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Environmentally balanced approaches to future deep seabed mining

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ENVIRONMENTALLY BALANCED APPROACHES TO FUTURE DEEP SEABED MINING

By

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views and are not necessarily endorsed by the University.

(Signature):.....

(Date): 20-09-2022

Supervised by:

Prof. Dr Hening Jensen, LL.M.

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Abstract

Title of dissertation: **Environmentally balanced approaches to future deep seabed mining.**

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The discovery of seabed resources dates back to 1873, when the *Challenger* discovered manganese nodules 3,500 meters deep near the Clarion-Clipperton fracture zone. The activities in the Area have been regulated since 1994 with the Agreement relative to UNCLOS Part XI. The most relevant principle governing Area is that its resources are a Common Heritage of Mankind. Due to the nature of their constituents, deep-sea minerals represent high value and interest to the industries. However, the exploitation of mineral resources in the area means the loss of ecosystems and the unrecoverable source of resources because their regeneration takes millions of years.

This dissertation analyses the international framework on deep-sea mining (DSM) through a review of the historical background of the United Nations Convention on the Law of the Sea (UNCLOS), the formation of the International Seabed Authority (ISA) and the evolution of the exercise of its functions.

The main objective of the research is to provide a comprehensive overview of deep-sea governance. The study made an overview of deep-sea mining, contrasting the process led by ISA to emit a Mining Code to start exploiting resources in the Area with scientific information available on the consequences of mining the seabed. Also, it examines the content of the Mining Code draft and official documents given by ISA.

The research will explain the proposal for a moratorium on deep sea mining based on official historical information available and the technical documents issued by experts and stakeholders. Consequently, the dissertation attempts to reach a possible balanced approach to the governance of deep seabed exploitation.

KEYWORDS: Deepsea Mining, ISA, Mining Code, Moratorium on Deepsea Mining

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List of Abbreviations

1994 Agreement - Agreement relating to the implementation of Part XI of UNCLOS

Area (the) - the seabed and ocean floor and subsoil thereof beyond the limits of national jurisdiction

APEI - Area of particular environmental interest

CCZ - Clarion-Clipperton Zone

CFC - Cobalt-rich ferromanganese crusts

DSM - Deep Sea Mining

EEZ - Economic Exclusive Zone

EIA - Environmental Impact Assessment

EMMP - Environmental Management and Monitoring Plan

ISA - International Seabed Authority

IWG - Informal Working Groups

LTC - Legal and Technical Committee

PMN - Polymetallic manganese nodules

REMPs - Regional environmental management plans

SDG - Sustainable Development Goal

PMS - Polymetallic massive sulphides

PW - Plan of Work

UN - United Nations

UNCLOS - United Nations Convention on the Law of the Sea

CHAPTER 1: INTRODUCTION

1.1. Problem Statement

The minerals and metals required for the technology industry are increasing nowadays and will be more valuable in the coming years due to the insufficiency of land resources. The resources found in the Area are fields of manganese (polymetallic) nodules (PMN) on the abyssal plains, polymetallic massive sulphides (PMS) around hydrothermal vents, and cobalt-rich ferromanganese crusts (CFC) on the flanks of seamounts (Miller et al., 2018). All resources discovered in the seabed help produce mobile phones, PCs, laptops and batteries, electricity production, jewellery, pharmaceutical products, construction industry, super alloys production and vehicle pieces. Also, gas hydrates not in seabed mineral deposits but containing methane, ethane, propane or butane are desired and exploitable resources (Buffet and Archer, 2004).

After fifteen years of explorations permitted by ISA in the Clarion-Clipperton Zone, the Indian Ocean, Mid Atlantic Ridge, South Atlantic Ocean and the Pacific Ocean, the group of resources researched are mainly three. First, the PMN contain manganese (Mn), nickel (Ni), copper (Cu), cobalt (Co), molybdenum (Mo) and rare earth metals (Hein et al., 2013). Many countries and institutions sponsored by member states have invested enormous capital in exploring the Area for PMN. These countries await the opportunity to initiate exploitation activities and recover their investment. However, the regulation for the exploitation of deep seabed minerals is not officially in force. ISA and member states are still developing it and have published a regulation draft.

