EXPLORATION AND EXTRACTION OF DEEP SEABED MINERALS: AN ANALYSIS OF PROPERTY LAW DISCOURSE AND ITS REGULATION

Abstract

The exponential development of technology has made mining minerals from the deep sea viable, with almost every nation wanting to lay claim to a portion of these valuable minerals. Deep sea mining is popularly viewed as the solution to dwindling mineral supplies on land. Its proponents argue that deep sea mining does not cause environmental damage through deforestation, toxic waste, carbon emissions or fresh water eutrophication. They also argue that suspending deep sea mining trials would squander the sizeable investment that research, exploration and equipment involved, which would compromise the quantum of current and future funding investors would be willing to contribute. Considering the apparent motive, most countries have to pursue deep sea mineral extraction, and it may be essential to take these arguments with a pinch of salt. According to article 297 of the Indian Constitution, the Union of India possesses exclusive rights to all minerals underlying the ocean within territorial waters and the exclusive economic zone. However, to mine minerals outside these areas, India needs to adhere to the UNCLOS. While the UNCLOS and ISA have been quick to lay down a property right regime to explore and extract deep sea minerals, the question of why these rights should be granted has not been considered. This paper seeks to illustrate the potential cost of mining and extraction on remote marine environments, the absence of merit in the arguments of deep sea mining advocates, and the futility of the present scheme of the ISA while exploring different philosophies of property law.

I Introduction

THE DEEP seabed abounds in minerals like manganese, nickel, copper, cobalt, iron, zinc, silver, and gold, occurring naturally in deposits of polymetallic nodules, polymetallic sulphides, and ferromanganese crusts. These minerals were first discovered by the Challenger Expedition in the 1870s and maintained a mysterious, inhospitable perception. Following the Second World War, technological progress led to the invention of the submarine, offshore drilling, and the expansion of the exclusive economic zone.[1] Additionally, the world realised that land-based resources were dwindling at an alarming rate and would soon become insufficient to sponsor future developmental activities. On the other hand, the minerals on the ocean floor would last for four hundred years as per the consumption rates of the 1960s.[2] These factors highlighted the value of the deep sea resources as an attractive source of commercial activity.[3]

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1 Penelope Warne, "Arctic Scramble: International Law and the Continental Shelf" *Aberdeen Press and J.*, 24 Oct. 1, 2007).

2 G. Bulkley, *The Allocation of Property Rights to Unmined Minerals on the Ocean Floor* (Warwick Economic Research Papers No. 81, 1975).

3 Vatsala Mani, "Exploitation of Deepsea-Bed Minerals: Some Economic Issues" 35(1) *India Quarterly* 52-66 (1979).

The property law philosophy of the seas can be traced back to the 15th Century when nations declared sovereignty over parts of the high seas.[4] Hugo Grotius put forth his arguments for *Mare Liberum*, or the freedom of the seas, in the early 17th Century, positing that property is grounded upon occupation by enclosing or seizing something. He argued that since the ocean could not be confined, it must necessarily be free.[5] This principle held up until the early 20th Century when technological advancements made it possible to access and occupy continental shelves.[6] It was only a matter of time until further technological innovations would make the deep sea bed accessible. At the same time, developing nations that were newly becoming independent began to insist on the equitable sharing of resources.[7] This finally led to the United Nations Convention on the Law of the Sea (UNCLOS) agreements. Additionally, the International Seabed Authority (ISA) was set up under UNCLOS to regulate the exploration of mineral deposits.[8]

The UNCLOS and the ISA declare the deep sea and its resources to be declared part of the Global Commons.[9] They define the seas beyond national jurisdiction, including the resources, subsoil, and seafloor therein, as the common heritage of mankind. Being a regulatory body, the ISA grants nations exploration contracts to determine the viability of mining the deposits and examine the impact of commercial mining on the marine environment. UNCLOS has brought in guidelines to regulate the actual exploration and mining process to monitor and reduce effects on marine ecology.[10] The ISA has granted thirty exploration contracts to governments or contractors sponsored by national governments. Sixteen of these contracts are for exploration in the Clarion-Clipperton Fracture Zone (CCZ) in the Pacific Ocean, and six are for exploration in the Western Pacific Ocean. The rest are for exploration in the Indian Ocean.[11]

