DISTINCTIONS BETWEEN MARINE SCIENTIFIC RESEARCH AND BIOPROSPECTING FROM THE PERSPECTIVE OF BENEFIT SHARING

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ABSTRACT

The governance of Marine Genetic Resources (MGRs) in Areas Beyond National Jurisdiction (ABNJ) poses growing legal challenges, particularly in distinguishing Marine Scientific Research (MSR) from bioprospecting for benefit-sharing purposes. Drawing on Ostrom's Common Pool Resource (CPR) theory, this study categorizes MGR-related activities into three phases -- acquisition, genetic analysis, and commercialization -- to trace the shift from shared scientific use to private exploitation and identify triggers for equitable benefit-sharing. It finds that while UNCLOS offers limited guidance, the BBNJ Agreement fills part of this gap through a dual-track mechanism promoting both public data access and support for biodiversity and capacity-building in developing states. Nonetheless, uncertainties remain regarding transnational legal responsibilities and implementation standards. The thesis ultimately proposes a flexible governance model integrating CPR theory, property rights, and the Common Heritage of Humankind principle to balance research freedom with equitable and sustainable resource management.

Keywords: Marine genetic resources; marine research; dual-track mechanism; sustainable resource management.

DIFERENÇAS ENTRE PESQUISA CIENTÍFICA MARINHA E BIOPROSPECÇÃO NA PERSPECTIVA DA PARTILHA DE BENEFÍCIOS

RESUMO

A governança dos Recursos Genéticos Marinhos (RGM) em Áreas além da Jurisdição Nacional (ABNJ) apresenta desafios jurídicos crescentes, particularmente na distinção entre Pesquisa Científica Marinha (PCM) e bioprospecção para fins de compartilhamento de benefícios. Com base na teoria dos Recursos de Uso Comum (RUC) de Ostrom, este estudo categoriza as atividades relacionadas aos RGM em três fases – aquisição, análise genética e

comercialização – para rastrear a transição do uso científico compartilhado para a exploração privada e identificar os fatores que impulsionam o compartilhamento equitativo de benefícios. O estudo constata que, embora a Convenção das Nações Unidas sobre o Direito do Mar (CNUDM) ofereça orientação limitada, o acordo sobre áreas além da jurisdição nacional (ABNJ) preenche parte dessa lacuna por meio de um mecanismo de dupla via que promove tanto o acesso público a dados quanto o apoio à biodiversidade e ao desenvolvimento de capacidades em países em desenvolvimento. No entanto, ainda existem incertezas quanto às responsabilidades jurídicas transnacionais e aos padrões de implementação. A tese propõe, em última análise, um modelo de governança flexível que integra a teoria dos RUC, os direitos de propriedade e o princípio do patrimônio comum da humanidade para equilibrar a liberdade de pesquisa com a gestão equitativa e sustentável dos recursos.

Palavras-chave: Recursos genéticos marinhos; pesquisa marinha; mecanismo de dupla via; gestão sustentável de recursos.

1 INTRODUCTION

The legal governance of Marine Genetic Resources (MGRs) in areas beyond national jurisdiction (ABNJ) remains underdeveloped. While the United Nations Convention on the Law of the Sea (UNCLOS) establishes a comprehensive framework for Marine Scientific Research (MSR), it does not define or regulate bioprospecting, nor does it provide a benefit-sharing mechanism applicable to activities involving MGRs. Unlike the open and collaborative nature of MSR, bioprospecting involves privatization and commercialization (Gragl, 2014), risking overexploitation of shared resources and a potential tragedy of the commons without proper regulation (Garcia; Cortês, 2023). This normative gap has become increasingly significant as scientific research and commercial activities rely heavily on genetic information derived from deep-sea organisms.

To address these challenges, the world governments have been discussing for nearly two decades, including five years of intense negotiations, and have finally reached the BBNJ Agreement in 2023. MGRs had been one of the most controversial issues during the negotiations (Leary, 2019). Advanced developed countries need to incentivize bioprospecting through the private sector, while developing countries insist on receiving benefits from any activity related to MGRs (Mendenhall *et al*., 2023). Because of the blurring of the boundaries between MSR and bioprospecting, the question of how to introduce appropriate benefit-sharing mechanisms at the scientific research stage has become complex (Morgera, 2016). Even MSR without explicit commercial intent can generate results with potential economic value, raising the question of when benefit-sharing obligations should arise.

This article argues that the current binary classification between MSR and bioprospecting in the law of the sea is conceptually inadequate and normatively insufficient.