According to Vanreusel et al. (2016), the exploitation will undoubtedly conduct to the loss of significant biodiversity that may never recuperate. The irreversible impact is because the nodules just grow a few mm per million years; during this time, manganese from the sea adsorbs to a nodule substance, then bacteria oxidised it becoming a nodule matrix of 4 to 10 cm in diameter with a potato shape.

Second, the seafloor PMS located in hydrothermal vents have high sulphide ($S2^{-}$) content and are lofty in copper (Cu), gold (Au), zinc (Zn), lead (Pb), barium (Ba) and silver (Ag) (NCBI,2022). Boschen et al. (2013) indicates deposits with enough mineral

tonnage and quality to attract the mining industry. Still, these PMS deposits are near benthic communities and may hold specially adapted and endemic fauna that will be impacted severely in case of exploitation. Third, CFC at seamounts that its components are manganese (Mn), iron, cobalt (Co), copper (Cu), nickel (Ni) and platinum (Pt). It is the most complex resource to extract because crusts are fastened to the rocks, but cobalt is of high value due to its use in superalloys for aircraft motors and the batteries industry (Hein et al., 2013).

Generally speaking, the deep sea is full of resources, and minerals are crucial for the development and prosperity of human society. Discovering and developing deposits links elevated risk, long time, and requires economic investment (Haldar, 2018). On the other hand, the same kind of resource distribution on the continental ground has become a relevant source of money for some countries. The few countries fortunate to have minerals can develop their industry or exercise a monopoly on sales (Hein, 2013); mighty governments or huge companies assign budgets to exploration programs to find sustainable resource sources. Humanity is reaching a point where the resources not found on the continent will be extracted from other places, such as the seabed, despite the catastrophic consequences for ecosystems and the seafloor, which are not yet determined precisely by science. Still, collecting PMN, PMS or CFC from physically huge fields in a deep sea requires machinery that probably will destroy the sea soil. It is not only a matter of harvesting the minerals but also transportation from the deep to the surface industrially.

In light of this controversial scenario, it is necessary to ascertain the current regulations that govern the activities in the Area and the status of the Mining Code and identify potential balanced approaches to deep seabed exploitation governance.

1.2. Research aims and objectives

This research aims to study the governance of deep-sea mining and its potential environmental impacts. The research progresses according to the following three objectives to accomplish the investigation aim:

- Analyse the antecedents and current status of the regulations related to the exploitation of deep seabed minerals.

- Explore the status of the drafting of the Mining Code at ISA.
- Identify potential balanced approaches to deep seabed exploitation governance.

1.3. Research questions

- What are the current regulations that govern the activities in the Area?
- What is the current status of the regulation for exploiting the mineral resources in the Area?
- What is the potential balanced approach to deep seabed exploitation governance?

1.4. Methodology

The dissertation entails literature reviews of qualitative data using methods such as analysis of the international framework on deep sea mining, the resolutions and reports from the International Seabed Authority (ISA), and especially the Law of the Sea and Mining Code draft. Also, Peer-Reviewed journals and public documents related to DSM, its impacts and the proposal for a moratorium on Deep-Sea Mining. In addition, the dissertation critically analyses the documents containing relevant information on ISA's role. Primarily information will be sourced from official sites, books, journals and related papers.

CHAPTER 2: INTERNATIONAL FRAMEWORK ON DEEP SEA MINING

2.1. Introduction

The running for resources has always been part of the world's development and could be a problematic pressing issue confronting humanity in the future. For many decades, the discovered resources kept the economic development of the world and the population growing. However, constant consumption has generated shortages, and the law of supply and demand affects costs, thus empowering developed countries with resources and the capacity to build manufactured products and buy resources from developing countries.

