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# Environmental Protection and Deep-Sea Mining: Balancing Resource Extraction and Marine Conservation


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*This article looks into the interactions between deep sea mining and the environment to show how there is a pressing need to use resources from sea beds while at the same time protecting and preserving the sea regions. With the increasing demand for such mineral resources in the global market as cobalt and nickel, the deep sea appears to be a significant source. However, the environmental effects associated with mining — from habitat degradation to loss of bio-diversity — present many questions. Acting as a roadmap for international lawyers, this article engages the provisions of the United Nations Convention on the Law of Sea (UNCLOS) and emphasises the need for the precautionary principle. Also, there are presented the problems of EIAs within the context of mining proposal assessment, and possible solutions are outlined for more sustainable mining practices. This is because the author agrees with the idea that for deep-sea ecosystems, protection is necessary due to rapidly intensifying industrial attention, regulation, rigorous scientific investigations, and cross-border collaboration.*[1]



**Keywords:** *deep-sea mining, environmental protection, marine ecosystems, resource extraction, biodiversity.*


[1] Rahul Sharma, *Environmental Issues of Deep-Sea Mining: Impacts, Consequences, and Policy Perspectives* (Springer International Publishing 2019)

## INTRODUCTION

As the global community seeks to meet the climate change challenge of providing the growing world access to clean energy and enabling the energy transition to renewable resources, demand for critical metals like cobalt, nickel, and rare earth elements has never been higher. These are important for the production of batteries, renewable energy appliances, and many other electronics. Therefore, the development that provides the basis for implicit opportunities, such as the industry of deep-seabed mining that focuses on mineral deposits located in the ocean deep, has its risks. However, the increase in interest in these SOFCs raises genuine questions about the possible consequences on the delicate ocean environment. The deep sea hosts such species and populations of poorly known and extraordinarily vulnerable to Anthropogenic disturbance. This article explores the dilemma of conserving marine ecosystems and utilising resources concerning International Law, especially the United Nations Convention of the Law of the Sea 1982, and the impact of what has been termed the precautionary principle in light of deep-sea mining[2].

## THE SIGNIFICANCE OF DEEP-SEA MINERALS

Polymetallic nodules, seafloor massive sulfides, and cobalt-rich crusts are now being viewed as critically important resources in the fight to satisfy global energy needs. These minerals are found in fields including the CCZ in the Pacific Ocean with a potential of containing the following Polymetallic Nodules: Copper, Nickel, Cobalt, as well as rare earth elements. Apart from this, deep-sea minerals are very important for several sectors, especially those that deal with the production of renewable energy resources. Cobalt and nickel are important in the battery of electric vehicles and storage of renewable energy. The richest field of these manganese nodules is located in the Pacific Ocean in the Clarion-Clipperton Zone (CCZ)[3]. These resources are becoming irresistible as the world shifts towards sustainable energy, thereafter taking deep sea mining into the list of unrestrained resource exploitation. These human resources are captivating the interest and, consequently, exploration and exploitation of the seas and because

[2] United Nations Convention on the Law of the Sea 1982
[3] 'Marine Resources – Opportunities and Risks' (2014) World Ocean Review <https://worldoceanreview.com/wp-content/downloads/wor3/WOR3_en.pdf> accessed 10 November 2024

of that, many firms are going for licenses from ISA to work on the high seas. But at the same time, the demand for these resources and the consequences of mining them may have negative effects on the environment.

## ENVIRONMENTAL RISKS OF DEEP-SEA MINING

Hadalpelagic systems are those that potentially harbour some of the lowest levels of species interaction and biological knowledge on our planet. They include such species as hydrothermal vent and cold seep communities, abyssal plains, and deep-sea corals. All these ecosystems are essential in anchoring global participation in the acts of biodiversity, carbon, and ocean. The potential environmental impacts of deep-sea mining are significant and multifaceted:

- **Habitat Destruction:** Another politically important but scientifically questionable argument against bioturbation created by seabed mining is the loss of prehistoric sea-bottom formations that were disrupted and destroyed during the mining process.
- **Sediment Plumes:** Mining activities have reported occurrences of sediment plumes, which may smother benthic organisms, affect their feeding, and also affect their reproductive systems[4].
- **Pollution:** High levels of heavy metals and other pollutants that are released during mining can be toxic to marine life and may introduce different types of risks into the food chain for both marine life and human life.
- **Biodiversity Loss:** Some of the species that exist in the deep sea are not seen in other environments. Mining activities could cause the depletion of the balance of the species before such species have been researched and documented.

