

Evaluating the impact of the BBNJ Agreement on regulatory gaps in a competent IFB: a case study of MGRs management in the Antarctic Treaty Area

PAN Min*

School of Political Science and International Relations, Tongji University, Shanghai 200092, China

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Abstract On 19 June 2023, the Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ Agreement) was adopted. The BBNJ Agreement aims to regulate the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction, including the high seas and the international seabed area. The BBNJ Agreement enters into an already crowded institutional landscape as a global authority with broad objectives, inevitably interacting with existing institutions, frameworks, and bodies (IFBs). Existing research has primarily focused on two areas: the first examines the impact of the institutions established by the BBNJ Agreement on existing marine governance IFBs; the second explores its influence on issues currently lacking institutional arrangements. However, comparatively little attention has been given to the Agreement's potential impact on governance gaps within established systems. This paper takes the case of marine genetic resource (MGRs) management in the Antarctic Treaty Area to explore how the BBNJ Agreement may address regulatory gaps in a competent governance framework. Due to shortcomings in addressing core issues, concerning the legal status of MGRs access regulations, benefit-sharing mechanisms, and disclosure of origin, the Agreement is unlikely to have a significant impact on the governance of MGRs in the Antarctic Treaty System (ATS) in the short term. On the other hand, the ATS, as an effective governance framework for the Antarctic Treaty Area, has mature regulations and practical experience in Antarctic governance. Over the years, the ATS has focused on regulating bioprospecting activities as scientific research ones and strict environmental impact assessment procedures. However, there has not been an effective consensus on the regulation of commercial biological prospecting. This paper further explores the coordination issue between the BBNJ Agreement and the ATS, suggesting that in the future, MGRs governance in the Antarctic Treaty Area may evolve into a polycentric governance system.

Keywords BBNJ Agreement, Antarctic Treaty System (ATS), marine genetic resources (MGRs), polycentric governance

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1 Introduction

On 19 June 2023, the Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological

Diversity of Areas beyond National Jurisdiction (BBNJ Agreement) was formally adopted and is expected to come into force in 2025. This treaty aims to protect and sustainably manage marine biodiversity in Areas beyond National Jurisdiction (ABNJ). Unlike most other multilateral environmental agreements that typically arise in response to newly identified transboundary environmental issues, the BBNJ Agreement enters into an already crowded

* Corresponding author. E-mail: panmin417@163.com

institutional landscape as a global authority with broad objectives. (Kim, 2024). With 52 institutions, frameworks, and bodies (IFBs) worldwide potentially impacted, how to manage the relationship between these existing IFBs and the new institutions established under the BBNJ Agreement remains a topic of significant scholarly debate. Furthermore, the future architecture of marine governance is a subject of continuous exploration (Langlet and Vadrot, 2023).

Existing research has primarily focused on two key areas: One aspect concerns the impact of the institutions created by the BBNJ Agreement on existing marine governance IFBs. As an authoritative framework governing high seas activities, how will the BBNJ Agreement influence current governance structures? Can the so-called “undermine” provision effectively address the relationship between the BBNJ Agreement and pre-existing IFBs? Much of the discussion centers around the BBNJ Agreement’s impact on regional fisheries management organizations and its relationship with the International Seabed Authority (Friedman, 2024; Tian and Guo, 2025). The other aspect is the impact of the BBNJ Agreement on issues that currently lack institutional agreements (Kraabel, 2022; Nishimoto, 2022; Young and Kim, 2021). For instance, can institutions established under the BBNJ Agreement directly designate marine protected areas (MPAs) in the Arctic high seas of the Arctic Ocean?

However, there is relatively little discussion regarding the impact of the BBNJ Agreement on governance gaps within an established governance system. Can the relevant institutions under the BBNJ Agreement directly establish management rules? A pertinent example is the governance of marine genetic resources (MGRs) in the Southern Ocean. On the one hand, the Antarctic Treaty System (ATS), which has a long history independent of the United Nations Convention on the Law of the Sea (UNCLOS), governs the Southern Ocean. The BBNJ Agreement has drawn extensively from the ATS, particularly in areas like the establishment of MPAs and environmental impact assessment (EIA). On the other hand, the ATS still has not established comprehensive governance rules for MGRs in the Southern Ocean, despite more than two decades of discussion and negotiation. This remains a critical issue in every session of the Antarctic Treaty Consultative Meeting (ATCM). This paper explores the potential impact of the BBNJ Agreement on governance gaps within such a competent governance system.

