CONCEPTUAL AND LEGAL FRAMEWORK OF INTELLECTUAL PROPERTY RIGHTS IN MARINE RESOURCES

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ABSTRACT

Marine Genetic Resources (MGRs) are in a significant yet ambiguous position, positioned between ocean governance, biodiversity law, and Intellectual Property Systems. Advances in Science and Technology enabling marine biotechnological research have allowed us to obtain considerable pharmaceutical, industrial and commercial value from the genetic materials provided by marine plants and animals, especially from marine organisms found at extreme depths and in harsh conditions. The current legal framework for access, ownership, and sharing of benefits fails to embrace all MGRs. The purpose of this paper is to explore the legal and theoretical basis of the governance of MGRs, with emphasis on how the UN convention on the Law of the Sea (UNCLOS), the Convention on Biological Diversity (CBD), the Nagoya Protocol and the Agreement on Biodiversity Beyond National Jurisdiction (BBNJ), interact to govern MGRs. UNCLOS does provide jurisdictions for certain countries; however it does not provide a complete framework for regulating genetic resources found outside of National Jurisdictions (high seas). While the CBD and Nagoya Protocol provide for Access to genetic resources and Benefit Sharing from such Access; they are only applicable for areas within the Jurisdiction of states. The BBNJ Agreement provides a significant advancement in the way that Access and Benefit Sharing will apply to Areas Beyond National Jurisdiction (ABNJ) however it has not addressed the issue of intellectual property rights and enforcement of ABNJ agreements. Another issue also discussed in the article is the increasing importance of Digital Sequence Information (DSI), which poses a threat to the traditional benefit sharing models of access based by allowing an innovation without access to marine samples. It critically appraises the patent practices with reference to MGR-derived inventions in which there exist issues regarding biopiracy, non-disclosure and championing inequality in distribution of benefits. The article claims that there should be a moderate regulation strategy that would coordinate the

incentives of innovation with conservation, transparency, and international equity.

Keywords: Marine Genetic Resources, Intellectual Property Rights, Access and Benefit Sharing, Bio piracy, Digital Sequence Information.

INTRODUCTION

The cardinal foundation of this dissertation depends upon how precise the definition of MGR and ABNJ is done. These are not merely a technical description but also legal constructs which carry significant implications in Intellectual Property arenas, ABS and marine governance. Even though there are regulations at the international level, the absence of a uniform definition and legislation created doctrinal ambiguities that shapes debates on ownership and protection. Marine Genetic Resources have emerged as a hot topic in today environmental and intellectual property law. The genetic material derived from marine organisms has a great capacity for application in pharmaceuticals, biotechnology and industrial processes[1]. As scientific exploration goes deeper into the cardinal hot bed of the ocean ecosystem, varieties of new organisms are discovered in extreme environments such as hydrothermal vents and cold seeps which ascend the significance and economic value[2]. This growing recognition has ignited hot debates on the jurisdictional and patenting value of the Marine Genetic Resources.

Recent developments have shaped a fragmented legal framework. Within territorial jurisdictions states enjoys the ultimate sovereign rights over the genetic resources under CBD and Nagoya Protocols. However, these establishments doesn't extend till the Area Beyond National Jurisdiction, leaving High Seas administration under an ambiguity. UNCLOS laid down a jurisdictional foundation but does not give a strait jacket formula to regulate genetic resources, thus creating a tussle between High Seas and common heritage of mankind.

This chapter defines the definitional scope of MGRs, the evolution of international frameworks, unresolved issues of sovereignty and ownership. It further deals with role of intellectual property in governing marine innovation.

[1] World Intellectual Property Organization, *Intellectual Property and Genetic Resources* (WIPO Publication No. RN2023/5/10, 2023), https://www.wipo.int/edocs/pubdocs/en/wipo-pub-rn2023-5-10-en-intellectual-property-and-genetic-resources.pdf.
[2] Oldham, Paul. (2014). Valuing the Deep: Marine Genetic Resources in Areas Beyond National Jurisdiction. 10.13140/2.1.2612.5605.