Several countries are ready to test their mining technology, which makes it necessary to examine the present property right regime to the minerals of the deep sea. This

4 J. E. S. Fawcett, "How Free Are the Seas?" 49 *Int'l Aff.* 14 (1973).

5 Nandasiri Jasentuliyana, *Space Law: Development and Scope* 4 (Greenwood Publishing Group, 1992).

6 Kemal Baslar, *The Concept of the Common Heritage of Mankind in Inernational Law* 43- 45 (BRILL, 1998).

7 Lora Viikari, *From Manganese Nodules to Lunar Regolith: A Comparative Legal Study of the Utilization of Natural Resources in the Deep Seabed and Outer Space* 41-49 (Rovaniemi : University of Lapland, 2002).

8 Scott J. Shackelford, "The Tragedy of the Common Heritage of Mankind" 28 Stan. *Envtl. L. J.* 120-126 (2009).

9 Arts. 136, 137(2), United Nations Convention of the Law of the Sea; United Nations General Assembly Resolution 2749/XXV: Declaration of the Principles Governing the Sea Bed and the Ocean Floor and the Subsoil beyond the Limits of National Jurisdiction.

10 International Seabed Authority (ISA), *Exploration Contracts*, *available at*: https://www.isa.org.jm/exploration-contracts (last visited on May 14, 2022).

11 *Ibid.*

paper deals with three broad themes. Part I analyses whether rights to minerals should be granted in the first place. It evaluates the potential of exploration and mining to cause environmental damage and weighs this against the potential contribution of deep sea minerals to global development. Part II discusses the *res nullius* philosophy, determines why it eventually leads to the tragedy of the commons and evaluates the effect of this tragedy. Finally, part III examines why a regulatory body like the UNCLOS or the ISA is necessary and weighs this necessity against its flaws.

II Minerals under the sea: Who benefits?

The vast repositories of minerals under the deep sea attract several countries to delve deeper into the ocean and seek minerals prospecting in the high seas. Thus, from a property law perspective, it becomes the first imperative to determine whether individual nations should be granted proprietary rights to deep sea minerals. This entails examining the environmental impacts of deep sea mining and mineral extraction and discussing whether such extraction would be worth the harm caused.

Nature of marine biology in the deep sea

The exploration contracts granted by the ISA enable entities to search for deposits of polymetallic nodules, analyse them, test mining equipment and transportation systems and carry out environmental impact studies.[12] Most of these contracts explore those areas on marine abyssal plains that constitute some of the most remote ecosystems on Earth.[13] Despite accounting for 98.5% of the Earth capable of supporting life, most deep seas remain unexplored. This means that most flora and fauna in these parts remain undocumented.[14] However, an assessment of some of the areas in the CCZ led to the discovery of several previously undiscovered marine species. These discoveries constitute almost 90% of all creatures collected for study. Additionally, some of the faunae collected are rare that they cannot be found in any other deep sea areas outside the CCZ.[15] Some deep sea species with long life spans are vulnerable to physical disturbance because of their slow growth rates.[16] With specific reference to polymetallic nodules, the inaccessibility of fauna residing within nodules has rendered them extremely difficult to document, with reports that the removal of nodules may significantly destroy

12 International Seabed Authority (ISA), *Decision of the Assembly of the International Seabed Authority relating to the regulations on prospecting and exploration for polymetallic sulphides in the Area*, Regulation 1(3)(b), ISBA/16/A/12/Rev.1, (Nov. 15, 2010).

13 Olive Heffernan, "Seabed mining is coming — bringing mineral riches and fears of epic extinctions" 571 *Nature* 465 (July 24, 2019).

14 Richard Mahapatra, Anupam Chakravartty, "Mining at deep sea" *Down To Earth* (Sep. 15, 2014), *available at*: https://www.downtoearth.org.in/coverage/mining/mining-at-deepsea-46049 (last visited on May14, 2022).