There is a wealth of literature on the impact of the BBNJ Agreement on existing IFBs. This paper primarily adopts a literature-based research approach by collecting, organizing, and analyzing existing studies to gather information, identify key issues, and develop arguments—particularly focusing on research related to MGRs under the BBNJ Agreement and bioprospecting of biological resources within the ATS.

An initial conclusion is that it will be difficult for the institutions under the BBNJ Agreement to directly create

regulations to manage MGRs activities in the Southern Ocean. We will argue the viewpoint from two perspectives. First, the provisions related to MGRs in the BBNJ Agreement are currently inadequate. Second, the ATS has long been working towards establishing MGRs governance rules, and several influential Antarctic Treaty Consultative Parties (ATCPs) to the Antarctic Treaty have repeatedly emphasized that MGRs activities in the Southern Ocean should be managed under the ATS. Finally, the paper examines the future governance structure for MGRs in the Antarctic Treaty Area and the evolving relationship between the BBNJ Agreement and IFBs within the broader framework of marine governance. Drawing inspiration from Rakhyn E. Kim, the paper emphasizes the future Polycentric structure of marine governance (Kim, 2024).

2 Regulation of MGRs in the BBNJ Agreement: shortcomings and the long road to improvement

Although the BBNJ Agreement aims to regulate MGRs on a global scale, its shortcomings on key issues limit its ability to exert significant influence, and it is unlikely that detailed governance rules will be established to manage MGRs activities in the Southern Ocean in the short term.

2.1 Unclear legal status of MGRs and contradictory access provisions

One of the key issues in the BBNJ Agreement is the lack of a clear definition of the legal status of MGRs, coupled with contradictory provisions related to access to these resources. During the negotiation process, the Group of 77/China proposed applying the principle of “common heritage of mankind” to all resources in the deep seabed, including MGRs. In contrast, developed countries, particularly the United States, argued that the freedom of the high seas should apply to MGRs in ABNJ, adhering to a “first come, first served” approach (Fan and Lu, 2023; Jin, 2021). These fundamental differences over the legal status of MGRs remained unresolved throughout much of the negotiation process. To break the deadlock, the Agreement ultimately adopted a “suspending disputes” approach, postponing a decision on the legal status of MGRs in favor of avoiding further confrontation. In the final text of the BBNJ Agreement, while the principles of freedom of the high seas and the common heritage of mankind are acknowledged, their relationship and implications for the governance of MGRs are not explicitly defined (Enyew, 2024). As early as 2006, a scholar identified three policy options for establishing a comprehensive international regime for the MGRs in the high seas and deep-sea seabed. Two of these options were the “open access (laissez-faire) approach” and the global public good (common heritage of mankind) approach (Herber, 2006). However, the 2023

BBNJ Agreement still fails to provide a clear definition between the two.

The “Suspending disputes” approach has introduced significant contradictions, particularly in the provisions governing MGRs collection. The Agreement imposes several restrictions on activities related to MGRs. It establishes a prior notification procedure, sets a threshold for EIA, and emphasizes respect for the rights of indigenous peoples and local communities during MGRs collection. Parties must also provide timely updates to the Clearing-House Mechanism and submit a comprehensive report to the Access and Benefit-Sharing Committee every two years. Despite these procedural safeguards, the Agreement paradoxically allows natural and legal persons of parties to collect MGRs without obtaining special licenses (BBNJ Agreement Article 11). This regulatory loophole undermines the strict procedures it seeks to establish, creating significant inconsistencies in the governance of MGRs collection activities.

The contradictory provisions within the BBNJ Agreement regarding the regulation of MGRs not only create inconsistencies between governance tools and legal logic but also undermine the fairness, enforceability, and ecological effectiveness of the regime. While such design flaws may be tolerable in the initial phase of implementation, failure to address them promptly—particularly through the Conference of the Parties (COP)—could significantly compromise the Agreement’s global effectiveness. This is especially true in ecologically sensitive areas such as the Southern Ocean, where unresolved regulatory gaps may trigger a dual crisis of governance legitimacy and international cooperation.

2.2 Limitations and challenges of benefit-sharing mechanisms

The monetary benefit-sharing mechanisms for MGRs emerged as one of the most contentious issues during the BBNJ Agreement negotiations, reflecting the divide between developed and developing countries (Shi, 2023). The benefit-sharing framework consists of two components: “non-monetary benefit-sharing”, which includes access to sample collections and digital sequence information, and “monetary benefit-sharing”, derived from the profits of commercial development.

