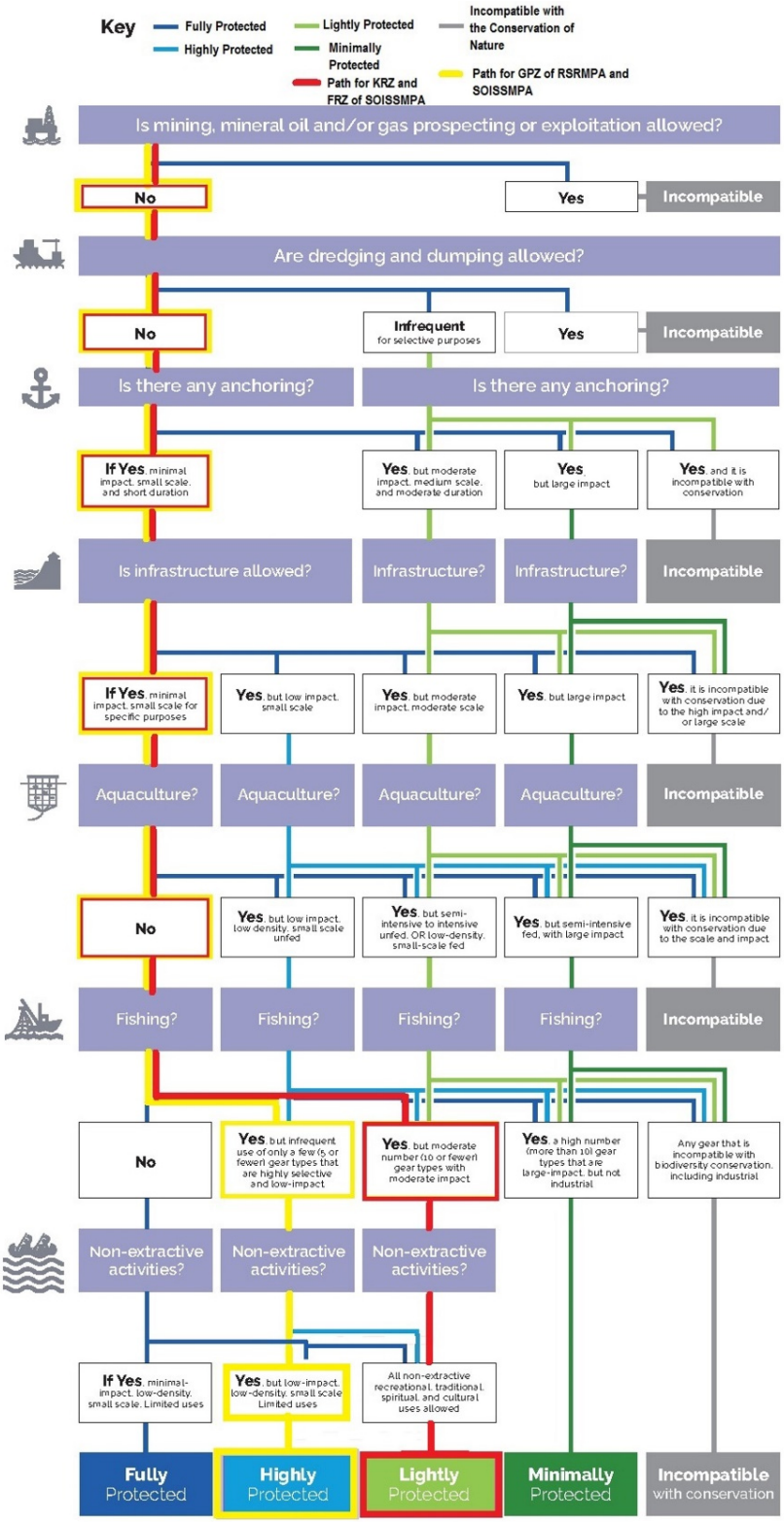


Figure 3. Level of protection decision tree for Ross Sea region MPA and South Orkney Islands Southern Shelf MPA. The yellow path shows the Level of Protection for the South Orkney Islands and General Protection Zone of the Ross Sea region MPAs. The red path shows the Level of Protection for both the Krill Research Zone and Special Research Zone of the Ross Sea region MPA. From [Grorud-Colvert, K.; Sullivan-Stack, J.; Roberts, C.; Constant, V.; Horta e Costa, B.; Pike, E.P.; Kingston, N.; Laffoley, D.; Sala, E.; Claudet, J.; et al. The MPA Guide: A Framework to Achieve Global Goals for the Ocean. Science 2021, 373, doi:10.1126/science.abf0861]. Reprinted with permission from AAAS.