During the last century, a worldwide regulation for the oceans has been discussed. After many negotiations subject to economic pressures and interests, the United Nations Convention on the Law of the Sea was signed in 1982. Later, in 1994, it was agreed to include Part XI of UNCLOS to regulate the Area and create the ISA. Nowadays, the start of activities for the exploitation of the Area is being discussed.

Therefore, this chapter outlines the main drivers of the international framework on DSM, starting with UNCLOS, followed by an overview of the ISA, focusing on its role and its Strategic Plan 2019 - 2023. In addition, the document will explain the two-year deadline established in Part XI of UNCLOS. Finally, the chapter's conclusions will be delivered as a preliminary contribution to the research conclusions.

2.2. Law of the Sea

2.2.1. Antecedents

UNCLOS dates back to 1956, when the first law of the sea conference was held. The United Nations International Law Commission (ILC), conformed of fifteen members, delivered its final report based on discussions such as high seas and territorial seas regime, the law of treaties, diplomatic intercourse and immunities, consular intercourse and immunities, state responsibility and arbitral procedure (United Nations, 1956).

Following the recommendation of the first conference, the UN General Assembly resolved not to deal with the problems associated with the high seas, territorial waters, contiguous zones, continental shelf and superjacent waters until the ILC studies them and reports on their legal relationship (United Nations, 1957). On 29 April 1958, after a lengthy legal, technical, biological, economic and political evaluation process and product of the first conferences, the UN Conference on the Law of the Sea released to the signature the Convention on the Territorial Sea and the Contiguous Zone (CTS); the Convention on the High Seas (CHS); the Convention on Fishing and Conservation of the Living Resources of the High Seas (CFCLR); the Convention on the Continental Shelf (CCS); and the Optional Protocol of Signature about the Compulsory Settlement of Disputes (OPSD). These instruments entered into force between 1962 and 1966 (Treves, 2008). Therefore, the international aspiration to reach an agreement on proper management of the sea started six decades ago; however, remain topics to discuss, such as biodiversity beyond national jurisdiction and sea floor exploitation.

According to Treves (2008), the adoption of four conventions and a protocol instead of one all-encompassing instrument originated as a device to attract the acceptance of many States to at least some of the Conventions, avoiding radical reservations or domestic opposition to one or more of its main parts. Especially CFCLR for coastal states that have fisheries as an economic pillar. In 1960, the Second United Nations Conference on the Law of the Sea discussed territorial sea extension and fishery limits, which were not in the four Conventions. However, it recognised that international law implementation could impact fisheries in some coastal states. It generates practice modifications and requirements for many States. Also, economic growth and the coastal States' living standards require international aid to improve fishing industries, which in many cases are stopped by a lack of modern tools, technical knowledge, and funds (United Nations, 1960).

In 1967 started, a new discussion process to examine the questions of the reservation only for peaceful aims of the sea-bed and the ocean floor, and the subsoil thereof, underlying the high seas beyond national jurisdiction, and the benefit of their resources for humankind. To that aim, an Ad Hoc Committee was formed (United Nations, 1967). Having evaluated the report of the Ad Hoc Committee in 1968, the General Assembly decided to launch a forty-two Member States Committee on the Peaceful Uses of the

Sea-Bed and the Ocean Floor beyond the Limits of National Jurisdiction (United Nations, 1968).

Later in 1970, the General Assembly determined to call the Third Conference on the Law of the Sea in 1973 and informed the Committee on the Peaceful Uses of the Sea-Bed and the Ocean Floor beyond the Limits of National Jurisdiction to work as a preparatory body for the meeting (United Nations, 1970). One hundred sixty states participated in the Third Conference, which was held in eleven sessions between 1973 and 1982. In the first session, the Conference designate a General Committee and the following three principal committees, a Drafting Committee and a Credentials Committee. The first one coordinated the global sea-bed and ocean floor beyond national jurisdiction governance. The second one was in charge of the territorial sea, the contiguous zone, the continental shelf, the exclusive economic zone, the high seas, land-locked countries, shelf-locked States and States with narrow coasts and the transmission from the high seas. At last, the third one discussed the subject of marine environment conservation.