However, given the limited commercial exploitation of MGRs in the high seas, developed countries expressed concerns that excessive monetary obligations might discourage research and development. To reach a consensus, the Agreement introduced a mandatory payment mechanism for developed countries. Yet, the payment amounts are minimal—only 50% of the annual fee, ranging from tens to hundreds of thousands of U.S. dollars. Such contributions are insufficient to meaningfully support capacity building and technical training in developing countries, rendering the monetary benefit-sharing mechanism largely symbolic and ineffective in addressing the needs of developing nations

(Zhang, 2024).

The monetary benefit-sharing mechanism under the BBNJ Agreement, due to its low-intensity and low-effectiveness design, fails to adequately address the institutional concerns of developing countries, leading to weak incentives and reduced willingness to participate. On one hand, the contribution amounts are extremely limited and fall short of meeting the actual needs of developing countries in terms of scientific infrastructure, technical training, and capacity building. As a result, the mechanism is largely symbolic, with many developing states viewing it as an unfulfilled institutional promise. This perception risks undermining their engagement in key areas such as sample sharing and information exchange, while further exacerbating concerns over the fairness of the regime between the Global North and Global South.

On the other hand, the limitations of this mechanism threaten the overall institutional stability and cooperative foundation of the Agreement. Its legitimacy and sustainability are weakened by the lack of meaningful redistribution, and pressures from developing countries to reform the payment structure may lead to renewed institutional contestation at future Conferences of the Parties. In sum, the current monetary benefit-sharing mechanism is ill-equipped to support a fair, effective, and inclusive system of global governance over MGRs, and thus requires timely institutional adjustments and substantive reform.

2.3 The absence of an MGRs source disclosure mechanism

During the intergovernmental negotiations of the BBNJ Agreement, developing countries advocated for the inclusion of intellectual property provisions within the benefit-sharing mechanisms for MGRs. They specifically sought mandatory disclosure of the geographical origin of MGRs in patent applications. However, developed countries strongly opposed this proposal, arguing that such disclosure would undermine legal certainty, impose additional burdens on patent applicants, and stifle innovation (Guo, 2023). Ultimately, the BBNJ Agreement excluded provisions for source disclosure. This omission has rendered the benefit-sharing mechanisms for MGRs largely symbolic, lacking practical implementation (Zhang, 2024).

The method of shelving disputes to temporarily defer differences, leaving all unresolved issues to the COP after the Agreement comes into force, reflects the difficulty of addressing these problems over nearly 20 years. Given the complex nature of these issues, it seems unlikely they will be resolved in the short term once the agreement is implemented. This will likely be a long and challenging process. With numerous contradictions and unresolved problems within the BBNJ Agreement itself, it raises the question: how can the Agreement effectively manage MGRs activities in specific high seas areas?

While the BBNJ Agreement provides a framework for the regulation of MGRs at the global level, its shortcomings in key areas such as legal status, benefit-sharing, and source disclosure hinder its ability to have a substantive impact on MGRs governance in the short term. This challenge is particularly pronounced in the context of the well-established ATS, where the Agreement faces even greater difficulty in exerting influence.

The absence of a mandatory disclosure mechanism for the origin of MGRs in the BBNJ Agreement represents a fundamental design flaw. Without such a provision, the entire benefit-sharing framework lacks a foundational system of “source-based oversight”. It becomes difficult to identify the country or region of origin, making it nearly impossible to determine which states or communities are entitled to share in the benefits. The lack of transparency in patent applications and commercial utilization further prevents developing countries from recognizing the use of their resources, thereby undermining their ability to claim rights. This combination of information asymmetry and regulatory void renders the benefit-sharing regime largely symbolic, transforming it into a hollow framework with limited enforceability.

3 Discussion and regulation of biological prospecting under the ATS

The ATS is a robust and effective framework for governing the Antarctic Treaty Area, regulating human activities such as scientific research and fishing in the Southern Ocean. Notably, it has established stringent regulations to protect the Antarctic environment, which is particularly vulnerable. The following section explores its position on biological prospecting and how it manages this process in the Antarctic Treaty Area.