The two categories often overlap in methods, technologies, and early-stage research objectives, making the legal distinction difficult to operationalize. Against this background, the central research question of this article is: To what extent does the BBNJ Agreement establish a legally relevant distinction between MSR and bioprospecting for the purpose of benefit-sharing, given the silence of UNCLOS? Addressing this question requires clarifying the point at which benefit-sharing obligations arise and determining whether the BBNJ framework provides functional criteria capable of supplementing or reinterpreting UNCLOS rules.

Methodologically, the article employs a doctrinal legal methodology to interpret the relevant provisions of UNCLOS and the BBNJ Agreement. Using textual, systemic, and teleological interpretation in accordance with Articles 31 and 32 of the Vienna Convention on the Law of Treaties, the analysis examines how each instrument regulates Marine Scientific Research (MSR) and bioprospecting, and whether the BBNJ Agreement introduces criteria capable of supplementing UNCLOS's normative gaps. This legal analysis is complemented by a functional three-phase model - acquisition, genetic analysis, and commercialization - which traces how the legal character of MGR-related activities evolves across different stages.

This model does not replace legal reasoning but provides an analytical lens for identifying when benefit-sharing obligations may be triggered under the BBNJ framework. Primary sources include treaty texts, negotiation materials, and relevant case law, while secondary sources consist of academic commentary and expert reports. As the BBNJ Agreement has not yet entered into force, the methodology recognizes the limited availability of state practice and treats the analysis as interpretative rather than empirical.

The remainder of the article proceeds as follows. Section 2 examines the legal status of MGRs and the existing rules governing MSR and bioprospecting under UNCLOS and the BBNJ Agreement. Section 3 introduces the Common Pool Resource (CPR) framework and explains how the economic characteristics of MGR-related activities evolve across different research phases. Section 4 applies a property-rights perspective to assess the shift from shared scientific use to exclusive commercial exploitation. Section 5 analyses how the BBNJ Agreement regulates these activities and evaluates whether its dual benefit-sharing mechanism offers a unified framework for MSR and bioprospecting. Section 6 concludes that while the BBNJ Agreement partially addresses UNCLOS's regulatory gaps, further legal development is required to operationalize a coherent and equitable governance regime for MGRs in ABNJ.

2 LEGAL STATUS AND RULES OF MARINE SCIENTIFIC RESEARCH AND BIOPROSPECTING

2.1 Definition and Legal Status of Marine Genetic Resources

Marine Genetic Resources (MGRs) constitute genetic material of marine origin with actual or potential value. Their legal classification in ABNJ has long been debated because UNCLOS does not expressly regulate genetic resources. The view that MGRs follow Freedom of the High Seas (FoHS) (Leary, 2019; Churchill; Lowe, 1999; Allen, 2001) and the view that MGRs are part of CHM (Bourrel *et al*., 2018; Allen, 2001; Borgese, 1998; Lehmann, 2007) have engaged in a protracted debate during the negotiation of the BBNJ Agreement (Leary, 2019). The absence of explicit treaty language has produced a genuine normative gap rather than a mere policy uncertainty.

During the BBNJ negotiations, this gap resurfaced (Leary, 2019). The final text does not settle the legal status of MGRs but integrates elements of the CH principle into the governance framework (BBNJ Agreement, art. 7). Although UNCLOS does not exclude applying CHM to non-mineral resources, neither extend Part XI to MGRs. does it explicitly extend Part XI to MGRs. As a result, MGRs in ABNJ remain legally ambiguous: FoHS still operates in practice, yet must now be interpreted in light of the BBNJ Agreement's emphasis on equitable benefit-sharing (arts. 7–8). The effect is a coexistence of two principles without a defined hierarchy, which complicates the classification of MGR-related activities.

2.2 Definition and Legal Status of Marine Scientific Resources and Bioprospecting

Activities related to MGRs encompass MSR and bioprospecting, both of which involve the collection, analysis, and utilization of genetic material from marine organisms (Glowka, 1996). Despite the controversy (Stephens, 2016; Nordquist *et al*., 1991), MSR is primarily defined as the collection and analysis of samples and information with the aim of advancing human knowledge of the environment, rather than for economic gain (Zou & Telesetsky, 2021). This implies that the core features of MSR are openness, data dissemination, sample exchange, and the disclosure and publication of research results (Zou & Telesetsky, 2021). Since UNCLOS does not anywhere explicitly exclude economic benefit as a purpose of research, other interpretations are possible (Scovazzi, 2004).