Anchoring

Fishing vessels within the CCAMLR area are subject to Conservation Measure 22-06 which requires Contracting Parties to protect the bottom ecosystem from fishing and related activities [58]. Parties that want to propose bottom fishing activities must fill out forms that outline aspects such as detailed descriptions of anchors to ensure that there would be no adverse effects to the bottom ecosystem [58]. In terms of tourism and anchoring, the International Association of Antarctica Tour Operators (IAATO) is a self-regulating association that promotes environmentally sound tourism within Antarctica (see non-extractive activities section below). In the context of the current CCAMLR MPAs, tourism levels (and resulting anchoring) are very low (see below) and combined with protections through Conservation Measure 22-06 result in a low-impact, infrequent anchoring (Figure 3). However, it is recognized that more needs to be done to reduce the impact of ships in the Antarctic—including potential damage due to anchoring, which may increase in the future as shipping activity increases [63,64].

Infrastructure

Marine infrastructure can take on multiple forms, such as ports, harbors, and infrastructure to support tourism or aquaculture [22]. Currently, the only infrastructure in the CCAMLR area are coastal science bases and temporary piers to support research vessels (e.g., McMurdo Station has an ice pier that is rebuilt as needed; [65]). The South Orkney Islands Southern Shelf MPA does not have infrastructure (nor any planned) and the Ross Sea region MPA only has coastal science bases and the temporary ice pier at McMurdo (all subject to the provisions of the Environmental Protocol). Any built infrastructure, including for science, is regulated by the Environmental Protocol to the Antarctic Treaty which requires an Environmental Impact Assessment (EIA) for any proposed building activities [47]. The EIA process is split into three tiers based on the impacts of the proposed activity: "less than", "no more than", or "more than" a minor and/or transitory impact (Environmental Protocol, 1991). Based on this initial assessment, there are two levels of EIA that will follow depending on whether an activity may have "no more than" or "more than" a minor or transitory impact per the Environmental Protocol [66]. The initial environmental evaluation must include a description of the proposed activity and must consider alternatives to the activity, as well as potential impacts of the activity (including cumulative impacts) [47]. The comprehensive environmental evaluation requires the elements of an initial evaluation as well as details related to indirect impacts, methods and data used to determine potential impacts, identification of unavoidable impacts, estimates related to the duration and intensity of impacts, and identification of knowledge gaps and uncertainties related to the proposed activity [46]. The comprehensive environmental evaluation must also be presented at the Antarctic Treaty Consultative Meetings for discussion by Member States, as well as ongoing environmental monitoring to assess and verify the impact of the activity [66]. Given the current lack of infrastructure in CCAMLR MPAs and the required steps towards a comprehensive evaluation of infrastructure within the CCAMLR MPA area, this resulted in a Level of Protection assessment of infrastructure that is minimal impact (Figure 3).

Aquaculture

While no aquaculture exists in the high seas of the Southern Ocean, it is possible that it might occur in the future. If aquaculture were to be developed in the CCAMLR area, it would likely be subject to the same EIA rules under the Environmental Protocol and an activity would only be allowed if it did not cause adverse impacts to the marine environment and ecosystem (including birds or other animals) [46]. The EIA process is consistent for any form of infrastructure or planned activity, thus presumably would apply to aquaculture. However, since CCAMLR has jurisdiction for marine living resources in the Southern Ocean, it is not clear if CCAMLR would need to generate specific new provisions if aquaculture were to occur. In this moment, given that aquaculture has not occurred to

date, nor has there yet been a stated interest or discussion, there is currently no impact of aquaculture for either of the CCAMLR MPAs (Figure 3).