Finally, on 10 December 1982, the Conference adopted the UNCLOS, composing 320 articles and nine annexes. The states signed were driven by the wish to settle in a spirit of shared understanding, cooperation, and awareness of the historical importance of the Law of the Sea (United Nations, 1982).

2.2.2. Jurisdictional Zones of the Law of the Sea

According to Tanaka (2019), in law matters, the ocean is a single unit and is practically illustrated by the continuity of the marine spaces. For example, straddling marine species ignore national boundaries established by international conventions. UNCLOS divides the ocean between five categories, internal waters, territorial sea, archipelagic waters, the exclusive economic zone and the high seas. The UNCLOS defines three components, seafloor and subsoil, water column, and the atmosphere over the oceans. Additionally, UNCLOS delivers the contiguous zone, international straits, the continental shelf and the area (Tanaka, 2019). The most relevant marine zones for this study are developed below, but the Area´s discussion will be in a particular section.

- Internal Waters

  The United Nations Convention on the Law of the Sea (1982, art. 8) established that Internal Waters contain littoral areas and landward marine spaces of the baseline of the State.

- Territorial Sea

  Every Coastal State keeps rights over its territorial sea, which prolongs 12 nautical miles from the baseline. In this zone, the Coastal States have absolute jurisdiction over all activities, including foreign (*The United Nations Convention on the Law of the Sea*, 1982, art. 3).

- Contiguous Zone

  According to the United Nations Convention on the Law of the Sea (1982, art. 33), the Contiguous Zone is adjacent to the Territorial Sea and has 24 nautical miles from baselines. In this manner, it extends Coastal State enforcement jurisdiction to prevent or penalise customs, fiscal, immigration or sanitary legislation violations.

- Exclusive Economic Zone (EEZ)

  The EEZ is placed from the territorial sea limits to 200 nautical miles when high seas start. In EEZ, the coastal state has exclusive sovereignty over exploration, exploitation, conservation and management of all natural resources. This provision can prevent a violation by third parties of its economic assets in EEZ, such as fishing, bio-prospecting and wind-farming. Here the high seas freedoms regarding general navigation principles stay in place (*The United Nations Convention on the Law of the Sea*, 1982, art. 56).

- High Seas

  The High Seas begins 200 nautical miles from the coast and are open to all States, including landlocked; it is a freely available space, ruled under the equal rights principle. All state parties accepted that high seas should be for peaceful purposes (*The United Nations Convention on the Law of the Sea*, 1982, art. 87). UNCLOS sets freedom of navigation, overflight, laying submarine cables and

pipelines, artificial islands and installations construction, fishing and marine scientific research.

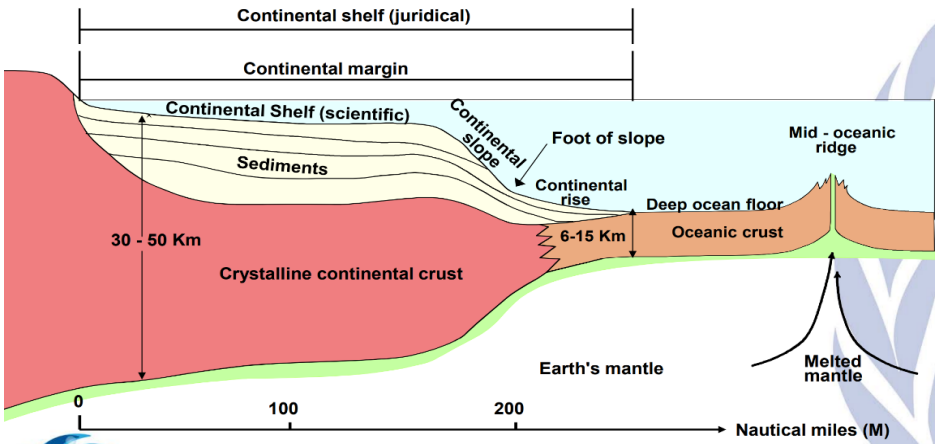
- Continental Shelf

The UNCLOS establish that the Continental Shelf includes the seabed and subsoil that extend beyond Coastal State territorial sea across land territory natural prolongation to the outer edge of the continental margin, or until 200 nautical miles from the baselines. (*The United Nations Convention on the Law of the Sea*, 1982, art. 76).