15 *Ibid.*

16 Kathryn Miller *et al.*, "An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gap" *Frontiers* (Jan. 10, 2018).

their habitats.[17] Nodules are home to unique and unstudied corals, jellyfish, octopus, squids, and several other creatures.[18]

The deep seas are characterised by little to no light, weak currents and a rate of sediment movement that is as low as 1 cm per 1000 years. The species residing on and in the deep sea bed are specially adapted to such conditions, making any disturbance in this temperate zone detrimental to the marine ecology's survival.[19] Mining waste and sediment plumes may disrupt phytoplankton blooms at the sea's surface, introducing toxic metals into aquatic food chains. This mining waste could also travel through the ocean, causing damage to nearby seamounts and coral reef systems, providing shelter and food for many fish and marine mammal species. It could also endanger fisheries.[20]

The extraction and mining process would require some form of light to navigate and safely extract nodules. This light pollution in the pitch dark of the deep sea could severely disrupt the creatures here, which are adapted to the complete absence of light. During the exploration and extraction processes, the noise pollution could alter tuna's swimming and schooling behaviour and even cause dolphins and whales to strand.[21] Unfortunately, no technology exists to rapidly document the extensive range of biodiversity on the ocean floor and their vulnerability to mining processes.[22] This implies that there is no way any assess the safety of large-scale mining processes, meaning that by the time catastrophic ecological damage is finally discovered, it could be too late to reduce or rectify this damage.

Environmental impacts of deep sea mining

Several tests have been conducted to assess the potential impact of deep sea mining on the marine environment. These tests have been small-scale tests, none of which come close to the scale of destruction that commercial extraction would entail.[23] The first test was the Disturbance and Recolonisation Experiment, or DISCOL, which involved raking the centre of a plot in the Pacific Ocean.[24] Despite its simplicity, the

17 A. Glover and C. Smith, "The deep sea floor ecosystem: current status and prospects of anthropogenic change by the year 2025" 30 *Environ. Conserv.* 219–241 (2003).

18 *Ibid.*

19 Elizabeth Alberts, "Deep sea mining: An environmental solution or impending catastrophe" *Mongabay* (June 16, 2020), *available at*: https://news.mongabay.com/2020/06/deepsea-mining-an-environmental-solution-or-impending-catastrophe/ (last visited on May 31, 2021).

20 A. Chin and K. Hari, "Predicting the impacts of mining of deep sea poly metallic nodules in the Pacific Ocean: A Review of Scientific Literature" 14 (Deep Sea Mining Campaign and Mining Watch Canada, May, 2020).

21 *Id.* at 34.

22 *Supra* note 14.

23 H. Thiel and G. Schriever, "Testing the environmental impacts of sea-bed mining" 572 *nature* 586 (August 27, 2019).

24 *Ibid.*

experiment had a detrimental effect on the marine environment. It caused the displacement of the soft soils on the seafloor, which rained down and buried the habitants of the seabed. Further, the plough marks from the test are evident even after 32 years, and the faunae that usually inhabit the seabed have not returned to the test site.[25]

The next test of significance is Managing the Impacts of Deep-sea Resource Exploitation (MIDAS). It was conducted by 11 European Union members. As per this study, ecosystems found it very difficult to recover from small-scale disturbances on the deep seafloor, with results similar to those of DISCOL.[26] MIDAS expects deep sea mining to cause the mortality of the suprabenthic *megafauna* that resides exclusively in nodules by fragmenting its substrate habitat. Further, MIDAS expects that mining will destroy the habitats of most of the species endemic to the mining area. The sediment plumes created in mining would expand to the surrounding regions and smother the creatures on the seabed.[27] The toxic waste released during the mining process would be dispersed by the water, affecting endemic flora and fauna and penetrating seamounts and coral reefs. This waste could spread further to the creatures residing in the reefs and the faunae that consume the species on the floor and affected areas, thus creating a balloon effect of toxicity.[28] Additionally, the deep sea is so dark as to be almost black, and every living being here is specially adapted to the darkness. Therefore, the light pollution caused by the DSM process may irreversibly affect these organisms.[29]

The third test of significance is the Indian Deepsea Environment Experiment, or INDEX, conducted in the Central Indian Ocean Basin. This test made 26 tows on the seafloor for 42 hours. INDEX yielded significantly different results, reporting that natural variability would ultimately restore the seafloor environment, with *macrofauna* recolonising the disturbed area quite soon and microfauna unaffected by the disturbances.[30] It also highlighted how the designing of the mining technology to harvest tightly-packed nodules with minimum contact with the ocean floor would reduce its impacts.[31] As of now, scholars agree that the actual impact of commercial

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25 *Ibid;* A. M. Post, *Deep Sea Mining and the Law of the Sea* 467 (BRILL, 1983).