1 .1. THE BASICS OF MARINE GENETIC RESOURCES

No convention or statutes has yet conclusively defined the concept of MGR. However, the Convention of Bio Diversity (CBD) offer a decent definition that throws some conceptual idea. The CBD defines genetic resources as "genetic material of actual and potential value"[3]. It again elucidates genetic material as "any material of plant or animal or microbial, or other origin containing functional units of heredity"[4]. This wide framing highlight the immense potential bestowed in the unexplored arena of MGRs. The United Nations Informal Consultative Process on the Oceans and the Law of the Sea (UNICPOLOS) Convention held in 2008 at New York has witnessed various Scientists presenting their opinions about MGRs and to facilitate them with more peculiar definitions. Panellists ranging Smithsonian Institute, Wood Hole Oceanographic Institution of United States to Australian Institute of Marine Science were present in the convention raising multifaceted issues and scope pertaining to MGRs.

Panellists vehemently argued on the importance of MGRs result from a unique DNA or RNA stands extracted cultured and modified in the laboratories. The strands which are replicated get likened to each other organisms to determine their potential applications after being simplified from laboratory. All research came to a conclusion that the MGRs contain valuable genetic materials ranging from microorganisms like bacteria , algae fungi etc. to larger forms of life such as plants, invertebrates, and even sometimes mammals in Oceanic body.

Furthermore, the location of MGRs have been reported by the panellists near to the hydrothermal vents in the deep sea bed[5]. Hydrothermal vents of the deep sea bed are predicted to be the future hotbed which yield MGRs[6]. The International Co-operation in ridge –Crest Studies has reported in their studies that hydro thermal vents are areas which are prone to tectonic and volcanic activity which spouts from the core of the Earth and are mostly found

[3] Convention on Biological Diversity, art. 2, June 5, 1992, 1760 U.N.T.S. 146, 31 I.L.M. 818 (1992).
[4] Id
[5] Margaret K. Tivey, Assoc. Scientist Marine Chemistry & Geochemistry of Woods Hole Oceano graphic Inst., presenting work of Professor Colin Devey of InterRidge at the United Nations Informal Consultative Process on Oceans and Law of the Sea: InterRidge statement of commitment to responsible research practices at deep-sea hydrothermal vents (June 27, 2007), abstract available at http://www. un.org/Deptsflos/consultative-process/documents/8-abstract%20-tivey-interridge.pdf, full-text of state ment available at http://www.interridge.org/irstatement [hereinafter Devey].
[6] Libby Evans-Illidge, Manager Bioresources Library, Austl. Inst. of Marine Sci., statement at the United Nations Informal Consultative Process on Oceans and Law of the Sea: Towards a Practical Knowledgebase for Marine Genetic Resources (June 25, 2007), abstract available at http://www.un.org/ Deptslos/consultativeprocess/documents/8_abstract evansillidge.pdf.

in deep sea beds where plates of earth continuously reform and reshape the seafloor[7]. A study of 2012 has revealed that at least 11 biogeographic provinces of hydrothermal vents[8]. The possibility of Hydrothermal vents shifting its phase from active to inactive and vice versa definitely cause vulnerability to these MGRs present in those areas. Due to their tectonic nature, areas of hydrothermal vents are volatile and subject to hap hazardous scenarios like Tsunami, Volcanic eruptions and Earthquakes. Tremendous changes in the temperature, pressure disrupts environments.

It is quite astonishing that even scientists are surprised that how MGRs have developed an inherent protectionist mechanisms to shield themselves from the adverse surroundings. Even scientist have stated that such adaptation can be used by human against the chronic diseases. Materials from MGRs have been tested for potential uses like developing antidotes for these diseases like Cancer, Leukaemia and other viral infections[9].

1.2 APPLICATION OF MARINE GENETIC RESOURCES IN VARIOUS SECTORS

Marine Genetic Resources have paved way for various innovations especially in fields relating to pharmaceuticals and healthcare.