Figure 1 shows that the continental margin involves three components: the continental shelf, the continental slope, and the continental rise. It is appropriate to illustrate the continental margin because it is home to most of the world's fisheries and represents high economic importance. The continental margin is the only part of the ocean where mineral resource exploitation occurs; for instance, dredges mine millions of tons of sand every year outside the United States coasts for shore renourishment. Oil and natural gas are the most significant resources exploited in continental margins currently. Also, there are antecedents of exploitation, such as tin from Indonesia, gold from Alaska, and diamonds from Namibia (Doyle, 2017).

Figure 1

Continental shelf - scientific and legal concepts



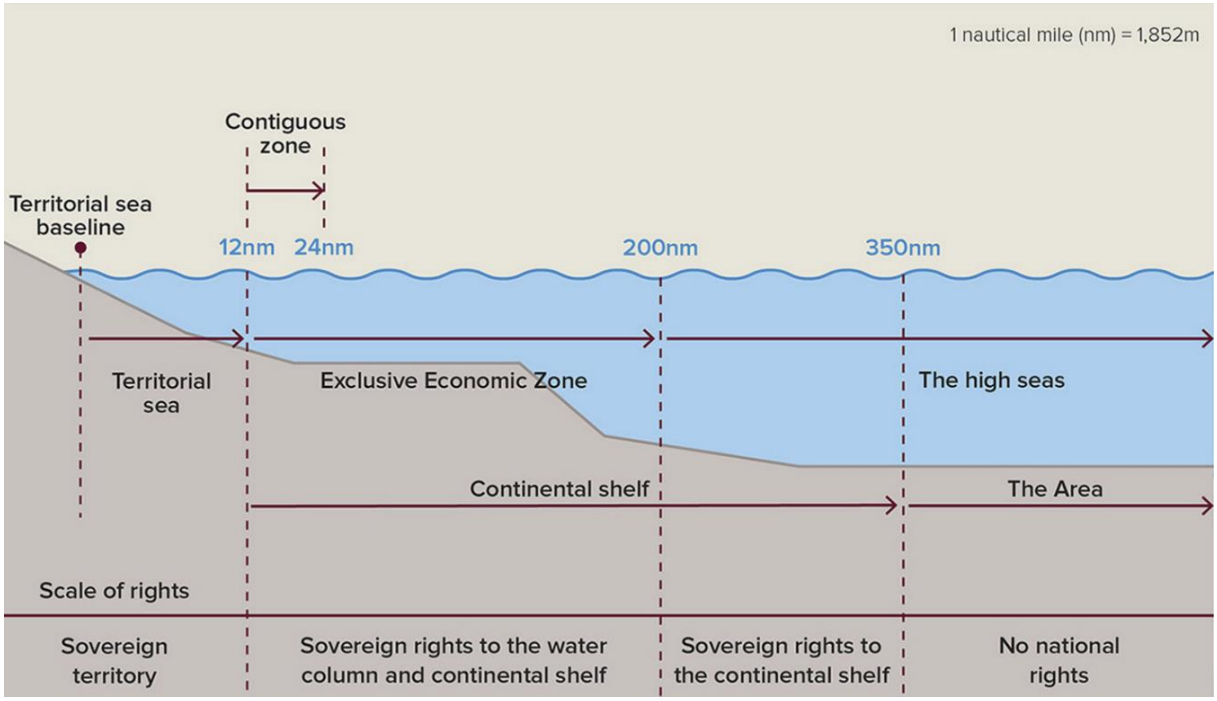
Note. The shape illustrates a cross-section of the seabed's topography components, which extends from the coastline to the deep ocean floor. Source: Salpin, (2015).