26 The MIDAS Consortium "Managing Impacts of Deep Sea Resource Exploitation-Research Highlights" 17-20, *available at*: https://www.eu-midas.net/ (last visited on May 16, 2022).

27 *Supra* note 16.

28 *Supra* note 20.

29 *Ibid.*

30 R. Sharma *et al.,* "Monitoring the Impact of Simulated Deep sea Mining in Central Indian Basin" 23(4) *Marine Georesources and Geotechnology* 339 (2005).

31 R. Sharma, "Indian Deep sea Environment Experiment (INDEX): An appraisal" 48(16) *Deep Sea Research Part II: Topical Studies in Oceanography* 3296 (2001).

mining cannot be accurately estimated. Mining technologies would have to be developed and tested, and their actual effects would have to be documented.[32] However, in light of the test results, it is almost certain that mining the deep sea will cause irreversible damage to the marine ecosystem.

Deep sea mining: should it be allowed?

Proponents of deep sea mining base their arguments around two significant prongs- the inequality of distribution of natural mineral resources and the necessity of deep sea minerals because of sustainable technology. Natural resources like minerals occur in scattered deposits. Most developed nations lack access to valuable mineral resources while developing countries often possess rich deposits of necessary ores and minerals. Developed nations have the most significant demand for them and, consequently, rely on imports that can be unreliable and cartelised.[33] Developed nations have therefore been among the first to claim the right to deep sea minerals. Developing countries have disputed this claim on the basis that deep sea minerals constitute the common heritage of humankind. Permitting a few developed countries to exploit these resources freely would deprive most of the world of their equitable share of benefits. Additionally, countries whose exports rely solely on the export of minerals would be adversely affected, and their competitive advantage lost.[34]

However, this justification is too simple to justify actions that could cause irreversible harm of an undetermined extent to the environment. The second justification regarding the necessity of deep sea mining relies on minerals like aluminium, copper, lithium, manganese, and nickel. These minerals are essential for developing green technologies like solar panels, wind turbines, and electric batteries and are also responsible for reducing global carbon emissions.[35] A single wind turbine requires more than a metric ton of copper, while electric car batteries require large amounts of cobalt, manganese and nickel.[36] The demand for sustainable energy sources is so great that cobalt, graphite, and lithium would need an increase of almost 500% by 2050 to enable it.[37] Proponents of deep sea mining argue that the rapid depletion of terrestrial mineral deposits will

32 *Supra* note 11; R. Sharma, "First Nodule to First Mine-Site: Development of Deep sea Mineral Resources from the Indian Ocean" 99(6) *Current Science* 750 (Sep. 25, 2010).

33 *Supra* note 1.

34 *Ibid.*

35 Doug Struck, "Treasures of the Deep: Tapping a Mineral - Rich Ocean Floor" 20(3) *Trust* 10-17 (2018).

36 Daniel Ackerman, "Deep sea Mining: How to Balance Need for Metals with Ecological Impacts", *Scientific American* (Aug. 31, 2020), *available at*: https://www.scientificamerican.com/article/deepsea-mining-how-to-balance-need-for-metals-with-ecological-impacts1/ (last visited on May 20, 2022).