They are:

a) Pharmaceuticals

The derivatives extracted from the MGRs are being widely used for treating antioxidant, antiviral, anti-cancerous, anti-tuberculosis, anti HIV and other purposes. However, developing these into patented pharmaceutical products, thus granting the patent owner temporary monopoly rights requires an extensive and highly regulated process. To commercialize these derivatives, these extracted minerals has to be synthesized in laboratory and subjected to meticulous testing. These test consists of various chemical test and three phase trial test. Phase

[7] Devey Supra Note 3

[8] Rogers, A. D., Tyler, P. A., Connelly, D. P., Copley, J. T., James, R., Larter, R. D., Linse, K., Mills, R. A., Garabato, A. N., Pancost, R. D., Pearce, D. A., Polunin, N. V., German, C. R., Shank, T., Boersch-Supan, P. H., Alker, B. J., Aquilina, A., Bennett, S. A., Clarke, A., Dinley, R. J., … Zwirglmaier, K. (2012). The discovery of new deep-sea hydrothermal vent communities in the southern ocean and implications for biogeography. *PLoS biology*, *10*(1), e1001234. https://doi.org/10.1371/journal.pbio.1001234

[9] The Secretary-General, Report of the Secretary-General on Oceans and the Law of the Sea, 1 127, delivered to the General Assembly at the sixty-second session, U.N. Doc. A/62/66 (Mar. 12, 2007) [here inafter Oceans and the Law of the Sea].

1 to measure safety, dose and pharmacokinetics, Secondly, top measure efficiency and tumour type and lastly, for large scale meticulous studies. Then it undergoes the patent procedures and marketed to public. The timespan to develop the product into a proper and full-fledged drug would take up to 10 to 15 years and would cost $800 million dollars[10].

b) Cosmetics:

In the cosmetics industry, Pigments known as Sycotemin which is made out from Cynobacteria have been developed to get protection from Ultraviolet rays. These pigments have been used for use in sunscreen formulations and anti–inflammation products. Additionally, Pseudoterosin commonly extracted from plant named sea whip plant have been incorporated into products to prevent skin irritation[11]. Beyond cosmetics, it has been shown potential in the pharmaceutical sector, having successfully passed pre-clinical tests and currently waiting to pursue its approval from US Food and Drug Administration (FDA).

c) Bioremediation

Moreover, MGRs have been used as a vital tools for bioremediation[12]. The concept can be elucidated as using living organisms for treating hazardous waste management and pollution control. Previously, MGRs are used as industrial microbes where it was successfully tested as removing dangerous chemical substances such as phenol, calcium and chloride from wastewater of industries.

1.3 EVOLUTION OF LEGAL FRAMEWORK FOR MGR (UNCLOS, CBD, NAGOYA PROTOCOL & BBNJ

The advent of novel technologies along with the need to call for emergency situations and challenges like Famine, disease and lack of environmentally friendly resources there is an interest in academic community on the MGRs. Today, MGRs are extensively used in the field of pharmacy for manufacture of medicines, vaccines and diagnostic tools. MGRs also play a

[10] United Nations Univ. Intst. of Advanced Sci. and the United Nations Educ., Sci. and Cultural Org., report presented at the United Nations Informal Consultative Process on Oceans and the Law of the Sea: An Update on Marine Genetic Resources: Scientific Research, Commercial Uses and a Database on Marine Bioprospecting, § 4.2, (June 25, 2007), available at http://www.ias.unu.edu/resource_centre/ Marine%20Genetic%20Resources%20UNU-IAS%20Report.pd

[11] Marinebiotech.org, Drugs from the Sea Index, Pseudopterosins, http://www.marinebiotech.org/ pseudopterosins.html (last visited June 16, 2008).

[12] Diamond v. Chakrabartry, 447 U.S. 303 (1980).

vital role in field of food security since they are employed in food manufacturing, production and improvement. Still, MGRS aren't full-fledgy utilised by the mankind for their studies and researches. This happens because of the ambiguity persists in defining MGRs in any International conventions. Thus fact entails a catena of legal and non-legal issues.

