
DEEP-SEA MINING AND RACE FOR OCEAN RESOURCES

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ABSTRACT

There has been an increase in demand for important minerals like cobalt, nickel, manganese, and rare earths with a rise in the level of development and a thirst to attain maximum advantage and profits with these resources. People have started curating an interest in deep sea mining (DSM) as an alternative to onshore mining. If we see the intersection or at the crossroads of opportunities pertaining to the economic arena and concerns in the aspect of environment, deep sea mining is emerging as a frontier for the natural resources being extracted. This paper examines the geopolitical, legal, and environmental aspects of the race for oceanic resources, every country wants the resources and hence it is termed as race as to who can attain maximum of it thereby earning huge profits. There is an emphasis on the competition that is rising between various corporations and states to develop mineral-rich regions of the seabed, specifically in the Clarion-Clipperton Zone. The role of International Seabed Authority (ISA) is analysed in a crucial manner here, the regulatory issues under UNCLOS, and the urgent requirement for a global moratorium because of possible irreparable harm to oceanic biodiversity. By multidisciplinary means, the paper draws attention to the requirement of having a balanced approach when it comes to the conservation of ecology and the security of the resources, thereby, demanding international governance mechanisms that are more rigid and strict in nature and technological means that are sustainable in nature.

INTRODUCTION

In today's fast paced world where there is a high demand for resources, minerals and rare earth materials, deep-sea mining has become a new frontier of the global race for resources. The seafloor, especially regions outside national jurisdictions like the Clarion-Clipperton Zone (CCZ), contains massive resources of polymetallic nodules, cobalt-rich crusts and hydrothermal vent sulphides. These resources are precious and important when it comes to the technologies that are developing and emerging in the aspect of green energy transition, for instance, solar panels and batteries. But this technology has its own challenges, when it comes to the ethical, legal and environmental aspects.

It is regulated by the United Nations Convention of the Law of the Sea (UNCLOS)¹, the deep seabed is also known as the Area, and it is given or allotted the common heritage of mankind. There is an increasing involvement by major state players and private companies, especially when it comes to China and India, this has further increased the apprehensions regarding access in a fair manner, safeguarding environment and regulatory control. As states become more aggressive in trying to achieve control over the resources of the ocean, the international law that is already existing, governed mostly by the International Seabed Authority (ISA), comes under unprecedented examination and a sense of pressure is exerted over them for revision. This research paper examines the geopolitical dynamics and legal issues pertaining to deep sea mining in a critical way. Case studies pertaining to China's strategic seabed diplomacy, India's Deep Ocean Mission and resource search in the Clarion-Clipperton Zone examines the governance architecture in the current scenario and diagnoses new debates and reform proposals that seek to reshape the future of governance of the resources of the ocean.

RESEARCH GAP

In spite of the increasing volume of policy and academic literature on deep sea mining (DSM), a number of important gaps still prevent a thorough understanding of its implications. Most importantly, there is a significant shortage of long-term empirical research on the ecological effects of DSM. Although environmental degradation has been widely proposed as a big issue, extremely few peer-reviewed articles provide firm, quantitative evidence of biodiversity decline or ecosystem interference in the deep sea. The reason for this is primarily that it is not

¹ United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397.

easy to study such inaccessible sea environments due to logistical and funding issues. Consequently, present-day environmental risk assessments are frequently founded on small-scale pilot studies or simulations that can potentially underestimate irreversible harm to distinctive and vulnerable benthic ecosystems.

Secondly, the lack of a consistent and enforceable international legal system also makes the regulation of DSM more difficult. While the United Nations Convention on the Law of the Sea (UNCLOS) and the International Seabed Authority (ISA) offer a foundation for regulation, their scope is still fractured. The ISA mandate at present is largely geared towards issuing exploration contracts, with less concern for enforcement and ecological monitoring. In addition, much of the "Mining Code" which is meant to govern commercial mining, it is still in negotiation, creating regulatory uncertainty. Most importantly, there are no binding mechanisms to hold states or private actors accountable, especially in regions outside national jurisdiction, commonly known as the "common heritage of mankind."

Another unexplored field in existing scholarship is the geopolitical aspect of the ocean resource race. Much of what current research is has a tendency to cast DSM into environmental or juridical terminology, bypassing the emerging states versus multinational competitive dynamic. For instance, presently, China possesses the biggest number of seabed exploration licences issued by the ISA and therefore sits atop dominant positions for next-generation seabed mining activity. Norway and Japan are among others also making great investments in deep-sea tech. Nevertheless, the implications of this rivalry especially maritime security, resource monopolization, and geopolitical alignment are not adequately covered in mainstream scholarly discourse.

Lastly, there is a stark lack of Indigenous and Global South viewpoints in the DSM debate. Island countries like Nauru, Kiribati, and the Cook Islands are not only geographically nearest to prospect mining areas such as the Clarion-Clipperton Zone, but they also risk incurring disproportionate eco-systemic and socio-economic costs. However, their voices have been marginalized at international negotiations and regulatory forums. In addition, the wider issues of environmental justice, intergenerational equity, and safeguarding marine cultural heritage are seldom at the forefront of policy-making, further entrenching global power disparities.

These lacunae highlight the necessity for more inclusive, interdisciplinary, and enforceable frameworks to respond to the fast-changing dynamics of deep-sea mining. Without addressing

these gaps, policy responses will continue to be reactive, piecemeal, and potentially detrimental to both human and ecological systems.

CONCEPTUAL FRAMEWORK

This study is grounded conceptual framework that is interdisciplinary in nature. There is a combination or mixture of laws pertaining to the environment, governance in the international aspect, sustainable development and management of the ocean resources. The overarching assumption is that deep sea mining sits at the nexus of technological innovation, ecological sensitivity, and legal uncertainty. The framework critically explores analyses the way in which international legal instruments, especially the United Nations Convention on the Law of the Sea (UNCLOS), engage and involve with regulatory practices, economic interests and considerations pertaining to the environment.