By contrast, bioprospecting in a broad sense is considered to cover the entire process

from sampling to commercialization, i.e., including all stages of research and development (Wales, 2015). This activity comprises sampling, isolation, characterization, screening, and ultimately product development and intellectual property (Morgera, 2015). Whether bioprospecting is simply a subset of MSR or constitutes resource exploitation remains unresolved in the literature (Morris-Sharma, 2017). MSR and bioprospecting are the same at the collection and access phases, just for different purposes. As a result, there is a divergence of views as to whether bioprospecting should be considered as MSR as understood by UNCLOS, or as a form of resource exploitation (Morris-Sharma, 2017).

2.3 Evolution of Rules from UNCLOS to BBNJ

The evolution of the law of the sea was founded on a clear differentiation between administrative authority (power to manage scientific research) and resource ownership (right to exploit resources), especially in ABNJ (Schofield *et al*., 2014). UNCLOS differentiates between scientific research (Part XIII) and resource exploitation (Parts V, VI, and XI), but genetic research on marine organisms does not fit neatly into either category. States have the right to conduct MSR in ABNJ (arts. 256–257), coupled with duties to cooperate, promote favorable research conditions, and disseminate results “of major programmes” (arts. 241–244). These provisions promote openness but do not establish any benefit-sharing obligations and do not address research with commercial potential.

The BBNJ Agreement partly fills this normative gap. It applies to the “utilization” of MGRs, defined broadly as “research and development on the genetic composition of MGRs” (art. 1(14); Heidar, 2020), which effectively includes both MSR and bioprospecting. This choice not to exempt MSR (earlier drafts considered such an exemption) reflects the functional inseparability of scientific and commercial research. The benefit-sharing mechanisms under the BBNJ Agreement adopt a dual-track system, comprising both monetary and non-monetary benefits, aimed at balancing scientific openness with equitable resource distribution (Ricard, 2023). Importantly, although the Agreement does not define bioprospecting, it generates differentiated legal consequences through notification requirements (arts. 12–14), public data-sharing obligations (art. 14(3)), and monetary benefit-sharing tied to commercialization (art. 52). In doing so, it indirectly creates a functional distinction between MSR and bioprospecting based on the stage of utilization rather than on subjective research intent.

3 COMMON POOL RESOURCE THEORY AND ITS APPLICATION TO MARINE GENETIC RESOURCES AND SCIENTIFIC RESEARCH

Natural resources, including land, sunlight, water and air, as well as human-made facilities, such as reservoirs and waterways, are resources that are shared by a large number of people and are traditionally referred to as "commons (Choe; Yun, 2017)." Hardin's theory predicts a tragedy of the commons in open-access situations (Hardin, 1968), whereas Ostrom demonstrates that collective governance can prevent overexploitation (Ostrom, 2003; Choe; Yun, 2017; Samuelson, 1954; Buchanan, 1965; Ostrom; Ostrom, 1977). According to Ostrom, Common Pool Resources (CPRs) are resources that are challenging to exclude or restrict users from accessing, and where consumption by one individual reduces the number of resources available to others (Ostrom *et al*., 1994). CPRs are characterized by high subtractability , use by one reduces availability to others (Ostrom; Ostrom, 1977), and low exclusivity, meaning it is difficult to prevent others from access (Ostrom; Ostrom, 1977). While some resources, like toll roads, allow technical control, the openness of the oceans makes regulating access to fish stocks nearly impossible, exemplifying technically infeasible exclusivity.

Table 1:Categorization of Goods

	Low Subtractability	**High Subtractability**
Low Exclusivity	Public Goods	Common Pool Resource
High Exclusivity	Toll Goods	Private Goods

Ostrom's fourfold typology, public goods, toll goods, CPRs, and private goods, provides a useful heuristic for understanding how the characteristics of MGRs evolve as research progresses. However, as Choe notes, exclusivity is not merely technical but socially constructed and can change as governance norms and property claims develop. This insight is relevant to MGRs because their legal treatment under UNCLOS and the BBNJ Agreement depends not only on their physical properties but also on whether international law recognizes legitimate forms of exclusion or privatization. CPR theory is used in this article solely as an analytical lens to describe changes in exclusivity and subtractability across different stages of MGR-related activities. It does not itself generate legal obligations; such obligations arise exclusively from treaty provisions under UNCLOS and the BBNJ Agreement.

Building on this conceptual foundation, this article adopts a functional three-phase model to illustrate how the economic and legal attributes of MGR-related activities evolve over time. Firstly, during the resource acquisition phase, access to ABNJ is theoretically non-

exclusive under UNCLOS, making MGRs resemble public goods. Yet technological and financial barriers produce de facto exclusivity, transforming physical samples into toll goods in practice. The legal consequence is that acquisition activities fall under the freedom of MSR (UNCLOS arts. 256-257), without triggering benefit-sharing obligations, except for the general duties of cooperation and transparency under arts. 241-244.