Fishing

Within *The MPA Guide*'s expanded guidance on Levels of Protection, the authors wrote that "any fishing that may be conducted for scientific research purposes in an MPA or zone is subject to review and approval of the MPA management authority based on its impact", which is also supported through the IUCN-WCC resolution on research fishing which we address further below ([22,67], p. 13). As Brooks et al. (2021) asserted, the GPZ (which comprises ~80%) of the Ross Sea region MPA is Highly Protected based on its use of fishing for research purposes only, and the management structures in place to allow for its active management. The SRZ of the Ross Sea region MPA allows for limited commercial krill and limited commercial toothfish fishing, resulting in a Level of Protection of Lightly Protected. The limited toothfish fishing in the SRZ mandates that there be an increased tagging rate to aid in scientific research [53]. The KRZ allows for limited krill fishing by beam and midwater trawl, which also resulted in a Level of Protection of Lightly Protected [53]. All non-research fishing of the Ross Sea region MPA is additionally done in accordance with the MPA's overall objectives [53]. While some of the gear types utilized within the KRZ and SRZ have a high impact (such as commercial longlines for the toothfish fishery) the 'on the ground' impact is more akin to moderate since they are highly controlled and minimally used. In the fishing section of the Level of Protection decision tree, both GPZ of the Ross Sea region MPA and the entirety of the South Orkney Islands Southern Shelf MPA are listed as 'yes, but infrequent use of few gear types' (Figure 3). The fishing activities of the KRZ and SRZ of the Ross Sea region MPA are listed as 'yes, but moderate number of gear with moderate impact' (Figure 3).

Non-extractive Activities

The CCAMLR area has very active tourism, including recreational activities. Tourism has grown dramatically over the last few decades, with ~55,000 individual tourists visiting the region in the 2019/2020 season [68]. While the majority of tourists visit the Antarctic Peninsula region (with growing concern over potential impact), only a limited number visit the area encompassed by the South Orkney Islands Southern Shelf and Ross Sea region MPAs [69]. Tourist vessels range widely from small capacity sailing yachts (~12 or fewer passengers) to large cruise ships (>500 passengers) [70]. As with all shipping, rules and recommendations adopted by the International Maritime Organization, including the Polar Code, would apply (as noted in the dumping section above). Tourists engage in a wide range of recreational activities, including kayaking, swimming, and scuba diving [68]. All tourists and operators are subject to the rules under the ATS, including the Environmental Protocol, which collectively mandates EIAs, protection of flora and fauna, waste management, and more (as noted above; [47,71]). The Antarctic Treaty Consultative Meeting has further developed codes of conduct for visitation. In conjunction with the Antarctic Treaty, IAATO has developed industry guidelines (consistent with Treaty rules) that its members of IAATO must follow [71]. Importantly, tourism regulations operate independently from CCAMLR MPAs; however, in 2018, IAATO began attending annual CCAMLR meetings as an observer [72], and submitted a paper in 2019 which voiced support for Antarctic MPAs, including seeking to ensure careful management of tourism activities in MPAs and contributing to objectives of the Ross Sea region MPA specifically [58,73,74]. While both of the CCAMLR MPAs have low-density tourism with limited use for non-extractive activities, the KRZ and SRZ of the Ross Sea region MPA were scored as Lightly Protected due to the impact of the fishing activities higher up in the decision tree (Figure 3).

3.2.3. Enabling Conditions

Enabling conditions encompass the principles that governance of an MPA must have in place to ensure that the design, social, and ecological goals of the MPA are met (Figure 4) [21].

The Ross Sea region MPA and the South Orkney Islands Southern Shelf MPA (according to *The MPA Guide* criteria) are both Actively Managed (see above), and meet most, but not all, of the relevant Enabling Conditions (Figure 4) [21].



Figure 4. Enabling Conditions from *The MPA Guide*. Check marks represent conditions that are currently reflected at least in part within the governance of Antarctica MPAs via either CCAMLR or the other bodies within the Antarctic Treaty System. Adapted with permission from Ref. [21], 2021, Science.