37 World Bank, "Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition, Climate Smart Mining" (2020).

be insufficient to support the required sustainable technologies. The minerals from the deep sea would provide the assurances as necessary for the same.[38]

Analysing the arguments of the proponents

It is essential to weigh its benefits against its costs while determining whether deep sea mining is desirable. The argument about the necessity of mineral resources and their dwindling land supply bears a great deal of merit. However, extracting minerals from the deep sea bed is not the only solution to this issue. Some studies report that the existing terrestrial stock of minerals would be sufficient to produce sustainable, renewable technology and support the energy revolution if these minerals are supplemented with urban mining and all the electronic waste accumulated up to this point.[39] Additionally, technological developments like sustainable product designs and circular economies focused on reducing, reusing, and recycling minerals significantly reduce the demand for minerals.[40]

It is also essential to determine the commercial viability of deep sea mining. In the past, the returns from deep sea mining projects have been compromised on account of technical issues, low mineral prices, low profitability, and competition from terrestrial deposits.[41] For instance, Papua New Guinea pursued the Solwara 1 project for hydrothermal vents and left the United States Government USD 125 million in debt when it failed.[42] Thus, the viability of the extraction process is far from assured. [43] However, there is no point in pursuing a project that is bound to fail, especially if the project has no guaranteed economic return and causes large-scale, irreversible destruction of the environment.

Rising environmental concerns because of global warming, overexploitation of resources, and the movement of marine habitats make it essential to ensure ecological integrity before pursuing new activities. In the absence of a pressing need to exploit marine resources, private rights to deep sea minerals should not be awarded to entities

38 *Supra* note 24.

39 S. Teske *et al.*, "Renewable Energy and Deep Sea Mining: Supply, Demand and Scenarios" (Report prepared by ISF for J.M.Kaplan Fund, Oceans 5 and Synchronicity Earth, July 2016).

40 Natalie Lowrey and Helen Rosenbaum, "Urban mining' can save the deep seabed from exploitation" *China Dialogue Ocean* (July 2019).

41 G. Glasby, "Deep Seabed Mining: Past Failures and Future Prospects" 20(2) *Marine Georesources and Geotechnology* 161-176 (2002).

42 Deep Sea Mining Campaign, London Mining Network, Mining Watch Canada, "Why the Rush? Seabed Mining in the Pacific Ocean" (July 2019), *available at:* http://www.deepseaminingoutofourdepth.org/wp-content/uploads/Why-the-Rush (last visited on May 12, 2022).

43 T. Abramowski and V. Stoyanova, "Deep sea Polymetallic Nodules: Renewed Interest as Resources for Environmentally Sustainable Development" (12th International Multidisciplinary Scientific Geo Conference, Conference Proceedings vol. 1, 2012).

because the extraction process will be largely unsustainable. However, UNCLOS and the ISA have decided to award private property rights to entities, and therefore, the efficacy of such an arrangement must be considered.

III Property rights to deep sea minerals and the tragedy of the commons

The rights to minerals under the sea were regarded initially as *res nullius*, which meant that any state could occupy a portion of the seabed and establish sovereignty over it. Part III of this paper discusses the reasons for the failure of such *res nullius* principles of property and why such principles cannot be applied to minerals under the sea.

Principles underlying *res nullius* property

Res nullius property refers to property that is freely accessible to everyone. No laws, rules or regulations govern its use. Thus, while everyone has the right to use the resource, no one has the right to exclude others from doing so.[44] This also means that the resource belongs to no one until someone appropriates it.[45] Therefore, the *res nullius* resource pool is held in common by every user, and every user has the right to access the resource independently. Further, the consumption of the resource is rivalrous to some degree. The consumption of every additional unit of the resource raises the costs of obtaining the same quantity of resources for every other user. Thus, while the benefit of the resource accrues only to the person exploiting it, the cost of exploitation will be borne by everyone because of the collective reduction of the scarce resource available for exploitation.

The most important characteristic of private property is the right to exclude others from the enjoyment of that property. This right incentivises property owners to maintain animal populations at sustainable levels, account for the social and environmental costs of their actions, and ensure that the level of grazing does not exceed the natural carrying capacity of the land. Every property owner incurs the costs and reaps the benefits of his actions alone. Every individual investment yields its full advantage solely to the person who owns that portion of the resource.[46] When a resource is *res nullius*, several entities share a common pool of resources. No resource user is individually accountable for their actions. When the common pool is a scarce resource, the *res nullius* philosophy creates externalities that, after continued use, exacerbate into the tragedy of the commons.

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44 A. Alchian & H. Demsetz, "The Property Right Paradigm" 33(1) *The Journal of Economic History* 16-27 (March, 1973).