3.1 The ATS is a competent governance regime for the Antarctic Treaty Area

The ATS has governed Antarctica for over six decades, establishing a competent framework that ensures peace, scientific cooperation, and environmental protection. As a comprehensive legal and institutional regime, it effectively regulates activities in the region, maintaining Antarctica as a zone dedicated to research and international collaboration (Hemmings, 2020). Established with the adoption of the Antarctic Treaty in 1959, the ATS has evolved into a robust mechanism through subsequent agreements, including the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the Protocol on Environmental Protection to the Antarctic Treaty (the Madrid Protocol) (Antarctic Treaty Secretariat, 1991).

The ATCM serves as the principal decision-making forum where signatory states deliberate and adopt binding measures for governance. The consensus rule is central to this process, ensuring that decisions are made collectively,

with all parties in agreement, thereby fostering cooperation and shared responsibility in managing the region. This approach has been essential in maintaining the stability and legitimacy of the Treaty system.

The ATS has demonstrated effective environmental governance. The Madrid Protocol designates Antarctica as a “natural reserve, devoted to peace and science”, imposing strict regulations on human activities, EIA, and waste management (Antarctic Treaty Secretariat, 1991). CCAMLR provides additional governance over marine resources, including the establishment of MPAs, and applies an ecosystem-based approach to fisheries management. It regulates human activities in the Southern Ocean, aiming to ensure the sustainable use of marine resources while protecting the integrity of the entire ecosystem.

The ATS has played a vital role in maintaining peace and facilitating scientific cooperation in Antarctica. However, it also faces several governance challenges (Yermakova, 2021). Illegal, unreported, and unregulated (IUU) fishing in the Southern Ocean poses a significant threat to the conservation objectives of CCAMLR (Antarctic Treaty Secretariat, 2023). Additionally, the existing legal framework struggles to effectively address climate change within Antarctica (Rothwell, 2021). Regulatory gaps persist in several key areas, including Antarctic tourism and the bioprospecting of Southern Ocean marine resources, raising concerns about the long-term sustainability and governance of human activities in the region (Antarctic Treaty Secretariat, 2024).

The root cause of these governance challenges lies in the “freeze” of sovereignty claims established under the Antarctic Treaty. Article IV of the Treaty stipulates that, for the duration of the Treaty, no new territorial claims may be made, and existing claims are neither recognized nor denied. This provision serves as the cornerstone of the ATS, ensuring stability in the region. However, its ambiguity allows states with differing positions to interpret it in ways that serve their own interests, thereby complicating the governance of emerging issues (Chen, 2018). Addressing these issues often touches on a fundamental question: Who owns Antarctica? Due to the sovereignty freeze, the exercise of jurisdiction over different parts of Antarctica is severely limited, leaving no single state with clear authority to manage specific matters. The Antarctic Treaty’s approach has been to freeze territorial disputes and promote scientific cooperation instead (Wang, 2022).

3.2 The ATS’s history of discussing bioprospecting in the Southern Ocean

The ATS has engaged in discussions on bioprospecting in the Southern Ocean for nearly as long as the United Nations has addressed the issue. The earliest mention of bioprospecting within the ATS can be traced to the ATCM XXIII in 1999, when the topic was introduced through an

information document submitted by the Scientific Committee on Antarctic Research (SCAR) (Antarctic Treaty Secretariat, 1999). Biological prospecting was first officially considered at ATCM XXV in 2002. At the meeting, the UK submitted WP-043 “Biological Prospecting in Antarctica” for consideration under agenda item 4(d), “Matters covered by Annex II (Conservation of Antarctic Fauna and Flora)” of the fifth session of the Committee for Environmental Protection (CEP) (Netherlands, 2018). Subsequent discussions continued, with bioprospecting being included in the agenda of the CEP VI meeting in 2003 (Agenda 7). From ATCM XXVII onwards, every ATCM has addressed Antarctic bioprospecting, highlighting its importance as one of the four main substantive issues alongside environmental protection, Antarctic tourism, and Antarctic security.

ATCM XXX established an informal open-ended web-based Intersessional Contact Group working until ATCM XXXI to examine the issue of biological prospecting in the Antarctic Treaty Area (Netherlands, 2008). There are a total of 30 working papers and information papers submitted by ATCPs and SCAR that contain the term ‘biological prospecting’ in their titles. The topic has also been frequently discussed within platforms such as SCAR, CEP, and CCAMLR (Wang and Sun, 2024).

ATCMs have discussed various specific issues related to biological prospecting in the Antarctic Treaty Area, including the definition of key terms such as “biological prospecting”, “biological resources”, “biological material”, “genetic resources”, and “genetic material”. Other topics include the territorial scope of biological prospecting within the Antarctic Treaty Area, legal status, access, environmental impact, commercialization, benefit-sharing, regulatory considerations, and legal and political issues. Most of the issues addressed in the BBNJ Agreement negotiations have also been discussed at ATCMs.