Some Enabling Conditions, such as clearly defined objectives, compliance and enforcement, ongoing monitoring and evaluation, adaptive management, incorporation of unique habitats and species, ecological design principles such as connectivity, viability of the MPA based on location, size, and permanence, and the precautionary approach are outlined within CCAMLR's Conservation Measure 91-04 (legal framework for MPAs), as well as the MPAs' specific conservation measures (Figure 4) [49,51,52]. Under the CAMLR Convention, the Enabling Conditions of long-term political will and commitment, evidence-based decision making, knowledge integration, clarity of rules, rights, and boundaries, and recognition of pre-existing rights are fulfilled [45]. Through annual CCAMLR meetings, public participation is achieved to some degree via the observers to the meetings, which include relevant nongovernmental and civil society organizations, and thus demonstrates coordination, communication, and collaboration (Figure 4) [75]. CCAMLR participates in some education and outreach initiatives via publicly available documents, videos, news releases, and other public facing and education initiatives (Figure 4) [76]. Effective management of external pressures is accomplished through the conservation measures process with assistance from the Scientific Committee of CCAMLR, which provides CCAMLR with the best available science on managing threats, including external pressures (Figure 4) [77].

However, there are many ways that the CCAMLR MPAs fall short of the Enabling Conditions for MPAs, indicating areas for possible improvement (Figure 4). While CCAMLR's website lists conservation measures, resolutions, meeting reports, and other relevant data produced by the Commission, many documents (e.g., draft research and monitoring plans, MPA reports) are not publicly available; making these additional documents available would greatly increase transparency around management and monitoring [78]. CCAMLR

does not yet meet the conditions of sustainable financing, sufficient staffing and funding, nor adequate administrative processes with regards to its MPAs. CCAMLR, and all of its activities, is entirely self-funded through the participating Member States on an annual basis [79]. CCAMLR does have some management responsibilities for MPAs (as noted above), but there are no CCAMLR staff dedicated exclusively to MPA management activities and very limited dedicated funds for MPAs with the exception of the Special MPA Fund which thus far has been restricted towards scientifically focused activities, including funding for developing MPA proposals [57]. Thus, cost and staff associated with MPA specific management, monitoring, and other activities end up being covered by specific national governments party to CCAMLR with interests in the area. The last performance review, conducted in 2017, suggested that cost reductions should be considered and that revenue-generating opportunities should be supported to develop the long-term financial sustainability of CCAMLR [57]. These opportunities could also provide financing for MPA activities.

There is also insufficient consideration of cultural values and perspectives (Figure 4). Under the Antarctic Treaty, all sovereignty is suspended. Historically, Antarctica has proved too inhospitable to support human settlements beyond dedicated scientific infrastructure, thus there have not been Indigenous and local rights holders. However, there is a growing body of evidence that Indigenous people had a relationship to Antarctica and its broader seascape (see [80–82]). This presents the opportunity, and the responsibility, to incorporate Indigenous perspectives into Antarctic and Southern Ocean management, including MPAs. Thus far, there have largely not been any considerations of cultural values, traditions, or activities, with the exception of the provisions under the Environmental Protocol to the Antarctic Treaty which allow for designating protected areas based on historical value and significance [83].

Stakeholder engagement could also be improved (Figure 4). Formal stakeholder engagement has been identified as one of the most important factors towards MPA success [84]. While many stakeholders (including civil society organizations) engage in CCAMLR annual meetings, workshops, science and more, CCAMLR does not yet have a stakeholder engagement plan. This plan would provide a formal document or strategy that ensures all interested parties are involved in the assessing, planning, and implementation of the MPA [84]. While an MPA needs full consensus to be implemented in CCAMLR, that consensus is left only to Member States of CCAMLR. Nongovernmental organizations and civil-society organizations—who often advocate for the public interests within the Antarctic region—do not have member status and are not involved in the legal process of establishing an MPA. Nor are they formally acknowledged as being involved in implementation or management, even though some of these groups provide funding, science, facilitation for events, and provide a global view on the issues being discussed [85]. A stakeholder engagement plan would formalize and facilitate engagement of these organizations and other stakeholders, including industry groups, to ensure a more successfully managed MPA. For example, in the subantarctic Heard and McDonald Islands MPA, the fishing industry actively participates in research and monitoring, including for illegal, unregulated, and unreported fishing [86]. A plan could also formalize engagement with Indigenous communities (per section above).

