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Governance Challenges of Deep Seabed Mining

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Historical Context and Legal Framework

Deep seabed mining has been an area of interest to mining companies, scientists, environmentalists and the international community throughout the 20th century. In 1967, Malta's Arvid Pardo gave an important speech at the UN General Assembly, prospecting the "untapped [mineral] wealth of quasi-infinite abundance" while also warning that uncontrolled exploitation would lead to the enrichment of few developed states at the expense of others, great power competition and eventually war. This paved the way for the recognition of the common heritage of [hu]mankind principle by the UN General Assembly in 1970.[1] Successively, the UN Convention on the Law of the Sea (or UNCLOS) consolidated the legal regime of the international seabed (or the Area) in its Part XI, designating it as the "common heritage of mankind" (or CHM). Part XI prohibited unilateral appropriation of the deep seabed and its resources and created an International Seabed Authority (ISA) to allocate and regulate mining rights. Furthermore, it foresaw that such international mechanism must accomplish the fair redistribution of benefits derived from DSM and the protection of the marine environment from mining's harmful effects.

1 UNGA Resolution 2749 (XXV) on Declaration of Principles governing the sea-bed and the ocean floor and the subsoil thereof beyond the limits of national jurisdiction.

Highlights

The UN Convention on the Law of the Sea designated the deep seabed as the "common heritage of mankind" and created the International Seabed Authority (ISA) to oversee mining rights, ensure equitable benefit-sharing, and protect the marine environment.

Frustrated by regulatory delays and scientific uncertainty, corporate actors are exploiting jurisdictional gaps and partnering with non-signatory states to bypass the ISA and pursue mining outside the UNCLOS framework.

Operational progress is hindered by unresolved financial mechanisms for royalty distribution and significant environmental concerns, particularly regarding biodiversity loss and the difficulty of monitoring remote deep-sea ecosystems.

While some investors support circumvention strategies, mining outside the UNCLOS system creates substantial legal risks and threatens the legitimacy of the global governance regime intended to prevent unilateral exploitation.

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Nevertheless, some aspects of Part XI were not acceptable to industrialized states, which instead adopted national rules for the mutual recognition of mining rights over the Area. UNCLOS entered into force only in 1994, together with an Agreement Implementing Part XI of UNCLOS ('IA') which significantly watered-down various provisions established to ensure developing states' participation in deep seabed mining. Most UNCLOS state parties are also signatories to the IA. However, a small number of states that joined UNCLOS before 1994, have not signed and ratified the IA as of now,[2] which complicates the effective implementation of the integrated framework established by the two instruments.

Today, the deep seabed mining industry seeks to transition from the exploration phase to the exploitation phase

Jurisdictional Boundaries and Current Exploration

UNCLOS defines the Area as the seabed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction. Thus, the boundaries of the Area are not directly established under the DSM regime and remain contingent upon the delimitation of national jurisdictions. Coastal states that seek to extend their jurisdiction beyond 200 nm can do so by submitting evidence of their outer continental shelf to the Commission on the Limits of the Continental Shelf (CLCS). With over fifty such applications still awaiting resolution, a degree of legal uncertainty persists in determining the precise limits of the Area.[3] This, however, has absolutely not deterred activities in the Area: the ISA has granted thirty-one exploration contracts with twenty-two contractors, covering about 1.5 million sq. kms of the deep seabed (the most significant area being the Clarion Clipperton Zone (CCZ) in the Pacific Ocean).[4]

The Push for Exploitation and Regulatory Pressures

Today, the deep seabed mining industry seeks to transition from the exploration phase to the exploitation phase. At the same time, the ISA is engaged in the highly challenging task of developing a full set of rules, regulations and procedures applicable to exploitation activities. This has proved to be an arduous task, due to the complexity of the Part XI regime, scientific uncertainty and lack of complete knowledge of the marine environment. The slow pace of progress has frustrated various mining companies as well as their sponsoring states: in 2021 Nauru invoked a provision that obliged the ISA to complete the exploitation regulations within a delay of two years.[5] As this did not result in the conferral of exploitation rights, Canada's The Metals Company (or TMC) initiated, on March 2025, "a process with [the US government]... to apply for exploration licenses and commercial recovery permits under."[6] On its side, the Trump administration decided to "expedite the process for reviewing and issuing seabed mineral exploration licenses and commercial recovery permits in areas beyond national jurisdiction under the Deep Seabed Hard Mineral Resources Act".[7] Accordingly, TMC started to refer to DSM as being part of the freedoms of the high seas.[8]

Financial Mechanisms and Benefit-Sharing

If UNCLOS and the IA do foresee the exploitation of the mineral resources of the Area, they do not anticipate exploitation taking place come-what-may.[9] CHM's different elements including benefit-sharing and environmental

2 These states include Afghanistan, United Arab Emirates, Egypt, Sudan, Colombia, El Salvador, Bhutan, Libya, Liechtenstein, North Korea and Rwanda.