Despite long discussions within the ATCM, including a peak period around 2008, the ATCM has failed to establish a comprehensive and systematic rule for Antarctic Bioprospecting activities, similar to those created by the United Nations. The ATS is even questioned whether it has the capacity to develop such rules (Nickels, 2020).

The ATCM has long failed to establish a comprehensive regulatory framework for bioprospecting activities in Antarctica. While some scholars attribute this to the consensus-based decision-making process—which inherently slows progress on complex and contentious issues (Cunningham-Hales, 2017)—this explanation addresses only the surface. The deeper and more fundamental reason lies in the “freeze” on territorial sovereignty claims. The Antarctic Treaty neither recognizes nor denies existing claims, allowing the seven claimant states to interpret the Treaty as not undermining their sovereignty. In accordance with UNCLOS, these states may assert sovereign rights over biological genetic resources located within their claimed territories and adjacent 200-nautical-mile zones. Consequently, any attempt to

introduce regulatory mechanisms under the ATCM risks opposition from these states. Furthermore, the sovereignty freeze has impeded the clarification of the legal status of Antarctic biological genetic resources. To avoid the legal and political sensitivities surrounding issues of ownership and sovereign rights, such activities are typically referred to as “biological prospecting” rather than as involving “genetic resources”, thereby framing them as scientific research rather than resource exploitation. The dilemmas and unresolved issues faced by the ATCM may likewise become challenges that the BBNJ Agreement will have to confront in the future.

3.3 ATCM’s regulation of bioprospecting and ATS as the appropriate framework

3.3.1 Bioprospecting as scientific research

The ATS does not directly regulate biological prospecting activities; however, the Antarctic Treaty, the Madrid Protocol, and the CCAMLR include provisions related to biological prospecting (Yermakova, 2021). The ATS primarily regulates and manages scientific endeavors. Resolutions such as ATCM XXVIII Resolution 7 (Antarctic Treaty Secretariat, 2005), ATCM XXXII Resolution 9 (Antarctic Treaty Secretariat, 2009), and ATCM XXXVI Resolution 6 (2013) have reaffirmed the point (Antarctic Treaty Secretariat, 2013). Consequently, the provisions related to “scientific research” in the Antarctic Treaty and the Protocol are applied to bioprospecting, including prior notification procedures, EIA, scientific data exchange, and the protection of biological resources (Zhang and Liu, 2024). The Protocol classifies human activities based on their potential environmental impact, dividing them into three levels: (1) less than a minor or transitory impact (no EIA required), (2) a minor or transitory impact (requires preliminary EIA), and (3) more than a minor or transitory impact (requires comprehensive EIA) (Antarctic Treaty Secretariat, 1991). Consultative parties conducting bioprospecting must also provide relevant information to the Electronic Information Exchange System established by ATCM, and bioprospecting activities are subject to the ATS’s inspection system (Antarctic Treaty Secretariat, 2005).

However, the biological prospecting in Antarctica is not merely a scientific activity but also a commercial one. Regulating such commercial activities under the framework of scientific regulation could potentially lead to dissatisfaction among certain consultative parties and may also fail to regulate commercial activities effectively. Some consultative parties argue that the limitations imposed by the ATS on the prospecting and commercial use of biological resources in the Antarctic Treaty Area might hinder scientific progress and economic development. In particular, they emphasize the need for more flexibility in bioprospecting activities, especially as discoveries could hold significant commercial potential. They advocate for

unrestricted access to biological resources, challenging the restrictions set by the ATS (Netherlands, 2008).

Some consultative parties contend that classifying bioprospecting solely as scientific research may not adequately address the commercial aspects of the activity. Commercial activities involve patents, trade secrets, and benefit-sharing mechanisms, whereas the regulation of Antarctic scientific activities does not include such provisions, as it requires the sharing of scientific results, which conflicts with the confidentiality inherent in commercial activities. Therefore, some consultative parties advocate for separating the regulation of the commercial aspects of Antarctic bioprospecting from the scientific aspects (Antarctic Treaty Secretariat, 2003; Netherlands, 2008). As a result, clearer and more comprehensive regulatory provisions within the ATS are needed. However, the Antarctic Treaty Consultative Parties, after more than 20 years of negotiations, have not reached a consensus on establishing a regulatory mechanism.