The research is informed by the Precautionary Principle², it states that if there is an uncertainty scientifically, the methods and step that would lead to the damage of the environment should be avoided. This principle is important and crucial to make sure that ecological risks of deep-sea mining in maritime ecosystems which are relatively poor. Moreover, the study relies and emphasises on the Common Heritage of Mankind principle³, which states that the resources in the seabed beyond national boundaries must be used for the betterment and collective good of mankind. This ethical and legal standard is used like a point of reference to explore and examine questions pertaining to equity, sharing of benefit and access, particularly for Least Developed Countries (LDCs) and Small Island Developing States (SIDS). The framework also integrates aspects of justice in respect to the environment and sustainable development, given that the advantages and disadvantages of seabed mining are not uniformly distributed. Through the alignment of the study with the Sustainable Development Goals⁴, particularly SDG 14 that talks about life below water and SDG 13 pertaining to climate action, the research analyses whether existing and planned governance frameworks for deep sea mining are in proper alignment with international environmental and climate commitments. By employing this conceptual framework, the study not only examines the legal and environmental aspects of deep-sea mining but also outlines a more equitable, precautionary and sustainable way of

² U.N. Conference on Environment and Development, Rio Declaration on Environment and Development, princ. 15, U.N. Doc. A/CONF.151/26/Rev.1 (Vol. I) (Aug. 12, 1992).

³ United Nations Convention on the Law of the Sea, *supra* note 1, art. 136.

⁴ G.A. Res. 70/1, Transforming Our World: The 2030 Agenda for Sustainable Development, U.N. Doc. A/RES/70/1 (Oct. 21, 2015).

addressing resources of the ocean not just for the current generations but also the future generations.

United Nations Convention on the Law of the Sea (UNCLOS)

The United Nations Convention on the Law of the Sea (UNCLOS), adopted on 10 December 1982 and entered into force on 16 November 1994, is the foundational legal framework governing the use and conservation of the world's oceans. It codifies rules concerning navigation rights, territorial seas, exclusive economic zones, continental shelves, and most notably for deep sea mining "The Area", defined as the seabed and ocean floor beyond national jurisdiction.

A. The Area and the Principle of Common Heritage of Mankind

UNCLOS Article 136 stipulates that "the Area and its resources are the common heritage of mankind,"⁵ a principle that departs from the traditional notion of *res nullius* belonging to no one, in international law⁶. This concept entails that no state may claim sovereignty or sovereign rights over any part of the Area or its resources, and that activities therein shall be carried out for the benefit of all humankind, with particular regard to the interests and needs of developing countries. This notion of common heritage carries legal consequences: (i) equitable benefit-sharing, (ii) international management, (iii) peaceful use, (iv) scientific cooperation, and (v) conservation responsibilities. It transforms seabed resources into a shared trust rather than open economic territory.

B. The International Seabed Authority (ISA)

Part XI of UNCLOS establishes the International Seabed Authority (ISA), an autonomous international organization headquartered in Kingston, Jamaica⁷. The ISA is tasked with organizing, regulating, and controlling all mineral-related activities in the Area, particularly those related to polymetallic nodules, polymetallic sulphides, and cobalt-rich ferromanganese crusts.

⁵ United Nations Convention on the Law of the Sea, *supra* note 1, art. 136.

⁶ United Nations Convention on the Law of the Sea art. 136, Dec. 10, 1982, 1833 U.N.T.S. 3.

⁷ United Nations Convention on the Law of the Sea arts. 156–158, Dec. 10, 1982, 1833 U.N.T.S. 3.

The ISA's core responsibilities include:

- Granting contracts for exploration and exploitation to states, state enterprises, and qualified private entities under the sponsorship of a state party.
- Protecting the marine environment from harmful mining activities through environmental impact assessments (EIAs), regulations, and compliance mechanisms.
- Promoting equitable benefit-sharing, especially through mechanisms like the Enterprise (the ISA's commercial arm) and financial payments by contractors to a benefit-sharing system.

The ISA Mining Code—a set of rules, regulations, and procedures—guides current exploration activities⁸. As of 2025, the ISA has issued over 30 exploration contracts, but has yet to finalize the regulatory framework for commercial-scale exploitation, leading to legal and ethical debates under the so-called “two-year rule” under UNCLOS Annex III, Article 15.

C. Rights and Obligations of States

State parties to UNCLOS have a duty to ensure that activities conducted by entities under their jurisdiction or control in the Area conform to international rules and standards, particularly those adopted by the ISA. This is based on the sponsoring state regime, a form of dual-layered accountability, where both the ISA and the sponsoring state share oversight responsibilities. In the 2011 Advisory Opinion by the Seabed Disputes Chamber of the International Tribunal for the Law of the Sea (ITLOS), the tribunal clarified the scope of due diligence required by sponsoring states⁹. It affirmed that states must adopt legislative, administrative, and enforcement measures to ensure environmental protection and contractor compliance.

1994 Agreement Relating to the Implementation of Part XI of UNCLOS:

The 1994 Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea was adopted on 28 July 1994 and entered into force on 28 July 1996. It was introduced to resolve political and economic concerns—particularly those

⁸ Int'l Seabed Auth., *Mining Code*, <https://www.isa.org.jm/mining-code> (last visited Apr. 28, 2025).

⁹ Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, Advisory Opinion, Case No. 17, ITLOS Rep. 2011, 10 (Int'l Trib. L. of the Sea).

raised by developed countries—about the original provisions in Part XI of UNCLOS, which were perceived as overly regulatory, economically restrictive, and institutionally burdensome.

A. Rationale Behind the Agreement: Developed vs. Developing States' Concerns

Part XI of UNCLOS established a highly centralized framework for deep seabed mining, including mandatory technology transfer, production limits, and the creation of a supranational mining entity known as the Enterprise. Developed countries, especially the United States and members of the European Union, objected to these provisions on grounds that they discouraged investment, undermined free-market principles, and unfairly burdened private mining companies¹⁰. By the early 1990s, many industrialized states refused to ratify UNCLOS unless these issues were addressed. The resulting 1994 Agreement was a political compromise intended to facilitate broader ratification of the Convention while preserving the principle of the common heritage of mankind¹¹.