In the genetic analysis phase, when microorganisms are successfully isolated and characterized, physical samples of the MGRs and genetic information isolated from them will be deposited in the biorepository, which is open to every scientist. These materials are non-exclusive but competitively valuable, matching the attributes of CPRs. Legally, this is the stage where the BBNJ Agreement begins to impose distinct obligations. The requirement to notify activities, assign identifiers, and deposit data in public databases (BBNJ arts. 12-14) means that even MSR becomes subject to enforceable transparency and data-sharing duties, regardless of commercial intent. The legal effect is an early-stage form of non-monetary benefit-sharing grounded in the public accessibility of genetic information.

In the commercialization phase, intellectual property rights confer exclusivity and control over downstream products, transforming genetic information into private goods. Here, the legal consequence becomes decisive: commercialization constitutes “utilization” under BBNJ art. 1 (14), thereby triggering monetary benefit-sharing obligation under art. 52, including milestone payments, product-based contributions, and revenue sharing. At this point, the activity is legally classified as bioprospecting, irrespective of how the research began.

Table 2: Phases of MGR Utilization and Corresponding Legal Consequences

Phase	***Legal Status of Resource***	***Benefit-Sharing Obligation***	***MSR/Bioprospecting Status***
1. Collection	*res communis* under ABNJ; access non-exclusive in law but exclusive in practice due to technical barriers	No benefit-sharing obligation; only possible notification under BBNJ arts. 12-14	No legal distinction between MSR and bioprospecting
2.Genetic Analysis	Genetic data treated as non-exclusive but competitively appropriable	Non-monetary obligations under BBNJ arts. 12-14	Functional divergence begins; MSR still primary category but subject to BBNJ obligations
3.Commercialization	Genetic information becomes exclusive through IPR; private good	Monetary benefit-sharing triggered under BBNJ art. 52	Legally classified as bioprospecting regardless of initial intent

This phased classification shows that the distinction between MSR and bioprospecting cannot rest on intent alone but must reflect changes in exclusivity, control, and resulting legal obligations. The CPR framework therefore provides a functional explanation for why the BBNJ Agreement imposes differentiated duties at different stages of utilization and why commercialization, not sampling, is the legally relevant trigger for monetary benefit-sharing.

Moreover, when applying CPR theory to MSR, the potential for a tragedy of the commons often exists. The sharing of resources within the scientific field is not absolutely open. In reality, scientists often keep information moderately confidential in order to protect the priority of their research results and to avoid “pre-empting” the release of their research results by others (Hagstrom, 1965). The resulting “informal property rights” are considered to be the private behavior of scientists with respect to the results of their research (Merges, 1996). The “free riding” behavior of some research institutions or individuals is the greatest threat to the sharing of scientific resources. Once publicly available scientific research results are used by commercial enterprises to apply for patents or produce goods, the value of the scientific research results themselves will be greatly reduced.

4 DISTINGUISH BETWEEN MARINE SCIENTIFIC RESEARCH AND BIOPROSPECTING FROM THE PERSPECTIVE OF PROPERTY RIGHTS

4.1 A Framework to Regulate Property

A property right constitutes an enforceable authority to perform a specific act within a defined area (Commons, 1968). Schlager and Ostrom’s classification of property rights -- access, withdrawal, management, exclusion, and alienation -- provides a useful analytical tool for understanding how different actors exercise control over resources at various stages of utilization. However, in the context of international law, these property-right categories do not themselves determine legal entitlements; rather, they help illuminate how shifts in control relate to treaty-based obligations.

Table 3: Bundles of Property Rights and Their Holders

	Authorized Entrant	*Authorized User*	*Claimant*	*Proprietor*	*Owner*
Access	√	√	√	√	√
Withdrawal		√	√	√	√
Management			√	√	√
Exclusion				√	√
Alienation					√

While CPR theory emphasize that the competitive and exclusive nature of the resource determines management challenges, and bundle of rights theory provides tools to address these challenges by specifying rights to use and manage the resource. For example, in the case of a fishery, bundle of rights theory can identify which groups have fishing, management or access rights, thus finding a balance between the competitive and shared nature of the

resource. This article adopts property-rights analysis not as a source of legal rules, but as a framework to explain how increasing exclusivity across stages of MGR utilization corresponds to different regulatory consequences under UNCLOS and the BBNJ Agreement. Following Breakey, holding property in an activity entail both the ability to access a resource and the ability to protect the outcomes of that activity (Breakey, 2011). These relational entitlements are temporary and disappear once the underlying activity ceases, which is particularly relevant for distinguishing research from commercial exploitation.