As more consultative parties engage in bioprospecting activities in the Antarctic Treaty Area (SCAR, 2021), the tension between commercial interests and scientific research has become increasingly apparent. This conflict not only contradicts the core principle of information sharing enshrined in the Antarctic Treaty (Cunningham-Hales, 2017) but also poses significant risks to the development of Antarctic biological sciences. For instance, the redirection of research funding toward commercial exploitation may lead to reduced support for other areas of biological research, ultimately hindering our comprehensive understanding of the Antarctic ecosystem. Moreover, the commercialization of bioprospecting could undermine the spirit of scientific collaboration that has long characterized Antarctic research. It may erode the mutual trust and open exchange among scientists—a cornerstone of Antarctic science and a foundational principle of the Antarctic Treaty (Hughes and Bridge, 2010).

3.3.2 ATS as the appropriate framework

The ATCM has consistently emphasized that the ATS is the appropriate framework for managing bioprospecting in the Antarctic Treaty Area (Antarctic Treaty Secretariat, 2005; 2009; 2013). Territorial claimants, such as Australia and New Zealand, stress that Antarctic biological prospecting activity is subject to the principles and regulatory arrangements of the ATS and ensure that the Antarctic biological prospecting occurs with the permission of a Treaty Consultative Party in the Antarctic Treaty Area (Australia and New Zealand, 2009). The UK, in its declaration during the signing of the BBNJ Agreement, also highlighted the interaction between the ATS and the BBNJ Agreement, affirming that the ATS addresses the unique legal, political, and environmental issues of the region and provides a comprehensive framework for managing Antarctica (United Kingdom of Great Britain and Northern Ireland, 2023). Chile declares that the Agreement shall in

no way undermine the legal regimes to which Chile is a party, such as, among others, the Antarctic Treaty and its related instruments in force (Chile, 2023). Furthermore, ATCM XXXII Resolution 9 established an informal working group to regulate bioprospecting activities comprehensively (Antarctic Treaty Secretariat, 2009).

On one hand, the BBNJ Agreement is a global governance framework for the high seas and the international seabed area, including the Southern Ocean, while also ensuring that it does not undermine the governing authority of existing IFBs. On the other hand, the ATS is a mature and comprehensive framework for the Antarctic Treaty Area, while the Antarctic Treaty, shall not “prejudice or in any way affect the rights, or the exercise of the rights, of any State under international law with regard to the high seas within that area” (Article VI of the Antarctic Treaty), and it lacks a comprehensive regulatory mechanism for bioprospecting. What will the governance structure for the biological resources of the Southern Ocean look like in the future? How will the governance of the high seas and the international seabed area be structured? And what is the relationship between the BBNJ Agreement and existing IFBs?

4 The impact of the BBNJ Agreement on regulatory gaps in a competent IFB is in coordination

The BBNJ Agreement is designed to address critical governance gaps in ABNJ, particularly in the high seas and deep-sea area, by responding to global challenges such as marine biodiversity conservation, equitable benefit-sharing, and institutional fragmentation. However, in terms of its functional positioning, the BBNJ Agreement does not seek to replace or restructure existing mechanisms. Rather, it emphasizes the principles of “cooperation and coordination”, aiming to bridge the regulatory gaps that persist even within mature governance frameworks.

As discussed above, the ATS stands as one of the most developed and exceptional regional regimes in global ocean governance. Anchored in the Antarctic Treaty, and supplemented by the Environmental Protocol and the CCAMLR, it integrates environmental protection, scientific research, and resource management. Precisely because of its comprehensive structure and long-standing operation, the BBNJ Agreement cannot—and is not intended to—supplant ATS governance in the Antarctic Treaty Area. Nonetheless, significant challenges remain within the ATS, particularly regarding the regulation of MGRs. Scientific research is often used as a regulatory façade to bypass oversight of the potential commercialization and privatization of MGRs. Furthermore, the ATS’s reliance on consensus-based decision-making results in slow responses to emerging issues. The deeper structural constraint may lie in the “sovereignty freeze” embedded in the Treaty, which limits

institutional evolution.

These dilemmas mirror the types of challenges the BBNJ Agreement is likely to face in its implementation. Today's global ocean governance landscape is marked by overlapping mandates, fragmented authorities, and a lack of overarching coordination. The BBNJ Agreement explicitly states that it does not undermine the mandates of existing organizations; instead, it prioritizes institutional coordination and cooperation. Its institutional architecture is therefore oriented toward complementing existing bodies by facilitating inter-institutional linkages, promoting information sharing, and encouraging regulatory coherence.