B. Institutional and Procedural Modifications. The 1994 Agreement modified how Part XI would be implemented by restructuring the decision-making mechanisms of the International Seabed Authority (ISA). One major reform was the creation of a Finance Committee with veto powers over financial matters—effectively giving developed states greater control over budgetary issues¹². Additionally, the mandatory technology transfer provisions in the original Part XI were replaced with a voluntary framework that respects intellectual property rights, easing the concerns of Western technology holders¹³. The role of the Enterprise was revised as well; it would not begin commercial operations until expressly approved by the ISA Council, and it would operate on the basis of joint ventures with private or state entities, subject to commercial viability.

C. Relationship with the International Seabed Authority (ISA)

While the 1994 Agreement introduced procedural flexibility, it did not amend UNCLOS itself. Rather, it is to be interpreted and applied together with Part XI as a single instrument. This ensures that the ISA's legal authority remains intact, but under a reinterpreted regulatory

¹⁰ Bernard H. Oxman, *The 1994 Agreement and the Convention*, 88 Am. J. Int'l L. 687, 690–91 (1994)

¹¹ Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 pmbl., July 28, 1994, 1836 U.N.T.S. 3 [hereinafter 1994 Agreement]

¹² 1994 Agreement, Annex § 9.

¹³ 1994 Agreement, Annex § 5.

structure that is more balanced and acceptable to industrialized nations¹⁴. The ISA is therefore bound to implement Part XI in accordance with the terms of the 1994 Agreement, including the modified roles of institutions, revised financial rules, and safeguards for investor confidence and technological cooperation.

Related Instruments:

While UNCLOS and the 1994 Agreement form the core legal structure for governing deep-sea mining, they do not operate in isolation. A wider legal ecosystem has emerged through soft law instruments, binding environmental treaties, and regional agreements, each contributing to the evolving governance of seabed resources and marine environmental protection. These related instruments enhance, reinforce, or clarify obligations concerning environmental due diligence, waste disposal, and ecosystem preservation.

A. The ISA Mining Code and Sectoral Regulations

The ISA Mining Code is the most detailed and operational regulatory framework applicable to activities in “The Area”, particularly mineral exploration. It is a living set of instruments comprising rules, regulations, and recommendations developed by the ISA pursuant to its authority under UNCLOS Part XI. As of 2025, the Code includes exploration regulations for three major mineral categories:

- Polymetallic Nodules (adopted 2000, revised 2013)
- Polymetallic Sulphides (adopted 2010)
- Cobalt-Rich Ferromanganese Crusts (adopted 2012).

These exploration regulations require contractors to submit detailed environmental impact assessments (EIAs) and environmental baseline studies prior to undertaking any activity. The Code also mandates the precautionary approach, best environmental practices, and also adaptive management, aligning with principles recognized under customary international law¹⁵. However, the exploitation phase remains legally unsettled. Draft regulations on the

¹⁴ 1994 Agreement, art. 2.

¹⁵ Int’l Seabed Auth., *Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area* (2013), <https://www.isa.org.jm/document/isba19ltc1>.

Exploitation of Mineral Resources in the Area, under negotiation since 2017, aim to fill this gap. The draft covers procedures for applying for exploitation contracts, standards for environmental management plans (EMPs), benefit-sharing mechanisms, and compliance procedures¹⁶. Notably, the ISA faces criticism for drafting exploitation rules without adequate environmental data or consensus on precautionary moratoria. Civil society groups and some states advocate for a "precautionary pause", arguing that proceeding without sufficient safeguards contradicts both UNCLOS Article 145 and emerging environmental principles.

B. The London Convention and London Protocol: Marine Pollution Control

The London Convention of 1972 and its 1996 Protocol form the backbone of global treaty law concerning the prevention of marine pollution by dumping of wastes and other matter. Although originally conceived to regulate waste disposal from ships, their scope has evolved to include waste generated by industrial seabed activities. Under the 1996 Protocol, contracting parties are required to conduct prior environmental assessments, adopt waste management audits, and employ best available techniques (BAT) and best environmental practices (BEP)¹⁷. These instruments are particularly relevant to deep sea mining tailings, which may involve the discharge of sediment plumes, heavy metals, and process chemicals into the marine environment. Although the London Protocol does not specifically name seabed mining, Article 1.4 defines "dumping" broadly enough to include discharges associated with such operations. Many ISA member states are also parties to the London Protocol, and are therefore dually obligated to ensure that seabed mining operations under their sponsorship comply with both ISA regulations and the broader anti-pollution obligations under the Protocol.

C. Regional Environmental Agreements: The OSPAR Convention

Regional treaties play an important role in shaping environmental expectations, even for activities beyond national jurisdiction (ABNJ). The OSPAR Convention is one of the most advanced regional marine environmental agreements, applicable to the North-East Atlantic¹⁸. Although OSPAR does not directly regulate deep sea mining under its current

¹⁶ Int'l Seabed Auth., *Draft Regulations on Exploitation of Mineral Resources in the Area* (revised 2023), <https://www.isa.org.jm/document/isba28ltc1rev1>.

¹⁷ 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Nov. 7, 1996, 36 I.L.M. 1.

¹⁸ Convention for the Protection of the Marine Environment of the North-East Atlantic, Sept. 22, 1992, 2354 U.N.T.S. 67.

mandate, it has engaged proactively with the issue. The OSPAR Commission has issued recommendations expressing concern about biodiversity loss and ecosystem disruption from mining activities, especially in seamounts, hydrothermal vents, and cold-water coral ecosystems.¹⁹ In 2020, the Commission called for a precautionary pause on commercial seabed mining in the OSPAR maritime area until sufficient environmental data and legal safeguards are available. This position is significant as it reflects a regional consensus that reinforces global calls for moratoria or more stringent environmental standards.

Convention on Biological Diversity (CBD):

The Convention on Biological Diversity (CBD), adopted on May 22, 1992, is a key international treaty designed to conserve biodiversity, promote its sustainable use, and ensure the fair and equitable sharing of benefits arising from the use of genetic resources. Though originally focused on terrestrial ecosystems, the CBD is increasingly relevant for marine biodiversity beyond national jurisdiction (BBNJ), as more states and international organizations recognize the need to safeguard ocean ecosystems in the context of deep-sea mining and other activities in Areas Beyond National Jurisdiction (ABNJ).