45 Susan J. Buck and Elinor Ostrom, *The Global Commons- An Introduction* 5 (1st ed., Island Press, 1998).

46 Carol Rose, "The Comedy of the Commons: Custom, Commerce, and Inherently Public Property" 53 *U. Chi. L. Rev.* 711 (1986).

Res nullius property and the tragedy of the commons

Externalities refer to a cost or benefit that affects a party who did not choose to incur that cost or benefit. There are two externalities connected with the usage of *res nullius* properties: the rise of the tragedy of the commons and the violation of intergenerational equity. The first externality refers to the cost incurred in harvesting an additional unit of the resource and results in what is referred to as the tragedy of the commons. Every rational entity bases its consumption pattern on a cost-benefit analysis of utilising or not utilising an additional resource unit. This process realises that while it will reap the sole benefit from that additional unit, the cost of such utilisation will be borne by everyone. Now, there will be a lesser unit for consumption by everyone. Thus, it will pay only a fraction of the cost.[47]

Further, every entity fails to account for the cost imposed by every other entity in harvesting that resource. Thus, this negative externality is entirely ignored by every rational entity while making a consumption decision. Eventually, as the number of entities seeking to utilise the scarce resource increases, the resource's actual utilisation begins to outstrip the existing supply of that resource. As this computation of how much of the resource to utilise exceeds the actual supply of the resource, the resource finally becomes barren. This situation of barrenness refers to the tragedy of the commons, as the ultimate result of such a pattern of consumption is that every entity is forced to bear the cost of the resource becoming extinct.[48]

This tragedy of the commons is exemplified in excessive hunting. Humans bring more and more marine animals like fish, sharks, whales, and terrestrial animals like lions, tigers, rhinos, and deer closer to extinction.[49] It is seen where overgrazing leads to the barrenness of land when it exceeds the carrying capacity of the land and where hunters brutally club baby seals and skin them alive so that they can achieve the benefits of the first kill and trade.[50] The same principle applies to problems of pollution, where the rational user finds that his share of the costs of releasing unpurified waste into the common pool is lesser than the cost of purification and chooses to do the former, as does every other user of the common pool.[51] Thus, allowing every user of a common resource pool freedom to act however he wants ruins everyone.

Res nullius property and the violation of inter-generational equity

The second externality arising from consuming resources from a common pool is an inter-generational externality concerning the future generation.[52] Intergenerational equity

47 *Ibid.*

48 Garett Hardin, "The Tragedy of the Commons" 162 *Science* 1243 (1968).

49 Scott McVay, *The Last of the Great Whales*, 215(2) *Scientific American* 13 (1966).

50 *Supra* note 37.

51 *Ibid.*

52 Subhashini Muthukrishnan, *Economics of Envirionment* 18 (PHI, Delhi, 2015).

is a principle of international law that represents the utilisation of natural resources in the present generation to save enough for the benefit of future generations.[53] It is one of the key principles constituting sustainable development. It requires water, forests, and minerals to be used so that there would be enough left over for future generations and pursue development in a manner that would sustain global warming and the pollution of the ozone enough for future generations to sustain themselves.[54]

The overutilisation of the resource depletes the stock of goods available for future generation and the profits arising out of that use. For example, where there is a common pool of resources in the form of a fishery, the population of fishes would reduce for the present and future generation because fishers have no guarantee that the smaller fishes they throwback today will be harvested by them when they grow big in the future. This means that the overfishing in the present will lead to fewer fishes that can survive to the next season, automatically reducing the available supply for the future. This often continues in a vicious cycle until the resource is exhausted or the species extinct.[55] It is the first externality that leads to the second, and managing the first would resultantly manage the second.

Thus, there is absolutely no relevant argument for maintaining that new resources like minerals under the deep sea as property should be *res nullius*. Like every other *res nullius* resource so far, they would be plagued by the tragedy of the commons and lead to an impossibility to observe the principle of inter-generational equity.

IV Minerals under the sea and international law: A property law discourse

The authors have established why *res nullius* principles of property would not be sustainable. Part IV of this paper discusses the *res communis* principles under which deep sea minerals operate, and evaluate how the UNCLOS and the ISA have attempted to deal with the externalities that would arise from *res nullius* principles. However, the UNCLOS and the ISA are not always foolproof or perfect.