4.2 Bundle of Rights of Marine Scientific Research and Bioprospecting in Difference Phases

The traditional binary distinction (public/private, scientific/commercial) ignores dynamic shifts and fails to account for the gradual transition of MSR to commercial applications or the open attributes of the early stages of bioprospecting (Thambisetty, 2024). This thesis divides the activities with respect to MGRs into three phases and analyzes how publicness is gradually weakened, and exclusivity is gradually strengthened in both MSR and bioprospecting activities.

In the acquisition phase, both MSR and bioprospecting operate under public domain rules, with MGRs in ABNJ as res communis accessible to all. Under UNCLOS arts. 256-257, all states may collect samples in ABNJ, and neither MSR nor bioprospecting actors possess exclusion or alienation rights. Researchers function as “authorized users” with access and withdrawal rights but without managerial or exclusion rights. Legally, no benefit-sharing obligations arise at this stage, and MSR and bioprospecting remain indistinguishable.

In the data analysis phase, genetic data from MGRs hold high social and economic value, fostering cooperation but also risking free-riding. Researchers initially hold significant control over data, but under the BBNJ Agreement, these exclusion rights diminish through mandatory data deposition and identifier requirements (arts. 12-14). Bioprospectors, by contrast, may attempt to maintain stronger exclusivity over the results of screening and characterization. The legal consequence is that non-monetary benefit-sharing obligations begin to apply, marking a functional divergence between MSR and bioprospecting, even though both remain within the scope of “utilization” under art. 1(14).

In the commercialization phase, property rights become most pronounced. Intellectual property regimes allow Bioprospectors to obtain exclusion and alienation rights over inventions, transforming the activity into one centered on private ownership. Researchers

conducting MSR, by contrast, return their results to the public domain except for attribution rights. Legally, commercialization triggers monetary benefit-sharing obligations under BBNJ art. 52, which clearly differentiates bioprospecting from MSR irrespective of initial intentions.

Overall, the property-rights framework demonstrates how increasing exclusivity and control correspond to progressively stronger benefit-sharing obligations. It also shows that the legal distinction between MSR and bioprospecting is not determined by subjective purpose but by the stage of utilization at which rights of exclusion and appropriation emerge, as defined by the BBNJ Agreement.

5 REGULATION OVER MARINE SCIENTIFIC RESEARCH AND BIOPROSPECTING UNDER BBNJ AGREEMENT

From a legal perspective, the central regulatory challenge is that MGRs in ABNJ fall between two doctrinal regimes: *res communis* under the freedom of the high seas and *res communis humanitatis* under the CHM principle. Because UNCLOS does not assign priority between these principles, the resulting ambiguity leaves MGR-related activities vulnerable to unregulated appropriation (Thambisetty, 2024). The BBNJ Agreement responds to this normative gap not by defining MSR or bioprospecting, but by introducing a structured set of obligations that functionally differentiate stages of MGR utilization.

5.1 The Regulatory Logic of Benefit-Sharing under BBNJ

The benefit-sharing mechanisms of the BBNJ Agreement serve three doctrinal purposes. First, overexploitation of common pool resources stems from untracked extraction and self-interest (Ostrom; Ostrom, 1977). The BBNJ Agreement's standardized batch identifiers address this by documenting the extraction, use, and sharing of marine resources, ensuring transparency, deterring free-riding, and enabling accountability (Chiarolla, 2024). In addition, transparency measures promote data sharing and enhance the effectiveness of data sharing and writing (Broggiato *et al*., 2024). Thus, by fixing each sample to a permanent identifier (BBNJ Agreement, art. 12), the Agreement creates a traceability system that reduces the risk of misappropriation and supports collective oversight.

Secondly, as patent values rise, open scientific sharing weakens (Merges, 1996), prompting the 1995 UBMTA framework (Breakey, 2011), which allows open exchange in non-profit research and property protection in commercial use (Merges, 1996). Non-monetary

benefit-sharing, including data deposition, sample sharing, and dissemination of research results (art. 14), attaches to activities in the acquisition and genetic-analysis phases. These obligations preserve the public-domain character of scientific outputs and protect MSR from being compromised by premature proprietary claims. As Merges notes, the BBNJ structure mitigates this by ensuring that early-stage results remain publicly accessible.