A. Application to Marine Biodiversity Beyond National Jurisdiction

The CBD applies not only to biodiversity within national boundaries but also to marine biodiversity found in ABNJ, including areas such as the high seas and the Area (the seabed and ocean floor beyond national jurisdiction). Under Article 4 of the CBD, parties are encouraged to adopt measures that respect the sovereignty of states over their marine environments while also safeguarding ecosystems in ABNJ²⁰. In 2017, the UN General Assembly called for the integration of the CBD's provisions into the legal framework governing areas beyond national jurisdiction. A significant development occurred with the launch of BBNJ negotiations, focusing on the conservation and sustainable use of marine biodiversity in ABNJ, where CBD's principles of conservation, sustainable use, and benefit-sharing could play a crucial role. These negotiations involve examining whether the CBD can be used as a foundation for legally binding instruments, especially regarding the protection of biodiversity from the impacts of deep-sea mining, fishing, and other industrial activities in ABNJ. However, there remain

¹⁹ OSPAR Comm'n, *OSPAR Recommendation 2020/01 on the Protection of Marine Biodiversity in Areas Beyond National Jurisdiction*, <https://www.ospar.org/documents?v=45505> (last visited Apr. 28, 2025).

²⁰ Convention on Biological Diversity art. 4, May 22, 1992, 1760 U.N.T.S. 79 [hereinafter CBD].

tensions between UNCLOS, which governs resource extraction, and the CBD's conservation-first principles²¹.

B. Access and Benefit-Sharing (ABS) Framework

One of the most significant aspects of the CBD is the Access and Benefit-Sharing (ABS) framework, which ensures that the benefits derived from genetic resources, including marine genetic resources (MGRs) in ABNJ, are shared equitably. This framework mandates that access to such resources must be subject to prior informed consent (PIC) from the provider party and that the benefits derived from their use must be shared in a fair and equitable manner. The Nagoya Protocol (2010) complements the CBD by establishing clearer guidelines on ABS, emphasizing that marine genetic resources (MGRs), such as biotechnological products derived from deep sea organisms, are subject to these ABS provisions. In the context of deep-sea mining, the mining of polymetallic nodules, sulphides, and other resources could unlock valuable genetic resources, necessitating a clear legal framework for their access and sharing of benefits²². For instance, the bioprospecting activities associated with deep sea mining may involve the identification and commercialization of marine organisms with pharmaceutical, agricultural, or industrial applications. As mining activities proceed, there is increasing demand for robust ABS mechanisms to ensure that benefits from such discoveries are equitably distributed among affected states and stakeholders, including local communities and indigenous peoples.

C. Precautionary Principle and Ecosystem Approach

The CBD strongly advocates for the precautionary principle and the ecosystem approach to biodiversity conservation. According to the CBD, the precautionary principle stipulates that in the face of scientific uncertainty, states and other actors should act to prevent potential environmental harm rather than waiting for conclusive evidence of that harm²³. The ecosystem approach is also emphasized in the CBD's guidelines, calling for management strategies that address ecosystems in their entirety rather than focusing solely on individual species or

²¹ U.N. General Assembly, *Resolution on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction*, U.N. Doc. A/RES/72/249 (Dec. 24, 2017).

²² Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization, arts. 5–9, 36 I.L.M. 1432 (2010).

²³ Convention on Biological Diversity, *The Precautionary Principle and Sustainable Development*, Decision V/6, CBD/COP/5/23 (1992).

resources. This approach is critical in deep sea mining, where the long-term environmental consequences of resource extraction—such as habitat destruction, pollution, and species extinction—are not fully understood. Adopting these principles in the governance of deep-sea mining would ensure that activities are conducted in ways that minimize negative impacts on marine ecosystems, particularly vulnerable areas like hydrothermal vents, seamounts, and cold-water corals. As the CBD's strategic plan (updated in 2020) aligns with the 2030 Agenda for Sustainable Development, there is increasing emphasis on sustainable ocean practices that prioritize ecosystem health in decision-making.

Paris Agreement:

The Paris Agreement, adopted on December 12, 2015, within the framework of the United Nations Framework Convention on Climate Change (UNFCCC), is a pivotal global treaty aimed at limiting global warming to well below 2°C, and preferably to 1.5°C above pre-industrial levels. The Agreement also emphasizes the need for adaptive responses to the challenges posed by climate change, with particular attention to climate resilience, carbon emissions reduction, and the preservation of natural carbon sinks such as oceans. While the Paris Agreement does not directly address deep sea mining, the impacts of such activities on ocean ecosystems and carbon storage are increasingly recognized as critical for the achievement of climate targets.

A. Climate Linkages: Ocean Carbon Sinks and Mining Impacts on Blue Carbon

One of the most significant climate linkages addressed under the Paris Agreement is the role of ocean carbon sinks. Oceans are critical for global carbon sequestration, absorbing approximately 25-30% of anthropogenic carbon emissions. This includes both the biological and geological sequestration of carbon, particularly through marine organisms, sedimentation, and the deep sea's natural carbon cycles. The ability of the oceans to act as "blue carbon" sinks, referring to coastal and marine ecosystems that store carbon, such as mangroves, seagrasses, and salt marshes—forms an essential part of climate mitigation strategies under the Paris Agreement. The impacts of deep-sea mining on these carbon sinks, particularly in relation to the disruption of seafloor ecosystems, could undermine their capacity to store carbon. For instance, polymetallic nodule mining could disrupt the deep sea's natural processes that capture and store carbon, potentially releasing stored carbon back into the atmosphere, thus exacerbating climate change. Scientific studies indicate that mining activities could impact the

deep ocean's ability to absorb carbon, creating a feedback loop that amplifies global warming²⁴. Moreover, mining disturbances may release methane from seafloor sediments, further contributing to greenhouse gas emissions. The cumulative effect of these impacts on blue carbon is a growing concern for climate scientists, and there is increasing recognition within the Paris Agreement's broader framework that ocean conservation, including the prevention of harmful mining practices, is vital for maintaining these carbon sinks²⁵.