Res communis principles governing deep sea minerals

While minerals under the sea were originally *res nullius*, this was altered into *res communis* rights after UNCLOS came into force. This meant that minerals would be considered to belong to humanity as a whole rather than to nations that established sovereignty over them.[56] As a result, most of the areas where minerals can be exploited are in areas

53 Alice Venn, "Social Justice in Climate Change" in Trevor M. Letcher (ed.), Managing *Global Warming- An Interface of Technology and Human Issues* 711-728 (Academic Press, 2019).

54 Edith Brown Weisis, *Intergenerational Equity* 19 (Max Planck Encyclopedias of International Law, Oxford Public International Law, last updated Feb. 2013).

55 *Supra* note 38.

56 Yong-Ok Park, "Res Communis versus Res Nullius" 5(1) *Journal of East and West Studies* 77-97 (1976).

beyond national jurisdiction, in the high seas. UNCLOS is commonly referred to as the constitution for the oceans and is believed to be the second most significant achievement of the United Nations. According to the UNCLOS, the seabed and subsoil beyond national jurisdiction are the common heritage of mankind, and minerals here are to be managed by the ISA on behalf of every nation. Now, no country may claim sovereign rights in this area or appropriate any part of its resources, though UNCLOS members may do so subject to international guidelines.

UNCLOS and the ISA require all activities here to be carried out to benefit humankind. They provide that no state must acquire more resources than it is equitable for it to acquire. The community as a whole may be authorised to take steps to ensure equitable sharing, including accounting for the interests of countries that did not have the opportunity to exploit these resources in the past and benefit from them.[57]

Tragedy of the commons: Possible solutions

International law functions primarily to mitigate international externalities.[58] The solution to the first externality is by making it more expensive for every user to continue polluting or utilising the common pool, often by implementing some coercive mechanism that every user of the resource pool agrees on, by penalises the user for his action.[59] However, this coercive mechanism must be voluntarily adopted by everyone. If it is not, individuals who can withdraw from cooperation will do so because it would be rational for them to reap collective benefits without bearing any costs. However, this would impose disproportionately high costs on the other common people, and such users would not be willing to bear them.[60]

The principles of the tragedy of the commons are known to everyone, and there is no reason to believe that every new resource discovered will not have the same results unless there is a regulatory mechanism that results in beneficial cooperation. The UNCLOS and ISA function as such a regulatory mechanism, where the cost of collaboration is not too high, and the ultimate result is the welfare of all nations.[61] The UNCLOS and ISA have created a system where the allocation of rights to minerals is restricted and based. This system has been designed to prevent the overutilisation of these resources. Further, the UNCLOS and ISA maintain that the rights to minerals

57 Commission to Study the Organisation of Peace, "Twenty-third Report on The United Nations and the Oceans: Current Issues in the Law of the Sea" (CSOP, 1973).

58 Sykes, Alan, "The Economics of Public International Law" (July 2004) *available at*: http://dx.doi.org/ 10.2139/ssrn.564383 (last visited on May 16, 2022).

59 *Ibid.*

60 *Supra* note 35.

61 Alan Sykes and Eric Posner, "Economic Foundations of the Law of the Sea" 104 (4) *American journal of International Law* 569-596 (October, 2010).

62 As suggested by G. Hardin, *supra* note 35.

under the sea are public property.[62] Therefore, there is no free entry into the common pool of deep sea minerals; access would be granted only by the ISA after being satisfied with certain conditions. In addition, the entity will account for the social costs it inflicts upon the common pool.