1.3.1 UNITED NATIONS CONVENTION ON LAW OF SEA

UNCLOS which concluded in 1982, provides foundational architecture for law of seas. It paved way to create jurisdictional zones such as territorial seas, Exclusive Economic Zones, and the high seas. While UNLCOS closely work with mineral regulations in Area of Common heritage if mankind it keep silent on Marine Genetic Resources[13].

Instead MGRs are governed by default principles, within EEZs state exercise their sovereign rights over their natural resources. This left bio prospering of MGRs in high seas and deep seabed which has been regulated for decades. The ambiguity of an exemplary rule created tension between technologically forwarded states and developing countries where the former can exploit MGRs[14].

UNCLOS enunciates provisions for Marine Scientific Researches requiring publication and dissemination of results. The obligations laid down ground work for hot debates on non-monetary benefit sharing and however, the advancement of technologies made UNCLOS outdated which demands a new convention.

1.3.2 CONVENTION OF BIOLOGICAL DIVERSITY

The 1992 convention has made a tremendous and pivotal change in the marine resources. Its objectives are conservation, sustainable use, equitable benefit sharing firstly recognised genetic resources and their economic value. The CBD defines "genetic material of actual or potential value including material of marine origin"[15].

Under the CBD, states hold sovereign rights over genetic resources within their jurisdiction. Access requires prior Information Consent and negotiation of mutually agreed terms. This

[13] United Nations Convention on the Law of the Sea art. 136, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS].
[14] Paul Oldham, *Valuing the Deep: Marine Genetic Resources in Areas Beyond National Jurisdiction* (2022), https://bookdown.org/poldham/valuingthedeep/introduction.html.
[15] CBD art. 2.

framework made sue to the fears of bio piracy ensuring that resource rich but technologically states would share in benefits derived from their biodiversity[16]. Even though, there are few limitations for CBD and firstly, it does not extend to ABNJ, by extending above territorial areas leaving High seas prone to vulnerabilities. Secondly, it predated the digital revolution and thus made no mention of digital Sequence Information (DSI), a future issue to be concerned.

1.3.3 NAGOYA PROTOCOL ON ACCESS AND BENEFIT SHARING

The Nagoya protocol of 2010 operationalized the CBDs third objective by establishing detailed access and benefitting system. It requires users to obtain PIC from provider countries to negotiate MAT specifying how monetary and non-monetary benefits would be shared.

For MGRs, the Nagoya Protocol enunciates that the states with jurisdiction over marine areas can assert control over access to samples and demand equitable returns. However, Protocols territorial scope excludes ABNJ. Collecting sample from High seas by the multinational companies continue to be an unaddressed issue without properly regulated. Yet another issue is concerning DSI where Nagoya Protocol is concerned physical genetic material and not data received from sequenced.

The Agreement on Biodiversity at Area Beyond National Jurisdiction (BBNJ) adopted and came into force in June 2023 is milestone event in addressing and regulating MGRs in High seas. It is the third implementing agreement under UNCLOS and introduces binding provision on marine genetic resources including benefit sharing.

The BBNJ Agreement defines MGRs to include "any material of marine origin containing functional units of heredity of actual or potential value"[17]. It tries to address the Nagoya /CBD gap by extending its regulation to Areas Beyond National Jurisdiction. The treaty mandates both monetary and non-monetary Benefit sharing supported by Clearing House Mechanism.

Politically, BBNJ negotiations reflecting a non-standing clash between developed countries defending research freedoms and developing states advocating CHM[18]. Still the agreement

[16] Vandana Shiva, *Biopiracy: The Plunder of Nature and Knowledge* (1997).
[17] 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, June 19, 2023, U.N. Doc. A/CONF.232/2023/4 [hereinafter BBNJ Agreement].
[18] Robert Blasiak et al., Corporate Control and Global Governance of Marine Genetic Resources, 4 Sci. Advances eaar5237 (2018).

leaves unresolved questions about interaction with Intellectual Property Rights. Proposals for mandatory disclosure of origin in patent applications were highly debated but ultimately deferred.