## LEGAL FRAMEWORK: UNCLOS AND THE PRECAUTIONARY PRINCIPLE

International law governing deep-sea mining is therefore provided by UNCLOS, which is the principal international legal instrument for the ocean. The area of the ocean floor beyond the exclusive national zones is described by UNCLOS as the "Area," and it is legal to refer to it as

[4] Lisa A Levin and Nadine Le Bris, 'The deep ocean under climate change' (2015) 350(6262) Science <https://www.science.org/doi/10.1126/science.aad0126> accessed 10 November 2024

the common heritage of mankind. Several requisites are placed on the shoulders of states and the ISA to ensure that such exercise is done responsibly and sustainably. Many of the legal systems that control deep-sea mining are rooted in the United Nations Convention on the Law of the Sea, which offers the general legal structure for managing the subsidy beyond any country's Exclusive Economic Zone. Key components of this framework include[5]:

- **The Common Heritage of Mankind:** UNCLOS also provides that the resources of the 'Area' (the seabed beyond the national jurisdiction) belong to all humankind. This principle provides for the principle of reasonable sharing of and sustainable use of deep-sea resources.
- **International Seabed Authority (ISA):** According to the Convention, the ISA is required to oversee the activities connected with minerals in the Area. They grant licenses to explore and develop those resources without polluting the marine environment to a very high level.
- **Environmental Obligations:** It is provided in Article 145 of UNCLOS that states and contractors shall take all necessary measures to prevent and minimise the adverse impact of mining on the marine environment. This comprises assessments of environmental impact (EIA) before issuing mining licenses.
- **The Precautionary Principle:** The precautionary principle, which has become one of the pillars of modern international environmental law, points to the existence of uncertainty. In the case of deep-sea mining, it plays a very important role in decision-making on measures that can help reduce impacts on the environment.

## CHALLENGES IN IMPLEMENTING ENVIRONMENTAL PROTECTION

Despite the legal frameworks in place, several challenges hinder the effective implementation of environmental protections in deep-sea mining:

[5] Michael Lodge, 'The International Seabed Authority and Deep Seabed Mining' (2017) 54(1-2) Our Ocean, Our World <https://www.un.org/en/chronicle/article/international-seabed-authority-and-deep-seabed-mining> accessed 11 November 2024

**The Regulation and Scientific Controversy:** The deep sea is still one of the most overlooked and explored regions on Earth, and therefore, little is still known about the area's ecosystems. This scientific ambivalence makes it difficult to perform EIA's properly because there is frequently inadequate data with which to estimate how mining projects may affect the environment. Furthermore, bringing out standards to address the issues deeming the ISA appropriate in the exploration and exploitation of resources would prove to be an activity hindered by various difficulties. The technology being adopted in deep-sea mining also continues to change, making any regulatory response unpredictable because existing frameworks may not address new innovative methods or their impact.

**Enforcement and Monitoring:** The compliance and enforcement of environmental laws in the area of the high seas remain complex. Due to its nature, the deep sea, it is hard for the ISA and other individual states to monitor and regulate mining. Monitoring environmental compliance is always a challenge because facilities have the potential to harm the environment without awareness because of a lack of mechanisms.[6]

**Scientific Uncertainty:** Little is known about organisms dwelling in deep-sea environments. Numerous species and ecological processes have not been identified to this date, which hinders the evaluation of the effects of mining and the efficiency of existing protective features.[7]

## THE ROLE OF ENVIRONMENTAL IMPACT ASSESSMENTS (EIAs)

Deep-sea mining could be controlled by making EIAs mandatory before issuing licenses concerning this business. According to the provisions of UNCLOS, EIAs are required to predict the effects on the ecosystem and bio-diverse, including coastal communities. EIAs stand indispensable for assessing the possible effects of deep-sea mining. Under UNCLOS, EIAs must be conducted on all proposed mining projects to evaluate the potential effects on the

[6] K M A Gjerde and R. Rayfuse, 'The Precautionary Principle and Deep-Sea Mining: Legal Obligations and Policy Directions' (2013) 36(2) Marine Policy 189-198
[7] Marine Resources – Opportunities and Risks (n 3)

environment before approval of licenses. However, several challenges hinder the effectiveness of EIAs[8]:

**EIAs in the context of Mining Licenses:** EIAs exist as a form of preconditioned means of putting the decision-makers on notice about the environmental consequences of planned mining ventures. The functions involve helping realise risks that may arise, suggesting preventive measures to be taken in case of such risks, and ensuring that the stakeholders are involved in decisions to be made.