2.2.3 The regulatory framework of human ocean activities

The regulatory framework of human ocean activities has two precise areas depending on the distance from the coast as established by the Law of the Sea. First, where coastal states own exclusive rights and jurisdiction over resources, it is composed of territorial waters and Economic Exclusive Zone (EEZ); some coastal states extended their continental shelf beyond EEZ. The extended continental shelf gives ownership only over seabed and mineral resources but not in the water column. Second, the area beyond national jurisdiction (ABNJ) includes the seabed "Area" and the water column; UNCLOS provide the legal framework for the "Area" (Figure 2). However, the Area's governance is ISA's responsibility.

Figure 2

Jurisdictional zones from a coastal state shore



Note. The figure shows UNCLOS´s jurisdictional zones; it can be seen as the territorial sea, exclusive economic zone and extended continental shelf under sovereign states (scale of rights). Source Miller et al. (2018).

Finally, Basir & Abd (2020) calculated that more than half of the maritime boundaries between States are undelimitated limits; also, more than 2.7 million square kilometres of potential extended continental shelf areas hold overlaying claims. Coastal States have the right to explore and exploit resources inside their continental shelf; nevertheless, some claims between countries about overlapping or lack of delimited boundaries bring bilateral issues.

2.2.4. The Area

The Area includes the seabed and ocean floors and their subsoil, outside the limits of national jurisdiction (*The United Nations Convention on the Law of the Sea*, 1982, art. 1). After the Coastal States established their limits and coverage of continental shelves, it represented 50% of the seafloor (Christiansen et al., 2019).

The seabed is rich in minerals such as polymetallic nodules that are precipitated iron oxyhydroxides and manganese oxides, on which metals such as nickel, cobalt, copper, titanium and rare earth elements are absorbed. The huge tonnage of nodules on the seabed and the immense amounts of critical metals point to polymetallic nodules as the future target of deep-sea mining (Hein et al., 2020). Indeed, Gasis & Greinert (2021), in their research, explained that polymetallic nodules are obtaining great interest because of the large number of metals it contains, such as Mn, Fe, Ni, Co, and Li. These minerals are beneficial for building electric cars and wind turbines to contribute to sustainable technologies. In addition, the pressure on the pharmaceutical industry to find cures, especially in recent worldwide pandemics, increased seabed exploration (de Almeida, 2020).

For that reason, sustainable exploitation of deep seabed minerals is a critical factor in ocean sustainability. In this context, deep-sea mining has arisen as a controversial topic that faces the proponents of DSM against the DSM opponents. After 60 years of discussions that determined the principle of the common heritage of humanity based on aspects such as protection, innovation, peace and justice, the fundaments of that discussions, according to Schmidt & Rivera (2020), are nearly covert behind the ISA process, named by Smith and Rivera as a technocratic facade.

2.3. Overview of the International Seabed Authority

2.3.1 Antecedents

The UNCLOS launched three institutions: the International Tribunal for the Law of the Sea (ITLOS), the ISA and the Commission on the Limits of the Continental Shelf (CLCS). Although they have different functions, the three are not exclusive because they all collaborate in implementing and interpreting the Law of the Sea. Today the role of ISA is crucial for the future of the ocean; the ocean is the source of life and a key player in climate and ecosystems.

The antecedents of ISA acknowledged that DSM was commercially possible. However, exploitation started seriously discussed in the 1960s, when it was realised that if unrestricted seabed exploitation were to proceed, the benefit would go to States with economic and technical advantages. On the other hand, mineral exporters states, mainly developing countries, will face disadvantages (Churchill & Lowe, 1999). Therefore, in the sixties, the exploitation discussion was an economic dispute between well-prepared States and developing countries that receive income from mineral exportation.

According to Churchill and Lowe (1999), international law would benefit only a few developed mining states before UNCLOS; there were three interpretations of international law related to the seabed. The first interpretation, based on the concept of the maritime limit, is the exploitability criterion for the outer limit of the continental shelf moved into deeper waters; thus, at some point, the entire ocean floor will be split among coastal states. This interpretation favours Coastal States but more those with overseas territories such as islands that increase their seabed. In this sense, the Mediterranean States have an unfair situation without commercial access to the seabed. Naturally, the coastal states have a strategic advantage reflected in their economy. For instance, maritime trade in the Mediterranean States has extra costs because the cargo must be transported by sea and land, be it trucks or trains.