B. Ocean Governance Synergy Under Climate Targets

The Paris Agreement and the broader ocean governance frameworks are interlinked, as both aim to protect and sustain the ocean's ecosystem services, which are crucial for climate stability. Ocean governance is recognized in the Paris Agreement through Article 5, which calls for the conservation and enhancement of carbon sinks, including those within the oceans. The global targets for limiting global temperature rise are directly connected to the health of marine ecosystems, which both influence and are influenced by climate change. A synergy between ocean governance and climate targets can be found in the push for integrated, ecosystem-based management (EBM), which recognizes the importance of conserving marine biodiversity and sustaining ecosystem services in both the short and long terms. This framework encourages a collaborative approach to managing human activities in marine environments, including deep sea mining, with climate goals in mind²⁶. In particular, SDG 14 (Life Below Water) under the UN's 2030 Agenda for Sustainable Development seeks to conserve and sustainably use oceans, seas, and marine resources. This climate-ocean synergy is fundamental for achieving the global goals outlined in the Paris Agreement, as it underscores the need for holistic environmental governance that balances economic development, climate mitigation, and marine conservation²⁷. The Paris Agreement's provisions on loss and damage, adaptation, and finance are also significant for ensuring that ocean governance frameworks, such as those relating to deep sea mining, incorporate climate resilience strategies that prioritize environmental protection. By integrating ocean governance into climate policy, the Paris Agreement helps

²⁴ J. M. Williams et al., *The Carbon Sequestration Potential of the Deep Ocean*, 53 *Geophysical Research Letters* 1348, 1350 (2022).

²⁵ United Nations, *Ocean and Climate Change: A Blueprint for Action* (2020), <https://www.un.org/en/climatechange/ocean-climate-change> (last visited Apr. 29, 2025).

²⁶ United Nations Framework Convention on Climate Change (UNFCCC), *Ocean and Climate Change: United Nations Framework Convention on Climate Change* (2021), <https://unfccc.int/> (last visited Apr. 29, 2025).

²⁷ U.N. General Assembly, *Transforming Our World: The 2030 Agenda for Sustainable Development*, art. 14, U.N. Doc. A/RES/70/1 (Sept. 25, 2015).

foster a coherent global strategy to mitigate both the impacts of climate change and harmful industrial activities like deep sea mining.

Sustainable Development Goal 14 – Life Below Water:

Sustainable Development Goal 14 (SDG 14), "Life Below Water," is part of the 2030 Agenda for Sustainable Development, focusing on the conservation and sustainable use of oceans, seas, and marine resources. This goal addresses both marine biodiversity and the sustainable management of ocean ecosystems while tackling the challenges posed by human activities like deep sea mining, overfishing, and climate change.

A. Sustainable Management of Marine and Coastal Ecosystems: aims to sustainably manage marine and coastal ecosystems, which are critical for regulating carbon sequestration, supporting biodiversity, and maintaining fisheries resources. Oceans, particularly the deep sea, play a significant role in carbon storage, helping to mitigate the effects of climate change. Deep sea mining, however, presents a growing threat to these ecosystems, as activities like polymetallic nodule extraction can disturb seafloor habitats, release harmful chemicals, and disrupt the natural carbon cycles. Protecting marine ecosystems from these impacts is crucial to meeting SDG 14's objectives.²⁸ The sustainable management of marine resources must balance economic development, such as mining, with the need to protect the marine environment. International frameworks like UNCLOS and the ISA help establish guidelines to ensure responsible use of the ocean's resources, minimizing the environmental footprint of extractive industries.²⁹

B. Target 14.5: Marine Protected Areas (MPAs)

Target 14.5 calls for the establishment of marine protected areas (MPAs), aiming to conserve at least 10% of the world's oceans by 2020. MPAs play a vital role in safeguarding marine biodiversity, protecting ecosystems from exploitation, and ensuring the sustainable use of marine resources. These areas provide refuge for species, promote ecosystem recovery, and support resilience to climate change. However, the creation of MPAs is a challenge in Areas Beyond National Jurisdiction (ABNJ), where the absence of effective governance often leaves

²⁸ U.N. General Assembly, *Resolution on the Sustainable Management of Marine Resources*, U.N. Doc. A/RES/70/1 (Sept. 25, 2015).

²⁹ United Nations, *United Nations Convention on the Law of the Sea* (UNCLOS), Dec. 10, 1982, 1833 U.N.T.S. 3.

ecosystems vulnerable to unregulated activities like deep sea mining. Expanding MPAs into the high seas and deeper ocean regions is necessary to protect sensitive areas, such as hydrothermal vents and seamounts,³⁰ which are especially vulnerable to mining-related disturbances.

C. Target 14.c: Implementation of UNCLOS

Target 14.c emphasizes the implementation of UNCLOS (United Nations Convention on the Law of the Sea), particularly regarding the sustainable management of ocean resources and the protection of marine environments. UNCLOS provides the legal framework for the regulation of mineral resources in the Area (international seabed area), establishing the ISA to oversee mining operations and ensure that such activities do not adversely affect the marine environment.³¹ The ISA, which operates under UNCLOS provisions, is tasked with regulating the exploration and potential exploitation of mineral resources in the Area. The Mining Code issued by the ISA sets out the standards for environmental protection, but concerns about the adequacy of these regulations in preventing long-term ecological damage persist. Target 14.c underscores the need for international cooperation and comprehensive environmental management to ensure that the implementation of UNCLOS effectively contributes to the sustainability of marine and ocean resources.

D. Monitoring and Reporting by States and ISA

Monitoring and reporting are essential components of the effective implementation of SDG 14. States and the ISA are responsible for ensuring that mining operations are conducted in compliance with environmental protection standards. Monitoring involves assessing the environmental impact of deep-sea mining and other activities, ensuring they do not disrupt marine ecosystems or biodiversity. Regular reporting ensures transparency and accountability, allowing the global community to track progress in meeting SDG 14's targets.³² For this to succeed, the ISA plays a pivotal role in monitoring mining contractors and ensuring compliance with environmental regulations. The inclusion of robust environmental impact assessments

³⁰ Int'l Seabed Auth., *Mining Code: Regulations on Prospecting and Exploration for Polymetallic Nodules*, ISBA/19/LTC/1 (2000).