**Issues with EIA Efficiency:** Some people believe that existing EIA procedures can be insufficient in the identification of impacts in deep-sea conditions. Deep-sea environments, thus, prove difficult to evaluate in terms of combined impacts and even more challenging to anticipate their behaviour in response to disruptions.

**Insufficient Baseline Data:** Although assessment of potential impacts is a routine practice in deep-sea environments, EIAs done in those areas are highly demanding due to the absence of background data. They added that most ecosystems are not well known and therefore, predicting the likely effect of the impacts remains challenging.

**Stakeholder Engagement:** Stakeholders and communities in the local setting are commonly not actively participating in the EIA process. More participation is paramount to guarantee representation and inclusion of complicated opinions in the processes.

## POSSIBLE SOLUTIONS AND MOVING FORWARD

These solutions would assist in addressing issues related to deep-sea mining while upholding valuable environmental protection.

**Improve Scientific Research and Data Collection:** Investment in scientific research could serve to improve ever-developing knowledge about the deep-sea ecosystem. Cumulative data on the species composition, functions of ecosystems, or potential mining impacts could provide a large scientific basis for credible decision-making. Collaborative research with scientists, government

[8] Aline L Jaeckel, *The International Seabed Authority and the Precautionary Principle* (Brill 2017)

leaders, and industry representatives is set up to augment knowledge across our wide field and to further effective sustainable practices.

**Stronger Regulatory Frameworks:** The ISA will pick up and develop more rigorous codes and binding international agreements to ensure responsible conduct around deep-sea mining. These structures should be supple to embrace new scientific revelations and technological advancements that aim at protecting marine ecosystems[9].

**Principle of 'No Net Loss':** Environmental regulations could state and imply 'no net loss' or 'net positive impact' to assure that 'there is no irreversible damage to these marine ecosystems as a result of deep-sea mining activities.' In essence, it would oblige a mining operator to show that their activity will ensure respect or augmentation of biodiversity and ecosystem health.

**Monitoring and Compliance:** The augmenting of enforcement mechanisms will guarantee minimum compliance with environmental codes. More investment in technology and resources would help enable the monitoring of the high seas.

**CASE STUDIES**

**Clarion-Clipperton Zone (CCZ):** The debate on deep-sea mining can be better understood by taking the hypothetical example of the Clarion-Clipperton Zone (CCZ). The CCZ, which is found mid-way between Hawaii and Mexico, is believed to contain abundant polymetallic nodules and is fast emerging as the key mining site. As much as Governments have granted exploration agreements, the environmental consequences have elicited concern and urged for enhanced safeguards together with full-blown SEIA before the commencement of mining.

**Regional Efforts:** Some of the Pacific Island Nations have fortunately been more proactive and have placed bans or moratoriums and gone regional on deep-sea mining. All these reflect the emerging consciousness of the local and global commitment to the conservation of ocean resources and encouraging the locals to have a stake in the management of the environments they live in.

[9] Sharma (n 1)

## CONCLUSION

While deep sea mining is prospecting for the deposit of the ocean floor, it brings about several concerns regarding environmental conservation. Due to the ever-increasing global literally of minerals, definitive measures to stake the balance between economic gains on one side and the vulnerable marine environment on the other side need to be put in place. Of course, UNCLOS and other sources of international law set out the legal basis for controlling selenium, but their adequacy, again, depends on their actual enforcement and scientific study, as well as on the advancement of the precautionary approach. While the desire for a new source of valuable metals and minerals carries great allure, deep-sea mining's future must be sustainable so as not to harm the marine environment beyond which repair is impossible. The management of the deep sea and its ecology, therefore, will require collective international efforts and strategic sustainable utilisation of resources.