In the second interpretation, continental shelf limits must be restricted to areas conforming roughly to the geological shelf. Thus, in the lack of any particular rule modifying the principles set out in the 1958 Geneva Conventions, the abyssal plains of the ocean beds would be subject to the high seas' freedoms. This interpretation set for

deep seabed is the "*res communis"* (a common thing) status, which means any state could use the area's resources, but no one can have exclusive title to it (Churchill & Lowe, 1999). This second version also favours developed countries with economic and technological capacities. The third and last interpretation was "*res nullius"* (a thing of no state) status*;* here, rights to particular areas of the seabed would be gained by their occupation, and then the first mining states to occupy the seabed would have become owners of parcels of the ocean floor (Churchill & Lowe, 1999).

A transcendental decision on the background of the UNCLOS provisions was the UN resolution of 1969 called "Moratorium Resolution", reached with the support of sixty-two states that voted in favour against twenty-eight, with twenty-eight abstentions. This General Assembly Resolution mentions the principles of collaboration in deep sea exploration and ocean floor beyond national jurisdiction; it also pretends to guarantee exploitation on behalf of humankind's benefit, thoughtless of geographic states distribution (United Nations, 1969). Therefore, United Nations (1969) declares that the States and persons are obliged to abstain from exploiting the resources in the area; claims to any portion of that area or its resources shall not be recognised. The standard issuance was the end for different interpretations of the law of the sea given by countries or private companies.

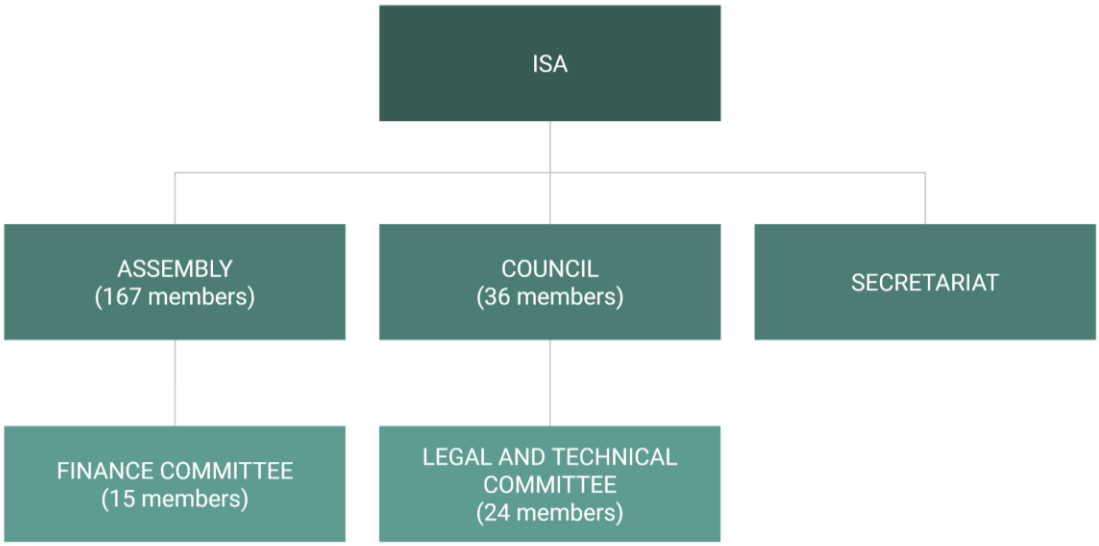
Later the United Nations, in the general assembly of 1970, resolved what looks like the first draft of part XI of UNCLOS; this document was called Declaration of Principles Governing the Sea-Bed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction. This document is a solemn declaration confirming that the Area involves the sea-bed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction. Its resources are a Common Heritage of Humankind. The declaration guarantees that none can proclaim sovereignty in the Area and will be governed by international law and open only for peaceful purposes. They also assert that measures should be taken for environmental protection and resource conservation (United Nations, 1970b). Finally, United Nations promulgated UNCLOS. Afterwards, in 1994, UNCLOS included Part XI, after discussions of governmental and private interests, which was implemented to create ISA.