3 Submissions, through the Secretary-General of the United Nations, to the Commission on the Limits of the Continental Shelf, pursuant to article 76, paragraph 8, of the United Nations Convention on the Law of the Sea of 10 December 1982, https://www.un.org/depts/los/clcs_new/commission_submissions.htm, accessed on 24th September, 2025.

4 ISA, Exploration Contracts, https://isa.org.jm/exploration-contracts/ accessed om 4th November 2025.

5 Pradeep Singh, The Invocation of the 'Two-Year Rule' at the International Seabed Authority: Legal Consequences and Implications (2022) 37(3) the International Journal of Marine and Coastal Law, p. 1.

6 The Metals Company to Apply for Permits under Existing U.S. Mining Code for Deep-Sea Minerals in the High Seas in Second Quarter of 2025, at https://investors.metals.co/news-releases/news-release-details/metals-company-apply-permits-under-existing-us-mining-code-deep

7 Unleashing America's Offshore Critical Minerals and Resources, Executive Order of 24 April 2025, https://www.whitehouse.gov/presidential-actions/2025/04/unleashing-americas-offshore-critical-minerals-and-resources/

8 CEO Statement on ISA and USA, March 20025, https://metals.co/ceo-statement-on-isa-and-usa/

9 Zachary Douglas et al., In the Matter of a Proposed Moratorium or Precautionary Pause on Deep Sea Mining Beyond National Jurisdiction, para. 100, available at https://www.pewtrusts.org/-/media/ assets/2023/03/deep-sea-mining-moratorium.pdf

protection - are all equally part of the ISA's regulatory mandate and must be attained for exploitation to take place.

Article 140 of UNCLOS codifies the benefit-sharing principle, requiring activities in the Area to be carried out "for the benefit of mankind as a whole" and mandates an "equitable sharing of financial and other economic benefits" derived from deep seabed mining. A portion of the contractors' mining revenues are thus supposed to flow to the ISA as royalty/ profit share: these royalties are expected to be a major source of the ISA's revenue.[10] There is a lack of consensus on whether royalties are to be paid on an ad-valorem basis or profit-sharing basis or a hybrid model. UNCLOS-specified royalty rates[11] are rendered inapplicable by the IA, which now simply provides for the royalty rates to be in the range of rates prevailing for land-based mining and the rate to be such that ensures optimal revenue to the ISA.[12] For an ad-valorem royalty, favored by most member states,[13] the discussed rates range from 2 – 6% to 40 – 70%. A royalty-only (ad-valorem royalty) payment regime for the Area would deviate from the normal practice in extractive industry taxation which normally consists of both a royalty and profit share/ profit taxes.[14]

Once the ISA's funds are ascertained, they are subject to various UNCLOS-specified mandatory withdrawals before the net funds are redistributed for the benefit of humankind. In this process, several technical questions are to be resolved by the ISA – for example whether ISA's administrative expenses[15] would be on a cost-recovery basis or a percentage overhead charge. Or how would contributions to the Economic Assistance Fund (for land-based mining developing countries adversely affected by seabed mining) be calculated and allocated.[16] Or whether member states' past contributions to the ISA are to be reimbursed.

Finally, upon arriving at the net amount for redistribution, member states need to agree on the development of crucial redistribution mechanisms: whether there may be a direct distribution to states or a Seabed Sustainability Fund, or some combination of the two. Direct disbursements would entail allocations to member states based on quantifiable, yet undefined, parameters such as population or per capita income.[17] The alternative option of a global fund may entail the accumulation and qualitative distribution towards public goods such as disease-eradication, climate change mitigation and so on.[18] However, there is very little clarity on the precise object and purpose of such fund.