There is no consideration of socio-economic status of the users or impact and benefit-sharing with distributional fairness (Figure 4). For example, all fishing in CCAMLR (with the exception of research fishing) is done in a 'race-to-fish' manner, which provides equal access to all contracting parties [86]. This means that no contracting party is favored over another, regardless of socio-economic status or distributional fairness.

3.3. Addressing Research Fishing

Conservation Measure 24-01, *The application of conservation measures to scientific research*, applies to the whole CAMLR Convention area, including within the current (and likely any future) MPAs in the CCAMLR area [51]. While research fishing can be inconsistent with

"no-take" provisions, this measure provides an opportunity for using fishing vessels as research platforms when remoteness and high costs can be a barrier to fisheries-independent research. Furthermore, and importantly, the process of getting research fishing approved in CCAMLR involves a multiyear process of developing the research with a clear hypothesis and research plan (as described in [53]). The research undergoes scrutiny by multiple Scientific Committee Working Groups, then by the Scientific Committee, who passes on advice to CCAMLR. CCAMLR must then decide via consensus whether or not to approve the proposed research fishing. In the case of the Ross Sea region MPA, Conservation Measure 91-05 further explicitly states that any research fishing must be consistent with the objectives of the MPA for it to be approved [52].

Since the Ross Sea region MPA came into force, CCAMLR has approved one research fishing plan in the MPA located in the GPZ. This research focused on investigating the life history of young toothfish pertinent to MPA objectives 2, 3, and 9 [52]. This research could only be conducted on the Ross Sea shelf (where the young toothfish are hypothesized to occupy), which is fully encompassed by the General Protection Zone. This research could, in theory, improve management of the fishery by providing additional life history information and may lend insight into whether the MPA is effectively protecting toothfish populations, specifically. Other proposed research fishing has been denied based on poor design and inconsistency with the MPA objectives [53]. It is useful to consider the Industrial Fishing Motion adopted by the IUCN which allows for scientific research via fishing vessels in an MPAs if it is "*low-impact scientific research activities and ecological monitoring related to and consistent with the values and restrictions of the protected area can be carried out, particularly when collection cannot be conducted elsewhere*" ([86], p. 1). Thus far, approved research fishing in the Ross Sea region MPA has been consistent with the IUCN resolution.

While currently research fishing has remained highly controlled (i.e., not ever approved in the South Orkney Islands Southern Shelf MPA and approved once in the Ross Sea region MPA), if high levels of research fishing begin to be approved in these MPAs, they would no longer be considered Highly Protected under *The MPA Guide* and may no longer be a 1A classification under IUCN. Furthermore, additional measures could strengthen provisions around research fishing to ensure it does not compromise the ecological values of the region the MPA encompasses. This might include precautionary measures such as completing an environmental impact assessment to anticipate potential risks of the research which also considers alternative non-extractive techniques; required data collection such as attaching cameras to fishing gear to measure and record any impacts of the gear on benthic communities; and control areas to evaluate impact. Indeed, given the stipulations of the Environmental Protocol requiring all proposed activities to include an EIA, while this has not historically applied to CCAMLR activities, doing so (especially around research fishing) would minimize ecological harm and improve biodiversity outcomes, especially in MPAs.

3.4. Outcomes: CCAMLR's Strengths and Limitations

A Highly Protected MPA is likely to provide biodiversity conservation and other benefits such as increased ecosystem resiliency, spillover of fished species to areas outside MPA borders, and climate solutions (e.g., carbon sequestration) (see Table 2 in [22]). The GPZ of the Ross Sea region MPA and the South Orkney Islands Southern Shelf MPA are both Highly Protected and may provide these benefits. The KRZ and SRZ of the Ross Sea region MPA are Lightly Protected and may have limited benefits, such as to specific species [22]. Whether or not these benefits are realized remains to be seen. The South Orkney Islands Southern Shelf MPA has been implemented for more than a decade and the most recent MPA report suggested that the ecosystems, habitats, and biological diversity protected by the MPA have remained conserved, suggesting the MPA is meeting its objectives [58]. However, ecological change may only become apparent over much longer (e.g., decadal) time periods due to climate change impacts [58]. Furthermore, the South Orkney Islands Southern Shelf MPA was designed to be part of a larger network of MPAs and despite additional proposals, CCAMLR has stalled in adopting additional MPAs

in recent years (see [87,88]). The Ross Sea region MPA was implemented in December 2017 and the first research and monitoring activities report will be submitted in 2022 for review by CCAMLR and its Scientific Committee. Given the long life histories of Antarctic species combined with environmental variability and climate change, assessing ecological change and whether the MPA is effectively meeting its objectives may take decades.