In relation to MGRs in the Antarctic Treaty Area, the BBNJ Agreement's main role may lie in harmonizing procedural differences—such as prior notification and transparency requirements for marine bioprospecting, thresholds and prerequisites for EIA, and the standards and procedures for monitoring MGRs collection (Zhang and Liu, 2024). On the issue of benefit-sharing, the divergence is even more pronounced. The Antarctic Treaty lacks binding provisions on benefit-sharing and generally leans toward non-monetary benefit-sharing models. CCAMLR focuses on conservation and the sustainable use of marine living resources, but does not explicitly address benefit-sharing mechanisms for MGRs. Conversely, while the BBNJ Agreement addresses benefit-sharing more directly, its lack of concrete implementation mechanisms and enforceable obligations remains a major shortcoming. These disparities suggest that significant coordination challenges lie ahead once the BBNJ Agreement enters into force.

To ensure that the BBNJ Agreement fulfills its coordinating function, future institutional development should focus on the following priorities: establishing liaison points and regular dialogue platforms among relevant mechanisms; creating shared databases and interoperable information systems; developing technical coordination standards for the access, disclosure, and benefit-sharing of MGRs; exploring joint assessment procedures with regional bodies—such as shared EIA processes.

Only by institutionalizing coordination through concrete operational procedures can the BBNJ Agreement effectively address regulatory gaps and move global ocean governance from a state of institutional coexistence toward one of institutional integration.

5 Polycentric governance system in the Antarctic Treaty Area and ABNJ

In response to the current fragmented landscape of ocean governance, the BBNJ Agreement aims to establish a unified, coordinated, and enforceable institutional framework for the global governance of ABNJ. It introduces key institutional components, including a COP,

scientific and technical bodies, and a financial mechanism, to oversee and manage issues such as MGRs, EIA, Area-Based Management Tools, capacity building, and marine technology transfer. In contrast, the ATS constitutes a legally binding multilateral legal framework that regulates activities and governance in the Antarctic Treaty Area. Especially following the entry into force of the Protocol on Environmental Protection, the ATS has evolved into a pioneering platform for global environmental governance, with demonstrative significance in areas such as ecosystem protection, environmental assessment, and sustainable use.

While the BBNJ Agreement represents a global governance mechanism, the ATS is inherently a regional regime, creating a vertical but non-hierarchical relationship between the two. Given the anarchic structure of the international system, the BBNJ Agreement will not hold absolute authority over the ATS, nor is it likely to replace the wide array of existing issue-specific ocean governance IFBs. A parallel can be drawn from the climate regime: following the adoption of the UN Framework Convention on Climate Change, a multitude of climate-related mechanisms have proliferated. The diversity and complexity of climate issues have rendered it unrealistic for any single global institution to comprehensively manage them all (Keohane and Victor, 2011). Similarly, the BBNJ Agreement is expected to face challenges of institutional overlap, coordination, and limited capacity. Looking ahead, our research suggests that the governance of bioprospecting and MGRs in the Antarctic Treaty Area—and in ABNJ more broadly—may evolve into a polycentric governance system. This perspective is inspired by Elinor Ostrom's model for managing complex global commons through multi-level, overlapping institutions.

5.1 “Polycentric order” and “polycentric governance theory”

Ostrom's “polycentric” governance theory inherits Michael Polanyi's concept of polycentric social order, where actors are both independent, freely pursuing their own interests, and interdependent, adjusting to each other, constrained by specific rules, and finding their positions within a broader system of social rules to integrate their relationships (Polanyi, 2011). Therefore, “polycentric” governance refers to a group of interdependent individuals who, around specific public issues, adopt flexible, adaptive, and diverse collective actions based on certain rules, seeking high-performance solutions to public problems through autonomous governance (Chen, 2007).

Polycentric governance has three main characteristics: autonomy of action, decentralization of decision-making, and coordination of relationships (Ostrom, 1990). Although the polycentric theory is derived from governance experiences within national jurisdictions or smaller scales, it is entirely applicable to global governance of public affairs, especially in today's world with advanced communication

vehicles and network technology.