Defining Beneficiaries and Non-State Parties

While discussing redistribution, it is pertinent to mention the challenge associated with ascertaining which are the DSM regime's beneficiaries. Article 140 of UNCLOS identifies the whole of mankind as the beneficiary of DSM, not only UNCLOS state parties. However, the ISA's work has had the effect of equating 'mankind' with member states, turning the CHM into the '*common heritage of member states*', and disregarding the position of about thirty non-signatory states. This will hurt the existing regime in any given scenario: on one hand, including non state parties (NSPs) in benefit-sharing would disincentivize states parties (or SPs) to participate and make financial/ technical contributions to the development of the regime. On the other hand, excluding NSPs from benefit-sharing risks incentivizing unilateral mining outside the UNCLOS framework and for their own benefit, without any benefits-redistribution to mankind.

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10 UNCLOS, Annex II, article 10.

11 Article 13, Annex III to UNCLOS.

12 Section 8, Annex to IA.

13 https://enb.iisd.org/negotiations/international-seabed-authority, accessed on 29 September 2025.

14 Daniel Wilde, An Evaluation of the Payment Regime for Deep Seabed Polymetallic Nodule Mining in the Area, Perspective on Deep-Sea Mining, p. 533.

15 UNCLOS, Article 173(2).

16 UNCLOS, Article 151(10) and Implementation Agreement, Section 7. A study requested by the ISA Council analyzes 13 developing land-based producer States of metals – Chile, the Democratic Republic of the Congo, Eritrea, Gabon, the Lao People's Democratic Republic, Madagascar, Mauritania, Mongolia, Namibia, Papa New Guinea, Peru, Zambia and Zimbabwe. https://www.isa.org.jm/news/isa-releases-study-potential-impact-mineral-production-international-seabed-area-economies/

17 Daniel Wilde and others, Equitable Sharing of Deep-Sea Mining Benefits: More Questions than Answers (2023) 151 Marine Policy 105572, 4: Studies have shown more than half of States parties receiving less than $50,000 per annum in the medium term, estimating that even for the few states with a large share of financial benefits the payments received may be insignificant compared to the size of their economies.

18 ISA Technical Study No. 31 on 'Equitable Sharing of Financial and other Economic Benefits from Deep-Seabed Mining'.

Environmental Challenges and Scientific Uncertainty

While it remains unclear who precisely stands to benefits from DSM, some stand to lose from activities in the Area. Here we refer to the marine life most at risk of habitat loss or extinction.[19] The majority of metazoan benthic species are still undescribed, including in the CCZ, where over 90% of known species are new to science and still lack a formal taxonomic classification.[20] This gap not only makes it difficult to understand the total extent of biodiversity but also complicates cross-site comparisons of species as different researchers may assign varying temporary names to the same species. This leaves the ecosystem functions poorly quantified and the role of biological communities to this ecosystem poorly understood. The remoteness of the mining sites poses a serious challenge to monitor compliance by both contractors and the ISA alike.[21]

Monitoring and Regulatory Tools

Under the ISA's current regulations, DSM contractors are obliged to collect baseline data, carry out environmental impact assessment (EIA) and monitor the effects on the relevant marine environment.[22] According to the ISA Recommendations for the Guidance of Contractors for the possible environmental impacts arising from exploration or minerals in the Area ('EIA Guidelines'), seven categories of baseline data must be addressed by contractors: physical oceanography, geology, chemistry and geochemistry, biological communities, sediment properties, bioturbation and sedimentation.[23] Paragraph 33 of the EIA Guidelines also lists the activities that require at all times a full environmental impact assessment to be carried out, including the testing of mining components, test-mining, the testing of discharge systems and equipment, drilling, sampling in nodule fields that exceeds 10,000 square meters.[24]

Data-collection by contractor is not the only tool available to achieve environmental protection. The ISA may "disapprove areas for exploitation by contractors… in cases where substantial evidence indicates the risk of serious harm to the marine environment."[25] Accordingly, in 2012, the ISA Council issued a Regional Environmental Management Plan (or REMP) for the Clarion Clipperton Zone, establishing nine Areas of Particular Environmental Interest (or APEI) where no exploration or exploitation activities will be allowed.[26]

Finally, the DSM regime imposes liabilities on contractors "for damage arising out of wrongful acts in the conduct of its operations".[27] Occurrence of environmental damage will not automatically create liability unless the damage is attributed to a wrongful act or omission. However, given the status of scientific knowledge about the marine environment of the Area, there may be significant challenges associated with assessing environmental damages.[28]