Outcomes for all levels of protection depend on effective implementation and active management, and the presence of Enabling Conditions. For example, the CCAMLR Secretariat and some CCAMLR Member States are actively managing the South Orkney Islands Southern Shelf and Ross Sea region MPA, but others are not, and some CCAMLR Member States still do not formally agree with the draft research and monitoring plans for these MPAs. Among Enabling Conditions, being part of the larger, more comprehensive governance regime of the ATS, CCAMLR increases its chances of achieving positive conservation outcomes. Currently, no other high seas marine living resource management bodies (e.g., RFMOs) are part of such a comprehensive governance regime (though see below section on the opportunity of BBNJ Agreement). The Environmental Protocol complements the CCAMLR MPAs by providing comprehensive protection and management from other activities and impacts. However, there are still gaps. For example, while the International Whaling Commission has designated the entire Southern Ocean a whale sanctuary, research permits can still be granted [89] including within CCAMLR MPAs. CCAMLR also does not have jurisdiction over shipping, infrastructure, or tourism, and the Environmental Protocol only extends to 60° S. These gaps could be filled with improved communication, coordination, and perhaps even formal memorandum of understandings with other competent bodies. Furthermore, in terms of Enabling Conditions, the lack of dedicated funding and staff may prove challenging to continue to manage and implement the MPAs. Increased transparency (e.g., making MPA papers and fisheries data publicly available) would also help along with having a stakeholder engagement plan that formalized and welcomed help and engagement from those outside of CCAMLR member national governments.

Finally, it is worth noting that the Highly Protected status and IUCN category IA status of the South Orkney Islands Southern Shelf and Ross Sea region MPAs could change if the conservation goals or impacts of human activities change, though for the IUCN categories it would require the management authority to self-report such a change. For example, the conservation outcomes of these MPAs could be compromised if research fishing were allowed at higher levels, additional fishing gears allowed in the MPAs, tourism dramatically increased, aquaculture operations ensued, or if elements of the Environmental Protocol changed (e.g., following a potential review by the Antarctic Treaty Parties in 2048) potentially removing some of the comprehensive protection it provides.

Conservation outcomes for these and other future MPAs may be improved through the forthcoming BBNJ Agreement, particularly via changes to Enabling Conditions. For example, the BBNJ Agreement may provide a mechanism towards funding the creation of MPAs via their text on a financial mechanism as well as more specifically for capacity building and transfer of technology [90]. This may aid with CCAMLR's struggles surrounding funding for adequate staffing and sustainable funding. Ideally, funding will be clear and equitable to support the development and implementation of MPAs in ABNJs, which has been identified as a barrier [91].

BBNJ Broader Implications

Highly protected MPAs are possible in international waters, resulting in positive outcomes such as enhancing resilience and preserving ecosystem functioning, maintaining, and recovering biodiversity including protection of rare and endangered species, among others [22,86]. This is especially important in ABNJ as they are largely data-poor and subjected to high fishing pressures [6,16].

With the BBNJ Agreement negotiations ongoing, there will likely be an increased interest and call for MPAs within ABNJs. Both the IUCN categories and *The MPA Guide* can aid in this process. The IUCN MPA guidelines can aid in informing the objectives

for MPAs so that they, in fact, qualify as MPAs as well as assist in describing the type and stringency of management measures to meet the proposed objectives [26]. The IUCN MPA guidelines also allow consistency through their definitions of the different protected area categories [26]. *The MPA Guide* provides further guidance as it can aid in identifying and tracking key Enabling Conditions and aligning Level of Protection with expected outcomes as the MPA progresses through different Stages of Establishment on the road to Actively Managed [22]. As such, it is important to raise awareness of these guides and, more specifically, the Enabling Conditions for effective MPAs now so these conditions can be better reflected in the treaty provisions for ABMTs.