Third, monetary benefit-sharing under Article 52 introduces an obligation linked to commercialization. The design of milestone payments, product-based contributions, and revenue-sharing mechanisms reflects a legal position: *commercialization of MGR-derived products constitutes a qualitatively different activity from scientific analysis*, regardless of the actor's original intent. Thus, the monetary track of the BBNJ Agreement formalizes the moment at which an activity is legally classified as bioprospecting. Futhermore, the BBNJ agreement ensures that MGRs are not depleted through overexploitation by providing for moderate use of deep-sea MGRs combined with a rigorous licensing and benefit-sharing system (Humphries; Harden-Davies, 2020).

5.2 Unified Framework for Marine Scientific Research and Bioprospecting

The BBNJ Agreement provides a unified regulatory structure by anchoring legal obligations to the stage of "utilization" rather than to the purpose of the actor. Under Article 1(14), "utilization" encompasses any research and development conducted on the genetic composition of MGRs, covering both MSR and bioprospecting. The legal effect is that all MGR-related activities fall within the BBNJ framework, but their obligations diverge as utilization progresses.

In MSR, all research activities and their outputs are subject to the public property regime. The protection towards scientific output is not to provide direct financial rewards for researchers, but to prevent research results from being commercially utilized by others without compensation. Otherwise, the contributions of researchers will not be duly respected in the process of commercial exploitation (Humphries; Harden-Davies, 2020). Researchers retain no exclusion or alienation rights over their outputs; instead, they contribute to a global pool of data and samples. Such protection should operate through benefit-sharing that reflects the public nature of resources and the value of their utilization.

In the context of bioprospecting, when an entity secures intellectual property rights or patents from its use of MGRs, its proprietary benefits derived from the commons should be allocated to monetary benefit-sharing arrangements. At this point, the actor's proprietary

control triggers monetary benefit-sharing obligations. The Agreement therefore prevents permanent privatization of genetic information by requiring that commercial gains be partially redistributed through the Special Fund. The agreement provides a tiered fee system that measures and documents the extent to which each user utilizes the public property by charging a periodic fee based on a diverse range of metrics based on the total activity of each party (Ricard, 2023). This fee system is not only consistent with equitable sharing in public property theory but also ensures the sustainability of the public resource.

Overall, the benefit-sharing mechanism of the BBNJ Agreement goes beyond the consideration of the purpose of the research or a single output and measures the utilization of public resources through a diversified set of objective criteria and feeds the ultimate benefits back into the public domain. This mechanism clearly divides participants in MSR and bioprospecting into two categories: non-monetary and monetary sharing, realizes equitable redistribution of resources, and promotes free and fair use of scientific research within the framework of public property theory.

6 CONCLUSIONS

This article examined whether the BBNJ Agreement provides a legally relevant distinction between Marine Scientific Research (MSR) and bioprospecting in the governance of Marine Genetic Resources (MGRs) in areas beyond national jurisdiction. UNCLOS offers an extensive framework for MSR but remains silent on bioprospecting and does not establish benefit-sharing obligations. This silence creates a normative gap that becomes significant as scientific research and commercial development increasingly rely on the same genetic materials. The BBNJ Agreement addresses this gap not by defining bioprospecting, but by imposing differentiated obligations at various stages of “utilization,” thereby creating a functional distinction.

Drawing on a three-phase model, acquisition, genetic analysis, and commercialization, this article demonstrated that the legal character of MGR-related activities changes as exclusivity increases. During the acquisition phase, activities fall under *res communis* rules and do not trigger benefit-sharing obligations. In the genetic-analysis phase, transparency obligations and non-monetary benefit-sharing duties under BBNJ Articles 12-14 apply, making MSR and bioprospecting begin to diverge in legal terms. In the commercialization phase, intellectual property and revenue generation activate the monetary benefit-sharing obligations under Article 52, marking the point at which the activity is legally classified as

bioprospecting regardless of initial research intent.

Future legal development will be needed to clarify the interaction between UNCLOS and the BBNJ Agreement, further specify implementation standards, and monitor state practice. Nonetheless, the dual-track benefit-sharing system established in the BBNJ Agreement lays a foundational structure that enhances transparency, prevents misappropriation, and promotes a fair distribution of commercial gains while maintaining the openness essential to scientific research.

REFERENCES

ALLEN, Craig H. Protecting the ocean Garden of Eden: international law issues in deep-sea vent resources conservation and management. **Georgetown International Environmental Law Review**, Washington, DC, v. 13, n. 3, p. 563-630, 2001.

BONNEY, Adelle. Bioprospecting, scientific research and deep-sea resources in areas beyond national jurisdiction: a critical legal analysis. **New Zealand Journal of Environmental Law**, Auckland, v. 10, p. 41-45, 2006.