Global Calls for a Moratorium

Accordingly, the lack of consensus on DSM's environmental impacts has led some member states, such as the UK and France, to urge a precautionary pause or moratorium on DSM. Such sentiment has been echoed by some technology and automative brands like BMW, Volkswagen or Samsung SDI which view the raw materials from the deep seabed non-compliant with their sustainable sourcing policies, until sufficient scientific findings are in place to assess the associated environmental risks.[29] Additionally, a growing group of financial and insurance institutions have excluded deep sea mining from their underwriting portfolios, tightening investment in the sector.[30] On the other side, other member states do support a deep seabed mining industry that has expended considerable resources in exploration activities. Thus, the ISA finds itself under conflicting pressure, standing with one foot on the brake and the other on the accelerator.

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19 Muriel Rabone et al., "How Many Metazoan Species Live in the World's Largest Mineral Exploration Region?" Current Biology 33, no. 12 (2023) : in the Clarion Clipperton Zone over 90% of known species are new to science and still lack a formal taxonomic classification.

20 Ibid.

21 Isabel Feichtner, Sharing the Riches of the Sea: The Redistributive and Fiscal Dimension of Deep Seabed Exploitation, European Journal of International Law, Volume 30, Issue 2, May 2019.

22 Decision of the Council of the International Seabed Authority relating to amendments to the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area and related matters, ISBA/19/C/17, Annex IV, sections 10, 11.

23 Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area, ISBA/25/LTC/6/Rev.3.

24 Ibid., para 33.

25 UNCLOS, article 162(2)(x).

26 Decision of the Council relating to an environmental management plan for the Clarion-Clipperton Zone, ISBA/18/C/22, 26 July 202, annex. In 2021, four additional APEIs in the Clarion Clipperton Zone were approved (ISBA/26/C/58).

27 Article 22, Annex III.

28 Ruth Mackenzie, Liability for Environmental Harm from Deep Seabed Mining Activities: Defining Environmental Damage (2019) Liability Issues for Deep Seabed Mining Series, Paper No., p 13.

29 Google, BMW, AB Volvo, Samsung back environmental call for pause on deep-sea mining, Reuters, 31 March 2021, https://www.reuters.com/business/sustainable-business/google-bmw-volvo-samsung-sdi-sign-up-wwf-call-temporary-ban-deep-sea-mining-2021-03-31/, accessed on October 12, 2025.

30 Major insurers withdraw support for deep sea mining, Insurance Business Magazine, 20 July 2024, https://www.insurancebusinessmag.com/nz/news/environmental/major-insurers-withdraw-support-for-deep-sea-mining-498048.aspx, accessed on October 26, 2025.

Corporate Circumvention and Jurisdictional Gaps

More recently, the ISA's efforts to finalize exploitation regulation have been hampered by new challenges to its authority. Cross-border corporate structures often exploit jurisdictional gaps, either to gain access to ISA contracts or to bypass the UNCLOS system altogether, and this adds layers of complexity to the governance of the DSM regime.[31]. In the past, the ISA allowed commercial actors from NSPs to set up companies in UNCLOS members so to acquire their nationality and their sponsorship.[32] Hence, NSP nationals could secure ISA contracts, through their SP subsidiaries, effectively circumventing the legal restrictions upon their participation.[33] Nowadays, the converse situation has arisen, where SP nationals pursue exploitation contracts outside the ISA system, through subsidiaries in NSPs. This has raised concerns of the multilateral system losing its relevance even before the Mining Code is fully developed.

The Legal Status of UNCLOS Part XI

Attempts to shift away from UNCLOS may prove unsustainable if Part XI of UNCLOS attains the status of customary international law binding on NSPs. Although UNCLOS enjoys quasi-universal membership, Part XI represents a novel development rather than a codification of pre-existing customary international law.[34] Hence, it is not clear whether NSPs are legally bound to the DSM regime.

Proponents of this view argue that Article 137 applies to all states, as opposed to UNCLOS state parties, that negotiations involved near-universal participation and an agreement that the Area should be regulated by a novel legal principle. They note that the reciprocating states regime did not explicitly deny the Area's status as CHM and that no state has acted outside the UNCLOS-created institutions.[35] Finally, they point that United States signed the IA, which still entails a duty to refrain from acts defeating that treaty's object and purpose.[36] Opponents highlight that the United States never ratified the UNCLOS owing to its objections to Part XI, that unilateral pre-UNCLOS exploration licenses were maintained, and that U.S. law partial reflection of the CHM principle does not amount to accepting the ISA's exclusive competence. Moreover, Article 4(2) of the IA precludes consent to be bound by the IA unless the state has also consented to UNCLOS.[37] Regardless of Part XI's customary status, Article 137 imposes on states parties a duty not to support mining activities conducted outside the UNCLOS framework.