However, one persistent problem is the fragmented nature of ocean governance in ABNJs. The emerging BBNJ Agreement may help fill this gap, depending on the final treaty text. The options for MPA establishment under the draft text indicate a range of views regarding the role of the Conference of Parties in adopting management measures for proposed MPAs, which will affect how the treaty will support ABMTs such as MPAs [92]. The approach that leaves responsibility for the adoption of management measures solely in the hands of other bodies could hinder the ability of the BBNJ Agreement to adopt comprehensive measures, address cumulative effects, or overcome the delays and politics of existing organizations by leaving decision-making subject to the same consensus-based voting procedures and power imbalances as before [42,92]. A more appropriate approach for the BBNJ Agreement would favor the creation of institutions that operate at the global scale, including a decision-making body and a scientific advisory body, while further connecting and strengthening existing institutions [92]. This all-inclusive approach is reminiscent of CCAMLR, which in conjunction with ATS is aligned by key principles, objectives, geographic remit, and a focus on scientific research. It is worth noting, however, that harmonization could be increased even within CCAMLR, such as through more meaningful engagement with tourism and shipping.

While the BBNJ Agreement is being negotiated—especially in light of the COVID-19 pandemic—use and development of ABNJ continues. Issues that loom for the high seas and seabed are the establishment of aquaculture and infrastructure for energy production [93]. These issues may just add to the fragmented governance and create additional complications for MPAs within ABNJ unless the BBNJ Agreement also includes strong provisions for environmental impact assessments and broader strategic environmental assessments [94].

Moreover, further consideration is needed on the conditions to foster cooperation and coordination in ABNJ between multiple institutions. Key lessons can be learned from the Southern Ocean governance regime which ensures that those who are party to CCAMLR directly support the goals and objectives of the ATS, including the Environmental Protocol, and that no activities are allowed unless subject to rigorous scientific study and review.

The current fragmented system of governance in ABNJ is missing the two key attributes for an "effective polycentric governance system": (1) generally applicable rules and norms structuring actions and behaviors, and (2) processes to enhance cooperation, coordination, and conflict resolution [39]. Based on work previously done, the role of (1) overarching rules, goals, and objectives and (2) formal and informal conflict resolution mechanisms, among other Enabling Conditions, are necessary to secure resilience of ocean institutions, ecosystems, and biodiversity to cope with growing pressures, uncertainty, and rapid change in ABNJs [39,95,96]. The Southern Ocean benefits from (1) but the slow progress on establishing its system of MPAs suggests that additional mechanisms may be needed to solve internal conflicts beyond a simple veto if CCAMLR is to maintain its leadership role in conservation.

4. Conclusions

Both the IUCN MPA guidelines and *The MPA Guide* are applicable to the high seas environment as exemplified by the CCAMLR MPAs. The IUCN MPA guidelines start by strictly defining what is or is not an MPA. By evaluating MPAs and their zones for the associated IUCN categories, governing bodies can reflect on their management objectives

and how they align with the expected conservation objectives. Assessing an MPA's Stage of Establishment, Level of Protection, and Enabling Conditions using *The MPA Guide* allows evaluators to identify gaps that may prevent the MPA from achieving its goals Both of these assessments should be periodically updated to reflect changes within the governance and management of the MPA, such as the opening of fishing or additional protections that may be established.

This work reinforces a template for ocean governance in ABNJ related to conservation that is productive. The holistic and precautionary governance structure of Antarctica—with CCAMLR, and the wider ATS, and other relevant legal instruments such as MARPOL, showcases that marine conservation, including utilizing MPAs, is possible if all States and stakeholders share the common objective of, as well as obligation for long-term conservation, as embodied in the Antarctic Treaty, the Environmental Protocol, and CCAMLR. With ongoing BBNJ Agreement negotiations still in discussion, including the institutional arrangements of the treaty, CCAMLR and the wider ATS stand out as a model for international governance within ABNJ, so long as CCAMLR continues to be focused on establishing MPAs committed to conservation.

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