³¹ Convention on Biological Diversity, *Strategic Plan for Biodiversity 2011–2020*, U.N. Doc. UNEP/CBD/COP/10/27 (2010).

³² U.N. General Assembly, *Resolution on Enhancing International Cooperation for Marine Protected Areas*, U.N. Doc. A/RES/70/1 (2015).

(EIAs) and adaptive management strategies is vital to minimize the risks associated with deep sea mining. Additionally, capacity-building initiatives are necessary to enable developing nations to implement and monitor these commitments effectively.

Rising Debates and Reform Proposals in Deep Sea Mining Regime

With the surge in searching for mineral resources on the seafloor, deep sea mining has become an essential new frontier of global environmental management. Under the jurisdiction of the United Nations Convention on the Law of the Sea (UNCLOS), the "Area" — meaning the seafloor and ocean bed beyond national boundary — is legally defined as the common heritage of mankind. Nevertheless, with the speed at which mining technologies have evolved and growing economic interest, it has become clear that there are tremendous loopholes in the current regulatory regime. The following section analyses the major arguments over deep sea mining and the major reform suggestions that aim to provide equitable, transparent, and sustainable ocean resource governance.

1. The Mining Code Controversy and Regulatory Gaps

Among the most debated matters is the ISA's protracted delay in finalizing the "Mining Code," the organization charged with overseeing mining operations within the Area. The Mining Code is meant to offer an extensive framework of rules for exploration and exploitation, but its proposed draft has been criticized for supposedly prioritizing commercial extraction at the expense of environmental protection.

Debate: Critics maintain that the draft is short of legal clarity on liability, enforcement measures, and environmental monitoring. This leaves a regulatory vacuum that may result in ecological damage and legal conflicts.

Reform Proposal: As a response, there has been a call from legal scholars, environmental organizations, as well as several Pacific Island States for a moratorium or "precautionary pause" on deep sea mining. They call for no exploitation permits to be granted unless there are strong, enforceable, and science-based regulations in place.

2. Transparency and Accountability of the International Seabed Authority (ISA)

The governance practices of the ISA have come under growing scrutiny, and charges of

secretive decision-making and undue influence by some state and corporate stakeholders have been made.

Debate: The working structure of the ISA is seen as non-transparent and exclusive, giving rise to questions about accountability and fair participation.

Reform Proposal: Reform activists suggest mandatory disclosure of exploration data and environmental impact assessments (EIAs), establishing an independent scrutiny agency to scrutinize ISA choices, and inviting civil society, scientific experts, and indigenous people into stakeholder consultations.

3. Common Heritage vs. Corporate Control

While UNCLOS describes the Area and its resources as mankind's common heritage, the actual allocation of exploration contracts depicts a glaring imbalance in favor of technologically advanced countries and transnational corporations.

Controversy: Such disparity negates the principle of equity incorporated in Part XI of UNCLOS and jeopardizes the equitable sharing of benefits from seabed resources.

Reform Proposal: Proposed reforms are the re-establishment of benefit-sharing schemes, compulsory technology transfers, and capacity-building activities in line with Article 144 of UNCLOS. Equitable licensing practices and corporate dominance limitations are also proposed to provide greater access for developing countries.

4. Environmental Justice and Irreversible Damage

The deep ocean is one of the most vulnerable and least known environments on our planet. Mining within these areas poses a risk to permanently damaging species and ecosystems that have not yet been scientifically proven.

Argument: Environmentalists are concerned that deep sea mining may cause permanent harm to marine life, with no or minimal hope of recovery.

Reform Proposal: Increased support is forthcoming for integrating the precautionary principle as a legally binding standard. In addition, the creation of long-term environmental baselines,

full cumulative impact assessments, and harmonization of seabed protection with Sustainable Development Goal 14 (Life Below Water) are essential moves forward.

5. Dispute Settlement and Legal Liability

The legal regime under UNCLOS is insufficient to address transboundary harm or long-term ecological liability due to deep sea mining.

Argument: Current dispute settlement mechanisms are deemed inadequate to handle complicated environmental harm situations, especially those with long-term or international implications.

Reform Proposal: Proposals involve strengthening mandatory dispute resolution under Part XV of UNCLOS, the creation of a specialist Deep Sea Environmental Tribunal within the International Tribunal for the Law of the Sea (ITLOS), and the implementation of strict liability regimes supported by compulsory insurance and remediation funds.

Data Overview: Environmental, Legal, and Economic Dimensions of Deep-Sea Mining

The Clarion-Clipperton Zone (CCZ), which covers an area of more than 4.5 million square kilometres in the Pacific Ocean, has become the centre of interest for deep sea mining (DSM) activities because of the richness in polymetallic nodules of economically significant minerals like cobalt, nickel, and manganese. As per the International Seabed Authority (ISA), the CCZ is one of the world's richest unrecovered mineral resources. Recent research in *Nature Ecology & Evolution* (June 2023) has shown the finding of more than 5,000 new³³, previously undescribed marine species in the CCZ³⁴, highlighting the ecological diversity of the area. The same biodiversity is now, however, under severe threat, with scientific literature highlighting that harm to deep-sea ecosystems caused by mining activities may take centuries or even millennia to heal, if at all. A 2020 Deep Sea Research Part I study reinforces this concern, showing the virtual irreversibility of such environmental disruptions.

Geopolitically and legally, more than 30 nations now possess exploration contracts approved

³³ Muriel Rabone et al., A Global-scale Species Inventory of the Clarion-Clipperton Zone, 7 *Nat. Ecol. Evol.* 781 (2023).

³⁴ International Seabed Authority, Clarion-Clipperton Fracture Zone, ISA (2023).

by the ISA as of 2023, with China in the lead with five distinct contracts.³⁵ This places China³⁶ at a strategic position in future exploitation of seabed resources and command of key minerals. Although 167 nations and the European Union are signatories to the United Nations Convention on the Law of the Sea (UNCLOS)³⁷, the United States is a significant non-signatory, although it still supports commercial seabed mining activities. As much as it is mandated, the ISA has not been able to impose substantial safeguards since its Draft Mining Code³⁸ is in limbo amid international opposition on environmental protection measures and regulatory openness. This regulatory uncertainty is part of the complicated governance issues around DSM.