1.3.5 Digital Sequence Information

As the time changes, the scientist started to rely on DSI stored in global databases instead of collecting samples at the sea. This undermines the CBD and Nagoya Protocol which ties benefit sharing to access materials.

At COPN 16 (2024)[19] which was held in Cali Colombia, states agrees to establish a multilateral mechanism for benefit sharing from DSI including creation of DSI fund. The fund is financed through industry contributions and aims to distribute benefits globally, especially to Global South nations.

1.3.6 The WIPO Treaty on Genetic Resources and Associated TK

In 2024, WIPO adopted the treaty on Intellectual Property, Genetic Resources, and Associated Traditional Knowledge. It requires patent applicants to disclose the origin of genetic resources used in inventions. For MGRs, thus introduces transparency into IPR systems long criticized for enabling bio piracy. However, enforcement still remains in ambiguity, as national patent office's vary in their ability and willingness to implement disclosure requirements.

1.4 ISSUES OF SOVEREIGNTY, OWNERSHIP AND ACCESS BENEFIT SHARING

The governance of Marine Genetic Resources (MGRs) is deeply clubbed with three overlapping legal and political questions. They are sovereignty, ownership and Access benefitting. Each of these dimensions is shaped by laws which are prevailing in sea, the regime of biodiversity, and genetic resources under CBD and Nagoya Protocol and recent agreement on BBNJ. While sovereignty defines who can regulate and control genetic resources , ownership defines the extent to which intellectual property law can privatise discoveries derived from the marine ecosystem and ABS results in balancing the benefits the benefits flow

[19] COP16, *Decision 16/9 on Multilateral Mechanism for Benefit Sharing from DSI* (2024).

back to provider states or international community. Finally, this entails in creating a tussle between innovation and equity in governance of marine life.

1.4.1 SOVEREIGNTY AND SOVEREIGN RIGHTS OVER MGRS

UNCLOS distinguishes between sovereignty and sovereign rights. Coastal states enjoy sovereignty over territorial rights and sovereign rights at the Exclusive Economic Zone (EEZ) and on continental shelf for exploring and exploiting natural resources. Precisely saying that when MGRs are collected in state's internal waters, territorial sea, EEZ or Continental Shelf, that state can lawfully regulate collect and use which includes requiring permits, material transfer agreements (MTA)and conditions that tie downstream research for commercialization of domestic benefit sharing rules[20].

The 2011 ITLOS Sea bed Dispute Chamber advisory opinion doesn't speak about MGRs, but it gave a light on how international institutions translate equity inflected principles into concrete obligations including due diligence and environment impact assessment[21].

1.4.2 ABS INSIDE NATIONAL JURISDICTION: CBD OR NAGOYA PRACTICE

When MGRs are accessed within national jurisdiction, Art 15 of the CBD and the Nagoya Protocol establish the framework: Prior informed consent is required and both monetary and non-monetary benefits are to be shared. However, implementation of state remain uncertain. Some demands permit even for pro bono researches while others exempt non-commercial work but mandate standard MTAs, data sharing, or local collaboration.

1.4.3. ABS BEYOND NATIONAL JURISDICTION: THE BBNJ PERSPECTIVE

The BBNJ Agreement is considered to be first multilateral regime to address the Marine Genetic Resources and the fair and equitable sharing of benefits from their use. It does not convert MGRs into state owned resources rather, it creates procedural and substantive obligations, standardized deposition of data and a package of non-monetary benefits. It takes

[20] Convention on Biological Diversity art. 15, June 5, 1992, 1760 U.N.T.S. 79; see also art. 2 (defining "genetic resources").
[21] Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, Advisory Opinion, Case No. 17, ¶¶ 117–135 (ITLOS Seabed Disputes Chamber Feb. 1, 2011).

up the potential of MGRs into capacity building and technology transfer, seeks to operationalize traceability and gestures towards handling DSI alongside physical samples.