Legal Disputes and Investor Risks

Hence, one can envision legal issues for all actors throughout the supply chain that recognize and aid in TMC exploitation of the Area's minerals outside UNCLOS. However, this has not deterred certain actors in the international community, as is evident from the significant industry and financial backing to TMC - be it Dutch Swiss AllSeas supplying offshore engineering capabilities or Korea Zinc providing strategic investment. Such circumstances are susceptible to disputes as civil society and other ocean users may wish to challenge those actors' involvement in deep sea mining. Because not all such disputes will fall under the jurisdiction of the Seabed Disputes Chamber of ITLOS, national courts may be called to play a crucial role. Concerned parties may attempt, through national litigation, to enforce article 137 against entities profiting from unauthorized DSM in the Area or against state authorities which recognized rights exercised over minerals recovered from the Area.

In some national laws, individuals may sue based on international treaties if the relevant provision is "sufficiently clear and precise to as to serve as the basis of a decision in a specific case" and "addressed to the authorities charged with the application of the law rather than the legislator."[38] Article 137 may fulfil these characteristics because it is not specifically addressed to states and entails a duty to refrain from a certain conduct as opposed to positive duties requiring

31 One notable case is Canada-based TMC which, having partnered with Pacific-island countries to access mining sites set aside for developing states under UNCLOS, has now announced its intention to apply for exploitation rights, over the same sites, from the United States (a non-signatory to UNCLOS).

32 ITLOS Advisory Opinion, 'Responsibilities and obligations of States, sponsoring persons and entities with respect to activities in the Area' dated 21 May 2024, para 159.

33 Joanna Dingwall, International Law and Corporate Actors in Deep Seabed Mining, Oxford Monographs in International Law (Oxford, 2021; online edn, Oxford Academic, 19 Aug. 2021), p. 155.

34 Bernard H. Oxman, The New Law of the Sea (1993) 69 American Bar Association Journal, 156: "[e]xcept for those on deep seabed mining and settlement of disputes," the provisions of the Convention already were regarded as authoritative statements of existing 'customary' international law applicable to all states."

35 Dingwall (n 33) pp 174 – 177.

36 Ibid., p 182 referring to article 18 of the Vienna Convention on the Law of Treaties (VCLT).

37 James Kraska, The U.S Executive Order on Seabed Mining is Consistent with International Law, 19 June 2025. However, it is not clear how and whether this affects the duty codified by Article 18 VCLT.

38 Swiss Federal Tribunal, L.X. v. M.F, decision of 22 December 1997, 90, 91, para. 3

additional legislation or regulation.[39] In other words, there are vast regulatory risks for investors who decide to get involved in deep sea mining not authorized by the ISA.

Conclusion: Institutional Challenges

The ISA simultaneously serves as a forum for multilateral negotiations, as regulator of exploration and exploitation activities, as collector and distributor of royalties and as protector of the deep seabed environment. At the national level, these technically demanding functions would be divided between separate governing bodies with distinct areas of expertise.[40] Instead, the ISA must juggle differing and sometimes competing missions. The foremost challenge certainly lies in the ISA's task of devising a comprehensive Mining Code with the consensus of one hundred-seventy members. Nevertheless, international law-making efforts in this field may become redundant without universal adherence to UNCLOS. Indeed, corporate actors are already attempting to circumvent their obligations by exploiting the domestic regimes of non-signatory states.

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39 In France, national courts have already applied UNCLOS provisions on fisheries to settle disputes pitting shipowners against state authorities. For example, in France see Cour de Cassation, Chambre commerciale, du 19 décembre 2000, 98-17.276, «Navire Explorer»; Cour d'appel de Rennes (3e Ch.) ,10 juin 2010, « Navire Vytautas » No 09-01673, DMF 2011 n° 728.

40 Why Deep-Seabed Mining Needs a Moratorium, Pew, 6 June 2025, https://www.pew.org/en/research-and-analysis/fact-sheets/2025/06/why-deep-sea-bed-mining-needs-a-moratorium, accessed on October 12, 2025.

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