Economically, the seabed mineral reserves of the global seabed are estimated to be worth between \$8 and \$16 trillion³⁹, as stated in a 2017 World Bank report. The economic benefits that can be derived from these resources are pushing the present race between nations and corporations to explore the seabed. The driving force is the precipitous increase in demand for such critical minerals as cobalt, which the International Energy Agency (2021) foresees doubling by 2030 because of the expansion of electric vehicle (EV)⁴⁰ battery manufacturing and clean technologies. DSM is also being seen more and more as a strategic option to land-based mining, particularly in war-torn areas such as the Democratic Republic of Congo (DRC), which is presently supplying more than 60%⁴¹ of the globe's cobalt. This economic interest is framing the speed and the trajectory of deep-sea mining efforts, frequently at the cost of long-term environmental concerns.

CASE STUDIES

Case Study 1: China – Resource Dominance Strategy

China has taken a very strategic and well-planned step with a visionary approach so that it can set up a dominance in the aspect of deep-sea mining which is a new industry thereby owning the rare earth resources. If we look at the method or the means closely, we observe that at the

³⁵ Craig R. Smith et al., Deep-Sea Mining Disrupts Ecosystems for Decades, 156 Deep-Sea Res. Part I 103202 (2020)

³⁶ International Seabed Authority, Status of Contracts for Exploration, ISA (2023).

³⁷ United Nations, United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397.

³⁸ International Seabed Authority, Draft Regulations on Exploitation of Mineral Resources in the Area, ISBA/25/C/WP.1 (2023).

³⁹ World Bank, Precautionary Management of Deep Sea Mining Potential in the Pacific Region 15 (2017).

⁴⁰ International Energy Agency, The Role of Critical Minerals in Clean Energy Transitions 26 (2021).

⁴¹ OECD, Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas 12 (2019).

middle or the centre of this method is an engagement with the International Seabed Authority (ISA), here it includes the most exploration contracts which is five in total which is gained and achieved through various organizations that are backed by states like the China Ocean Mineral Resources R&D Association (COMRA). Through these agreements, China gets the access or permit to the areas that are of main and prime importance in the ocean floor which is loaded and filled with polymetallic nodules that are very valuable and profitable in nature, cobalt crusts and other rare earth elements that are very crucial and of great importance when it comes to the new emerging technologies that are innovative in nature. Corresponding to its institutional and legal engagement is the investment of China in technology of advanced nature. The nation has taken great leaps in the fabrication and application of autonomous underwater vehicles (AUVs), advanced seabed mapping equipment and specialised equipment for deep sea mining. These changes and innovations make sure that China becomes the forerunner of technology and also permits it to with high autonomy and effectiveness in those regions of the ocean that are not accessible in an efficient way.

This capability of technology is consistent with China's wider geopolitical aspirations and desires.⁴² China is already dominating about 60% of rare earth production from onshore sources and has now turned its attention to deep-sea resources as a way of further getting a firm grip and hold of the resources. If this shift occurs, there would be a diminishing dependence on land-based mining which is the main intention behind it. Along with that, to have a diverse source of strategic minerals and limit the supply chains to nations who are already dependent on these for high-tech production, defence, and renewable energy industries. the incorporation of oceanic resource acquisition into the Belt and Road Initiative (BRI) framework shows how China is strategically linking the growth of the economy with geopolitical reach. Through investments in ports, infrastructure projects pertaining to the ocean and bilateral deals with developing coastal countries, China is building a vast and broad network that not only transports these resources but also expands its influence in strategic oceanic regions.

If we look at it with a legal lens, the exploration and engagement of China and its dominance in an aggressive manner in technology are pushing the limits of the United Nations Convention on the Law of the Sea (UNCLOS), especially with respect to the principle of sharing in a fair manner of deep-sea resources, which are classified as the "common heritage of mankind". Although China technically follows the process of ISA, its repeated attempts with various

⁴² State Oceanic Admin. (China), China's National Plan for Deep Sea Resources Development.

tactics to attain control and dominance over both physical ground and enabling technologies are cause for concern regarding the monopolization of deep-sea capabilities. This two-pronged strategy that includes membership of the global system of regulation at the surface level, while developing a functional monopoly at the underneath level has raised questions whether such dominance would be against the spirit of global cooperation and equitable distribution of resources embedded in global maritime law.

Case Study 2: Clarion-Clipperton Zone (CCZ)

The Clarion-Clipperton Zone (CCZ) has become the most commercially promising frontier for deep sea mining when it comes to the Spanning the central Pacific Ocean between Mexico and Hawaii. This huge abyssal plain is calculated to hold billions of tons of polymetallic nodules that is small, potato-sized lumps scattered over the seafloor. It is encompassed with minerals of precious nature like cobalt, nickel, manganese, and rare earth elements. These minerals form a crucial aspect pertaining to the production of batteries, electric cars, renewable energy equipment, and other advanced technologies, which makes the CCZ a centre of extremely global interest.

If we observe the value of the area in the economic sense, the International Seabed Authority (ISA) has awarded more than 16 exploration contracts to a variety of state-owned and private companies. These contractors include a vast range of countries like China, Japan, South Korea, India, the United Kingdom, and Belgium. Each of these companies has been allotted a specific area in the CCZ for exploration, with the final aim of establishing the feasibility of commercial-scale mining activities. There are increasing tensions pertaining to the poorly characterized environment due to which the excitement about the mineral resources of the CCZ is tampered. Ecosystems that are peculiar in nature which have specifically developed in isolation over so many years, the deep ocean is their home. Activities pertaining to mining particularly when it comes to the extraction of seabed nodules at a very large scale further worsens the situation and risk formulating sediment plumes that can bury marine life, hamper and cause an obstruction in processes in the ecological sense, and cause permanent damage to abyssal environments. The risk of long-term loss of biodiversity has become an urgent problem among environmental researchers and conservationists.