1.4.4 DIGITAL SEQUENCE INFORMATION (DSI): SOVEREIGN WITHOUT SAMPLES

The emergence of Digital Sequence Information has erupted the conventional logic of Access Benefit sharing norms. Conventionally, MGRs were considered to be tangible resources containing functional unit of hereditary as defined under Art 2 of Convention of Biological Diversity (CBD)[22]. The cardinal challenge is definitional. The CBD and its 2010 Nagoya Protocol does not predicted the digitalization of biology leaving ambiguity whether intangible data sources can be taken under the purview of genetic resources. Critics vehemently argued that extending ABS to cover DSI risks overreach as information is not material and lacks "functional units of heredity"[23]. Whereas other contend that excluding DSI undermines the CBD equity goals where the MNCs cab bypass ABS obligations by sequencing material once and after that using the same for a further indefinite period[24]. In retaliation to that, states and stakeholders have struggled to maintain balance in two competing imperatives: a) maintaining the open ethos that underpins the global maintenance and b) ensuring fair benefit sharing, especially for biodiversity rich but technologically disadvantaged countries.

The role of Intellectual property law has a high significance. Patent offices in countries like USA and UK, mandates the applicants to reveal nucleotide sequences if they are being a part and parcel of an innovation or invention. However, they does not translate into benefit sharing with country of origin. There are cases like Association of Molecular Pathology v. Myriad Genetics Inc., where US Supreme Court held that naturally occurring DNA sequences are not patentable, although synthetic CDNA can be done. This distinction elucidates that while raw sequence data may not qualify exclusive right whereas the value added uses of DSI can generate patentable outputs. This might also cause biopiracy in digital form as the MNCs consolidates patents over marine derived sequences without contributing to conservation or

[22] Convention on Biological Diversity art. 2, June 5, 1992, 1760 U.N.T.S. 79.
[23] Glowka, Lyle et al., *A Guide to the Convention on Biological Diversity* 19–21 (IUCN 1994)
[24] Sélim Louafi & Tom Dedeurwaerdere, *Global Scientific Commons Under the Nagoya Protocol: Governing Digital Sequence Information of Genetic Resources*, 9 Frontiers Plant Sci. 1, 2–4 (2018).

equality.[25]

The issue of DSI is also considered as a crucial issue in World Intellectual Property Organisation (WIPO). The diplomatic conference held on 2024 adopted the treaty of Intellectual Property, Genetic Resources and Associated Traditional Knowledge which requires patent applicants to reveal the origin or source of genetic resources including cases where innovation rests on the DSI.[26] The effect of this treaty would be crucial in blending obligations to disclose with ABS mechanism under CBD or Nagoya and the BBNJ Agreement.

DSI incorporates tension between the knowledge as a global commons and biodiversity as a sovereign resource. By extending ABS obligations to sequence data, recent legal instruments like CBD COP 15 decision, BBNJ Agreement acknowledge that digitalisation of biology cannot be kept outside of the governmental spheres.

1.5 PATENTING RIGHT OF MARINE GENETIC RESOURCES NAVIGATING INNOVATION AND CONSERVATION

Marine Genetic Resources which can considered from deep sea microbes to coral reef organisms. These ecological and biological assets can transform emerging technologies but their commercialisation make it prone to significant intellectual property challenges. In particular MGRs located in Areas Beyond National Jurisdiction which lie beyond the traditional governmental jurisdictions creating legal vacuums and opening doors for biopiracy and resource misappropriation.

1.5.1 IP rights in Marine Genetic Resources

Scientific research in marine biotechnology frequently yields new biomolecules, enzymes, and genetic sequences with potential commercial applications. Patents incentivizes this innovation by protecting inventors and attracting R &D investment. They also facilitate technology transfer and commercialisation. Yet, patenting MGRs is a herculean task which presents unique challenges.

[25] Graham Dutfield, Intellectual Property Rights and the Life Science Industries: Past, Present and Future 215–20 (2d ed. 2009).
[26] WIPO, Treaty on Intellectual Property, Genetic Resources and Associated Traditional Knowledge (adopted May 24, 2024).