5.2 Potential regulation of bioprospecting and MGRs activities

Autonomy of ATS: In this polycentric system, the ATS will maintain a high degree of autonomy, allowing it to establish its own specific rules and approaches for managing bioprospecting and MGRs activities. This autonomy ensures that decisions align with the unique political, environmental, and scientific contexts of different regions within the Antarctic Treaty Area. Such an approach will enable more responsive regulation, as each ATS can adjust its strategies in real-time based on new scientific knowledge, changing environmental conditions, or evolving political realities, offering greater flexibility and adaptability.

5.2.1 Decentralized authority and decision-making within ATS

The decision-making authority of the BBNJ institutions would remain largely decentralized, with the COP holding limited power in relation to existing IFB-type intergovernmental forums, such as CCAMLR and the ATCM itself. The BBNJ framework would not operate in isolation but would collaborate with other relevant institutions already managing Antarctic marine governance. Under the BBNJ Agreement, the role of the institutions (such as the COP) would primarily be to establish goals for MGRs activities and implement biodiversity conservation norms, rather than directly managing the bioprospecting and MGRs in the Antarctic Treaty Area.

5.2.2 Mobilization, coordination, and oversight of ATS actions by the BBNJ institutions

Key decisions regarding bioprospecting and MGRs regulation in the Southern Ocean may require consultation and cooperation between the BBNJ institutions and the ATS. The BBNJ institutional framework would utilize its regulatory authority to mobilize and oversee the actions of existing ATS, coordinating the relationships between institutions within the ATS to avoid conflicts or governance gaps. The effectiveness of these coordination policies will depend on the degree to which ATS internalize and adopt the goals set out in the BBNJ Agreement.

The shift towards polycentric governance could create a more dynamic and interconnected regulatory environment, where the rules governing bioprospecting and MGRs activities in the Antarctic Treaty Area are comprehensive, flexible, and sensitive to the region's unique challenges. However, the effectiveness of such a system will depend on the willingness of countries and institutions to collaborate and harmonize their goals, ensuring that regulation of MGRs and bioprospecting is effective, sustainable, and equitable in the context of the Antarctic Treaty Area's delicate environmental and geopolitical landscape.

5.3 Governance structure framework for the conservation and sustainable use of marine biodiversity in ABNJ in the future

The governance structure for the area beyond national jurisdictions could also evolve into a polycentric system (Kim, 2024). Under the BBNJ framework, bodies (such as the COP) would set goals for marine biodiversity conservation, implement biodiversity protection norms, and coordinate relationships between different marine governance IFBs. Over the course of more than two decades of negotiations, the goals and norms for marine biodiversity protection have become deeply ingrained, and thus, the primary role of the BBNJ bodies would be to coordinate the relationships between IFBs. Each IFB, while formally independent, would retain decision-making authority, setting its own specific governance objectives, tasks, and measures in line with BBNJ goals. They would govern autonomously and mutually oversee each other's progress toward achieving governance targets and internalizing BBNJ's biodiversity protection standards.

These high seas governance beyond national jurisdictions could achieve effective decision-making, oversight, and coordination. (1) Reasonableness of decision-making: Polycentric governance decentralizes decision-making, allowing local and grassroots actors to retain decision-making authority. IFBs responsible for managing specific regions or areas can make informed, rational decisions based on detailed, localized information. (2) Effectiveness of oversight: This refers to mutual oversight between IFBs. They have frequent interactions, are familiar with each other's operations, and can effectively monitor each other's actions in the pursuit of shared goals. (3) Effectiveness of coordination: Within the BBNJ framework, institutions like the COP would play the role of coordinator, providing a platform, rules, and comprehensive information to facilitate effective coordination between IFBs.

6 Conclusion: advancing through coordination and challenges

The BBNJ Agreement, as a significant milestone in global high seas governance, provides a broad framework of rules for the management of MGRs. However, its initial shortcomings, such as the ambiguous legal status of MGRs and weak benefit-sharing mechanisms, suggest that it will struggle to exert substantial influence on MGRs-related activities in the Southern Ocean in the short term.

In contrast, the ATS stands as the sole appropriate framework for managing activities in the Antarctic Treaty Area, including bioprospecting. The extensive history provides a robust foundation for effectively overseeing bioprospecting activities. Therefore, the ATS's mature legal framework and practical experience make it the most

suitable and effective system for managing bioprospecting in the Antarctic Treaty Area.

Looking ahead, the coordination between the BBNJ Agreement and ATS will become a critical issue in global ocean governance. Under a multi-centered governance model, these mechanisms are expected to achieve balance and collaboration, offering a more equitable and reasonable approach to MGRs governance on a global scale.

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