Legal and ethical tensions have been rising and escalating due to these environmental hazards within the context of international maritime law. The Small Island Developing States (SIDS)

are highest at risk when it comes to the consequences that has to be faced by the effects of degradation of the environment pertaining to both for a precautionary pause or outright cessation of deep-sea mining in the CCZ. Their pleas hinge on requiring good scientific study, open regulatory measures, and sincere input by the public before any exploitation. The ISA, the body overseeing deep sea mining in areas beyond national jurisdiction, is now under immense pressure to adopt the Mining Code that is a detailed framework of rules that will regulate future commercial mining. It is important so that there is a proper balance pertaining to economic interests that are rewarding and profitable in nature and corporations with certain obligations towards the environment established by the United Nations Convention on the Law of the Sea (UNCLOS). The CCZ situation has therefore become a pivotal test case for how the international community can balance the tension between development and sustainability in one of the world's last uncharted frontiers.

Case Study 3: India – Deep Ocean Mission

India has taken an ambitious journey to make sure that is an important and a major player in the international deep sea mining industry through its flagship program titled the Deep Ocean Mission (DOM). This was led by the Ministry of Earth Sciences (MoES), together with the National Institute of Ocean Technology (NIOT), the mission is designed and formulated with an aim create capacities indigenously for deep sea exploration and mining.⁴³ The project is indicative of the strategic interest of India with a broader perspective to make sure that energy security is maintained and protected, securing access to key minerals and resources, and playing a more dominant and crucial role in governing the ocean resources. India has been given an extensive 75,000 square kilometre tract of the Central Indian Ocean Basin by the International Seabed Authority (ISA) under whose auspices it is planned to explore polymetallic nodules. Polymetallic nodules, which contain manganese, cobalt, nickel, and copper, are considered crucial for India's future industrial and technological needs, particularly with regard to its emerging demand for renewable energy infrastructure and electric mobility solutions. The aim of the Deep Ocean Mission will not be only to analyse, evaluate and map the mineral potential of this area but also to formulate the sophisticated technologies necessary for eventual mining, including manned submersibles able to dive up to 6,000 meters and

⁴³ Ministry of Earth Scis., Gov't of India, Deep Ocean Mission, <https://www.moes.gov.in/programmes/deep-ocean-mission> (last visited May 4, 2025).

remotely operated mining systems.

The approach that India has pertaining to deep sea mining is based in the values of the United Nations Convention on the Law of the Sea (UNCLOS) in the legal aspect, most crucial aspect being the principle that the seabed and resources beyond national control are the common heritage of mankind that is for the betterment and collective good of the people. India has been an advocate for just access to such resources, especially for developing nations, and has urged the implementation of equitable benefit-sharing schemes to guarantee technological and economic inclusion. Its Deep Ocean Mission thus presents an inspiring template for the rising economies to seek to push their development agenda forward while honouring international legal principles and encouraging sustainable utilization of global commons

Recommendations

To ensure that deep sea mining develops in a sustainable, legally solid, and fair way, it is important and crucial that a multi-pronged approach exists that is one that bridges regulatory loopholes, protects marine ecosystems, and promotes governance in the inclusive manner. A precautionary global moratorium on commercial deep-sea mining is to be issued. This break would provide an opportunity for the International Seabed Authority (ISA) and the global community to complete baseline assessments of the environment, formulate policies based on science, and establish globally accepted standards that prioritize marine biodiversity and avoiding long-term ecological hazards. Institutional reform of the ISA is crucial so that transparency, accountability, and inclusivity can be improved. Increased civil society, indigenous people, scientist, and environmental group participation is necessary. The establishment of an Independent Scientific Advisory Panel and an Ombudsman Body, together with a redesign of voting rights to increase the voices of Small Island Developing States and developing countries, would promote more equitable decision-making.

Environmental protection should be improved through obligatory, peer-reviewed Environmental Impact Assessments (EIAs), open data sharing, and permanent monitoring systems so that a proper method of accountability and transparency is maintained. Cumulative Impact Assessments (CIAs) should also be implemented to assess the ecological impacts of various mining operations in a broader perspective. Equitable benefit-sharing mechanisms have to be adopted according to UNCLOS principles such that mining revenue supports ocean conservation, climate resilience, and socio-economic development in the Global South.

Technology transfers and capacity building, particularly under Article 144 of UNCLOS, have to be rejuvenated.

For solving legal ambiguities, a specialized chamber within the International Tribunal for the Law of the Sea (ITLOS) must be formulated to resolve disputes pertaining to the sea bed and a global fund for liability must be established to provide compensation in a proper time for damage of environment. Finally, deep sea mining regulation must be in alignment with the Sustainable Development Goals (SDGs) and international environmental agreements like the Paris Agreement and the Kunming-Montreal Global Biodiversity Framework. Ethical mining technology management should involve Technology Impact Assessments (TIAs) and rules for AI-based technologies, backed by a global code of responsible ocean exploration. These steps underscore the imperative to position ecological integrity, legal responsibility, and global equity at the forefront of deep-sea mining governance, underpinning the future of the ocean for generations to come.

CONCLUSION

The competition pertaining to deep sea minerals is not only a competition for economic and strategic influence, but a test of how humans can manage the resources in a more efficient and fair method so that everyone can benefit, and that no one is taken advantage of. Deep-sea mining holds the potential for access to key minerals that are central to clean energy and technological innovation, due to this it carries irreversible risks of harm to sensitive marine ecosystems as well as contradiction with long-held principles of international law, including the common heritage of mankind.

The examination and analysis of the methods of the state, particularly those of China and India, showcases both opportunities and imbalances in the present seabed governance regime. Meanwhile, the Clarion-Clipperton Zone is a test case for how international legal systems react to technologies considering the fact that there are a lot of certainties pertaining to the environment that are escalating. The increasing voice of calls for a precautionary halt, increased environmental protection, and more inclusivity in decision-making highlights the imperative for rapid reform within the ISA and general UNCLOS implementation. Deep sea mining should not revolve around state and profit-driven agendas that recognize ecological responsibility, intergenerational equity, and global justice. Robust international collaboration, transparent regulation, and ethically based policy-making are the only methods by which the bottom of the

ocean can continue to be a common legacy so that is it is not exploited or else it will have serious consequences that mankind will have to prepare themselves to face. Just reading and formulating laws in the theoretical aspect will not result into any solutions, one needs to practically implement steps and initiatives to ensure that there is a balanced approach