BORGESE, Elisabeth Mann. **The oceanic circle**: governing the seas as a global resource. Paris: UNESCO Publishing, 1998.

BREAKEY, Hugh. Two concepts of property: ownership of things and property in activities. **Philosophical Forum**, Boston, v. 42, n. 3, p. 239-247, 2011.

BROGGIATO, Arianna *et al*. Mare Geneticum: balancing governance of marine genetic resources in international waters. **International Journal of Marine and Coastal Law**, Leiden, v. 33, n. 1, p. 3-15, 2018.

BROGGIATO, Arianna *et al*. Monetary and non-monetary benefit sharing under the BBNJ Agreement. *In*: HUMPHRIES, Fran (ed.). **Decoding marine genetic resource governance under the BBNJ Agreement**. Cham: Springer, 2024. p. 7-22.

CHIAROLLA, Claudio. **Marine genetic resources governance under the BBNJ framework**. Cham: Springer, 2024.

CHOE, Hyun; YUN, Sun-Jin. Revisiting the concept of common pool resources: beyond Ostrom. **Development and Society**, Seul, v. 46, n. 1, p. 113-130, 2017.

CHURCHILL, Robin Churchill; LOWE, Alan Vaughan. **The law of the sea**. 3. ed. Manchester: Manchester University Press, 1999.

COMMONS, John Rogers. **Legal foundations of capitalism**. Madison: University of Wisconsin Press, 1968.

GARCIA, Maria da Glória; CORTÊS, Ana (ed.). **Blue planet law**: the ecology of our economic and technological world. Cham: Springer, 2023.

GLOWKA, Lyle. Deepest of ironies: genetic resources, marine scientific research, and the Area. **Ocean Yearbook**, Chicago, v. 12, p. 154-173, 1996.

GRAGL, Paul. Marine scientific research. *In*: ATTARD, David Joseph *et al*. (ed.). **The IMLI manual on international maritime law**: volume I: the law of the sea. Oxford: Oxford University Press, 2014. p. 406-422.

HAGSTROM, Warren O. **The scientific community**. New York: Basic Books, 1965.

HARDIN, Garrett. The tragedy of the commons. **Science**, Washington, DC, v. 162, n. 3859, p. 1243-1248, 1968.

HEIDAR, Tomas (ed.). **New knowledge and changing circumstances in the law of the sea**. Leiden: Brill Nijhoff, 2020.

HUMPHRIES, Fran. Marine genetic resources beyond national jurisdiction: the expansive scope of the BBNJ Agreement. *In*: HUMPHRIES, Fran (ed.). **Decoding marine genetic resource governance under the BBNJ Agreement**. Cham: Springer, 2024. p. 15-30.

HUMPHRIES, Fran; HARDEN-DAVIES, Harriet. Practical policy solutions for the final stage of BBNJ treaty negotiations. **Marine Policy**, Amsterdã, v. 122, p. 104-112, 2020.

KORN, Horst; FRIEDRICH, Susann; FEIT, Ute. **Deep sea genetic resources in the context of the Convention on Biological Diversity and the United Nations Convention on the Law of the Sea**. Bonn: Bundesamt für Naturschutz (BfN), 2003. (BfN-Skripten, 79).

LA FAYETTE, Angelique de. A new regime for the conservation and sustainable use of marine biodiversity and genetic resources beyond the limits of national jurisdiction. **International Journal of Marine and Coastal Law**, Leiden, v. 24, n. 2, p. 221-271, 2009.

LEARY, David. Agreeing to disagree on what we have or have not agreed on: the current state of play of the BBNJ negotiations on the status of marine genetic resources in areas beyond national jurisdiction. **Marine Policy**, Amsterdã, v. 99, p. 21-40, 2019.

LEHMANN, Friederike. The legal status of genetic resources of the deep seabed. **New Zealand Journal of Environmental Law**, Auckland, v. 11, p. 33-48, 2007.

MARINE & ENVIRONMENTAL LAW INSTITUTE. **Marine biodiversity beyond national jurisdictions workshop**: final report. Halifax: Dalhousie Law School, 2006.

MENDENHALL, Elizabeth *et al*. The ship has reached the shore: the final session of the "Biodiversity Beyond National Jurisdiction" negotiations. **Marine Policy**, Guildford, v. 155, p. 1-8, 2023.

MERGES, Robert P. Property rights theory and the commons: the case of scientific research. **Social Philosophy & Policy**, Cambridge, v. 13, n. 2, p. 145-162, 1996.

MORGERA, Elisa. Fair and equitable benefit-sharing at the cross-roads of the human right to science and international biodiversity law. **Laws**, Basel, v. 4, n. 4, p. 803-826, 2015.