Further, it has tried to address pollution by requiring entities conducting exploration and mining activities to act as per the precautionary principle, polluter pays principle and the direction of sustainable development. As per the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area, every entity must prevent, control, and reduce pollution and adverse impacts to the marine environment.[63] To this extent, every entity must apply a precautionary approach by assessing the risk to the marine environment before taking action as per best environmental practices and in case of uncertainty as to the effect, acting to retain the marine environment rather than causing it irreversible harm.[64] Further, this must be as per the best environmental and industry practices of that time.[65]

Enforcement of inter-generational equity

The ISA has dealt with the second externality of intergenerational equity. The ISA is the controlling authority that would grant entities access to mineral sites and may turn down applications where a state has sponsored mining activities that the ISA considers excessive.[66] It has made arrangements for equitable distribution of resources by calling for areas reserved for exploitation by developing countries when they have the necessary infrastructure to do so. Every entity from a developed nation applying for an exploration contract must survey area enough for two mining operations of equal economic value. It must submit an application to the ISA Legal and Technical Commission with data to back its claim of equality of commercial value of both areas. Then, the Commission will decide which to allot to the entity and which to retain as a reserved area.[67]

The approach of the UNCLOS and ISA: A critical appraisal

The ISA retains the final judgement to refuse or give an exploration project the go-ahead for the actual exploitation of mineral resources. A glaring problem with this approach is that no entity wants its efforts into the exploration process to go to waste.

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63 Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area (International Seabed Authority, 2000), Reg. 5(1)(a).

64 *Id.*, Reg. 33(2).

65 *Id.*, Reg. 33(2), Reg. 46.

66 Satya Nandan, "Legislative and Executive Powers of the International Seabed Authority for the Implementation of the Law of the Sea Convention" in Davor Vidas and Willy Ostreng (eds.), *Order for the Oceans at the Turn of the Century* 73-80 (Kluwer Law International, 1999).

67 International Seabed Authority (ISA), "Current Status of the Reserved Areas with the International Seabed Authority" (2019), *available at*: https://www.isa.org.jm/files/files/documents/ statusofreservedareas-01-2019-a.pdf (last visited on May 14, 2022).

A large amount of capital needs to be dedicated to developing capital-intensive technology, monitoring its effects, and maintaining the best experts in the world to document and analyse the impact of exploration on the deep sea ecology. There is no reason for sponsoring states or entities to invest in technology development if the ISA can ultimately hold that their actions would pollute the marine environment and forbid them from beginning operations.[68] Thus, though the principles formulated to adhere to the precautionary principle and sustainable development may be well-intentioned, entities mainly concerned with economic returns would have little reason to put in the efforts if they were not guaranteed a return on investment. This makes the efficacy of environmental-friendly principles doubtful, and the UNCLOS and ISA could end up not enforcing these principles strictly.

There are concerns about the processes as per which the ISA will resolve conflicts of interests and the lack of transparency and scrutiny. Environmental agencies believe that the regulations regarding deep sea mining are being formulated with haste, with very little consideration has been accorded to the precautionary principle. Furthermore, monitoring plans are not publicly available, raising further suspicions as to their efficacy and transparency. Further, in the absence of compulsory regulatory mechanisms, states could opt out of the regulations and operate in a manner that would cause significant and irreversible damage to marine ecology.

V Conclusion

The present system of regulations to exploit minerals under the sea is a faulty one. While assigning minerals *res communis* rather than *res nullius* rights was an intelligent move, and international law ignored the fundamental question of the necessity to exploit these minerals in the first place. The cost of deep sea mining on the marine environment is likely to be very high, causing irreversible damage on a large scale to a pristine, sensitive, undocumented ecology. The benefits of deep sea mining must be high enough to offset this cost. Unfortunately, there seems to be no immediate need for or sizeable benefit from deep sea mining. Terrestrial deposits of minerals, better technological designs, and recycling existing minerals would create all the required renewable energy sources needed to power the world.

Furthermore, there is no assured economic return of mining efforts since the investment required before extraction is significant. The projects that were carried out failed and left the nations in colossal debt. Thus, it is suggested that the exploration and extraction of deep sea minerals should not be permitted in the first instances. However, the present system does try to account for the externalities arising in the tragedy of the commons. It addresses overutilisation and intergenerational equity by creating a barrier to entry into the resource pool. Second, it tries to pursue sustainable development by

68 *Supra* note 53.

requiring sites to be kept in reserve for developing countries when they acquire the technology. Third, it addresses pollution by requiring states and mining entities to observe the precautionary principle. Ultimately, while there are concerns about the transparency and efficacy of such measures, especially considering that denying projects the go forward will cause the same shirking problem as *res nullius* resources, the present system is better than having no regulations at all.

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