Firstly, overlapping claims create a fragmented patent landscape. Multiple patents over different components of the same organisms can stifle further innovation by deterring further researchers from entering the field.[27] Secondly, the absence of disclosure requirements for the geographic origin of the sample undermines transparency and raises concerns about biopiracy. For instance, firms may patent marine-derived products without acknowledging the ecosystem concerning to their discoveries.

UNCLOS does something to address these problems. While it affirms the " freedom of scientific research" on the high seas, it does not impose obligations to share benefits derived from MGRs.[28] The first-come, first-served dynamics enable well-resourced actors to monopolise marine discoveries without compensating less technologically advanced states. Such practices conflict with the CBD and Nagoya Protocol's emphasis on ABS , which developing countries regard as central to fairness and equity.

Scholars and policy makers, therefore, propound new instruments under UNCLOS to cater to MGRs. These reforms include a) mandatory disclosure of sample origins in patent applications, b) a global registry of marine-related patents and c) capacity-building measures to ensure that developing countries share their benefits in marine bioprospecting. [29]

1.5.2 PATENTABILITY OF MARINE GENETIC RESOURCES

The question of whether MGRs are patentable depends on the criteria of novelty , inventive step, and industrial applicability since it is considered as sine qua non to acquire a regular patent. Natural substances are per se generally excluded from the patentability but isolated or modified substances can qualify if human intervention imparts new properties

Under the agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), patent must be granted in all fields of technology without any discrimination as to the place of invention.[30] Article 27.1 requires member states to confer patents indiscriminately. While Art

[27] Abhaya Ganashree, Who Owns Ocean Biodiversity?: The Legal Status and Role of Patents as a Means to Achieve Equitable Distribution of Benefits, 53 *Case W. Res. J. Int'l L.* 197 (2021).
[28] United Nations Convention on the Law of the Sea arts. 87, 136–37, Dec. 10, 1982, 1833 U.N.T.S. 3.
[29] Fran Humphries et al., A Tiered Approach to the Marine Genetic Resource Governance Framework under the Proposed UNCLOS Agreement for Biodiversity Beyond National Jurisdiction (BBNJ), 122 *Marine Pol'y* 103910 (2020).
[30] Agreement on Trade-Related Aspects of Intellectual Property Rights arts. 27.1, 27.3(b), Apr. 15, 1994, 1869 U.N.T.S. 299.

27.3 gives limited exclusion for plants, animals, and biological processes. This create interpretative leeway , but no explicit reason exists to exclude MGRs derived from ABNJ.

Jurisdictions diverge in practice. The European Union permits the patents in biological substance isolated from nature through technical processes , recognizing human intervention as the cardinal feature for the invention.[31] The United States follows the product of nature" rule excluding national laws and phenomena from patentability but allowing patents on modified genetic material.[32]

Other renowned jurisdictions include Australia, Japan and ARIPO states adopt broad patentability rules for generic inventions. By contrast Brazil and the Andean communities exclude plants, animals, and essential biological processes from patentability altogether.[33]

At procedural level, patenting MGRs causes unique concerns, For instance, MGR inventions may hinge on identifying marine genes or compounds without clear provenance. Patent laws generally require disclosure of invention but do not mandate disclosure of origin of genetic material. Thus the law on patents does not stipulate the identification of either of the species of origin or the geographic co-ordinates of marine samples used. Firms can exploit this lacuna, modern metagenomic methods let researchers infer gene function from pooled DNA without attaching it to a particular organism or locale. If unchecked, companies might obtain patents that effectively pre-empt braid class of genetic data.