MORGERA, Elisa. The need for an international legal concept of fair and equitable benefit sharing. **European Journal of International Law**, Oxford, v. 27, n. 2, p. 353-372, 2016.

MORRIS-SHARMA, N. Marine genetic resources in areas beyond national jurisdiction: issues with, in and outside of UNCLOS. *In*: NINAN, T. K. (ed.). **Biodiversity beyond national jurisdiction**. Leiden: Brill, 2017. p. 81-86.

MURAKI-GOTTLIEB, E.; MORGERA, Elisa. The need for an international legal concept of fair and equitable benefit sharing. **European Journal of International Law**, Oxford, v. 27, n. 2, p. 353-372, 2016.

NINAN, T. K. (ed.). **Biodiversity beyond national jurisdiction**. Leiden: Brill, 2017.

NORDQUIST, Myron H.; ROSENNE, Shabtai; YANKOV, Alexander. **United Nations Convention on the Law of the Sea 1982**: a commentary. Dordrecht: Martinus Nijhoff, 1991. v. 2.

ORGANIZAÇÃO DAS NAÇÕES UNIDAS. **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)**. New York: United Nations, 19 June 2023. Not yet in force.

ORGANIZAÇÃO DAS NAÇÕES UNIDAS. **Convention on Biological Diversity**. Rio de Janeiro: UN, 5 June 1992.

ORGANIZAÇÃO DAS NAÇÕES UNIDAS. **United Nations Convention on the Law of the Sea**. Montego Bay: UN, 10 Dec. 1982. United Nations Treaty Series, v. 1833, p. 397, 1994.

OSTROM, Elinor. How types of goods and property rights jointly affect collective action. **Journal of Theoretical Politics**, Londres, v. 15, n. 3, p. 239-270, 2003.

OSTROM, Elinor; GARDNER, Roy; WALKER, James. **Rules, games, and common-pool resources**. Ann Arbor: University of Michigan Press, 1994.

OSTROM, Vincent; OSTROM, Elinor. Public goods and public choices. *In*: SAVAS, E. S. (ed.). **Alternatives for delivering public services**. Boulder: Westview Press, 1977. p. 7-49.

RICARD, Pascale. The advent of the 2023 “BBNJ” Agreement: a preliminary legal analysis. **Environmental Policy and Law**, Amsterdã, v. 53, n. 6, p. 427-431, 2023.

ROBB, Catherine. **BBNJ and institutional conflicts**: the case of the International Seabed Authority. Cambridge: Cambridge University Press, 2024.

SALPIN, Cátia; GERMANI, Valentina. Patenting of research results related to genetic resources from areas beyond national jurisdiction: the crossroads of the law of the sea and intellectual property law. **Review of European Community & International Environmental Law**, Oxford, v. 16, n. 1, p. 12-23, 2007.

SAMUELSON, Paul A. The pure theory of public expenditure. **Review of Economics and Statistics**, Cambridge, v. 36, n. 4, p. 387-389, 1954.

SCHLAGER, Edella; OSTROM, Elinor. Property rights regimes and natural resources: a

conceptual analysis. **Land Economics**, Madison, v. 68, n. 3, p. 249-262, 1992.

SCHOFIELD, Clive; LEE, Seokwoo; KWON, Moon-Sang (ed.). **The limits of maritime jurisdiction**. Leiden: Brill Nijhoff, 2014.

SCOVAZZI, Tullio. Mining, protection of the environment, scientific research and bioprospecting: some considerations on the role of the International Seabed Authority. **International Journal of Marine and Coastal Law**, Leiden, v. 19, n. 4, p. 383-401, 2004.

STEPHENS, Tim. Marine scientific research. *In*: ROTHWELL, Donald *et al.* (ed.). **The Oxford handbook of the law of the sea**. Oxford: Oxford University Press, 2016. p. 559-575.

THAMBISETTY, Siva. The unfree commons: freedom of marine scientific research and the status of genetic resources beyond national jurisdiction. **Modern Law Review**, Londres, v. 87, n. 1, p. 1-25, 2024.

UNITED NATIONS. General Assembly. **Revised draft text of an 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**: note by the President. New York: UN, 2019.

WALES, Elizabeth. Marine genetic resources: the clash between patent law and marine law. **Natural Resources & Environment**, Chicago, v. 29, n. 1, p. 44-47, 2015.

ZOU, Keyuan; TELESETSKY, Anastasia (ed.). **Marine scientific research, new marine technologies and the law of the sea**. Leiden: Brill Nijhoff, 2021.