1.5.3 MGR BASED PATENTS AND BIO PIRACY

Innovation in metagenomics and bioinformatics enable scientists to identify gene functions from DNA fragments, often without tying them to specific organisms. While powerful, this can obscure the origin of the genetic material, complicating benefit sharing obligations. The absence of disclosure requirements in many patent systems allow firms to obtain rights over marine derived inventions without identifying their source.[34]

[31] Directive 98/44/EC of the European Parliament and of the Council, 1998 O.J. (L 213) 13.
[32] John M. Conley & R. Makowski, Rethinking the Product of Nature Doctrine as a Barrier to Biotechnology Patents in the United States—and Perhaps Europe as Well, 13 Info. & Commc'ns Tech. L. 3 (2004).
[33] Claudio Chiarolla, Intellectual Property Rights and Benefit Sharing from Marine Genetic Resources in Areas Beyond National Jurisdiction: Current Discussions and Regulatory Options, 4 Queen Mary J. Intell. Prop. 171 (2014).
[34] Marjo Vierros et al., Emerging and Unresolved Issues: The Example of Marine Genetic Resources of Areas Beyond National Jurisdiction, *in* Ocean Sustainability in the 21st Century 198 (2015).

Such practices risk locking up fundamental research tools. When patents extend to natural molecules or DNA constructs, they may impede access to essential input to further research. To retaliate against this, some jurisdictions include research exemptions though TRIPS leaves such exemptions optional.

1.4.4 TRANSPARENCY, GEO REFERENCING, AND ACCESS

Best marine researchers call for geo-referencing biodiversity samples – recording the precise coordinates of collection sites. This enables adherence to ABS obligations under the Nagoya Protocol and helps clarify jurisdictional claims. Yet in practice, georeferencing data is often incomplete, and collection sites are poorly documented.[35] A worldwide disclosure framework that prescribes the identification of origin at every stage of research and development could improve the transparency and support benefit sharing. It would safeguard the rights of states to assert sovereignty over resources connected within their territories while still upholding the principle of common heritage in areas beyond national jurisdiction.

1.4.5 BRINGING CONSERVATION AND INNOVATION HAND IN HAND

The challenge is to strike a balance between incentivizing innovation and conservation of marine ecosystems. Strict patent regimes risk monopolizing discoveries, while unregulated access risks over exploitation. Open access models, such as open licensing and free scientific publication, present alternatives by ensuring research outputs remain widely available. The Welcome Trust, for example mandates open access to peer review outputs within six months of publication.[36]

Open source models, though valuable fall short in sectors like marine biotechnology where research is expensive and investors except IP safeguards. A balanced approach would work better by using patents to attract investment while coupling them with disclosure requirements, benefit sharing duties, and open access measures to uphold equity and sustainability. However the European Union Sui genesis model protection for database protection shows that how this balance can function. It grants creators exclusive rights but set time limits and conditions that

[35] Arianna Broggiato, Exchange of Information on Research Programs Regarding Marine Biodiversity in Areas Beyond National Jurisdiction, in IUCN Info. Papers 55 (2013).
[36] Elena Stoica, The Implications of the New UK Open Access Policies on the Ownership of Copyright in Academic Publishing (2015).

guarantee eventual public access.[37] Integrating similar frameworks to MGRs governance would protect invention while encouraging shared responsibility.

CONCLUSION

Marine genetic resources highlight the uneasy intersection between science, sovereignty and equity. Their potential in biotechnology, medical arenas and industry is undeniable but the legal framework govern them is often fragmented. UNLCOS created jurisdictional zones but left generic resources in the high seas in uncertainty, thus creating an ambiguity. The CBD and Nagoya Protocol recognized sovereignty and benefit sharing but their accessibility ends in the borders of nations. The BBNJ Agreement has begun to close the gap, yet unresolved tension still remains on how innovation and equity should be taken hand in hand.

The real challenge is not whether MGRs should be exploited but how to ensure that their use caters for conservation and fairness. Stronger disclosure requirements, workable benefit sharing rules for both physical samples and digital data, and investment in capacity building for developing states are necessary steps. Without them, MGRs and their benefits will be concentrated in the hands of a few, thereby creating a monopoly, while the global community will bear the ecological and equity repercussions.

[37] Directive 96/9/EC of the European Parliament and of the Council, 1996 O.J. (L 77) 20.