2.3.2. Main features

The ISA is seated in Jamaica, and its central role is to organise and control the activities in the Area based on the principle of sovereign equality of its members, that are all the UNCLOS member states (*The United Nations Convention on the Law of the Sea*, 1982, art. 157). ISA structure is described in figure 3, which shows its principal organs, Assembly, Council and Secretariat. The two head organs which establish the ISA's policies and govern its job are the Assembly and the Council elected by the Assembly, which serves as the ISA's executive organ. The Secretariat is the third main organ and conducts the ISA's administration (Dingwall, 2021). Also, the Enterprise is established to be the body of the Authority that will carry out activities in the Area as well as transport activities, treatment and commerce of minerals extracted from the Area (*The United Nations Convention on the Law of the Sea*, 1982, art. 158).

Figure 3

Structure of the International Seabed Authority



Note. The ISA is an international organisation composed of three main organs, the Assembly, the Council and the Secretariat (Lallier & Maes, 2016).

- The Assembly

  The Assembly is considered the supreme organ of the Authority to which the other organs shall be accountable (*The United Nations Convention on the Law*

of the Sea, 1982, art. 160). The entire Authority members make the Assembly, and each member has one vote by right; they meet annually in regular sessions. When the Assembly requires it, they can meet in special sessions (*The United Nations Convention on the Law of the Sea*, 1982, art. 159). The Assembly has the authority to set general policies regarding UNCLOS provisions in the competence of the ISA.

- The Council

  The Council has 36 members elected by the Assembly based on provisions such as total world consumption, member states with significant investments to conduct activities in the Area, major members net exporters of minerals to be derived from the Area, members with particular interest and members elected under the principle of equitable geographical distribution (*The United Nations Convention on the Law of the Sea*, 1982, art. 161). Each council member has one vote, and the majority takes the decisions. As the executive body, the Council has significant powers relating to the scope of this research because the ISA´s Council should elaborate regulations to conduct a procedure when commercial exploitation is required or when a State sponsored by the Member States requests approval of plans of work. According to the United Nations Convention on the Law of the Sea (1982, Annex III, art. 3), relative to the prospecting, exploration and exploitation conditions, the plans of work should specify the areas to explore or exploit and comply with UNCLOS provisions and ISA regulations.

  The Council have two organs to receive recommendations relative to its functions, Economic Planning Commission and the Legal and Technical Commission. Members of both commissions should be nominated by state parties only; they should have appropriate qualifications relative to oceanology, marine environment protection, and economic and legal matters concerning DSM (*The United Nations Convention on the Law of the Sea,* 1982, art. 165).

- The Secretariat

  The Secretariat involves the Secretary-General and staff. The Secretary-General is the ISA´s chief administrative officer that shall perform during Assembly

meetings; the Assembly elects Secretary-General for four years between the Council candidates' proposals (*The United Nations Convention on the Law of the Sea*, 1982, art. 166). These organs have an international character; therefore, Secretary-General is autonomous and does not receive instructions from externals such as governments or privates (*The United Nations Convention on the Law of the Sea*, 1982, art. 168).

- The Enterprise

  According to Dingwall (2021), the Enterprise is the mining arm of the Authority but is not yet operational. The enterprise takes care of the activities in the Area directly. The Enterprise have the legal capacity to act within the framework of the international legal personality of the ISA (*The United Nations Convention on the Law of the Sea*, 1982, art. 170). According to Tanaka 2019, Part XI bring an innovative sense by providing a parallel system to support developing countries through the role of the Enterprise. The parallel system is because every applicant should present a Plan of Work (PW) that will contain two similar commercial value sites. When ISA approves PW, the ISA will reserve one place for the Enterprise on behalf of the Authority to transfer to a developing state (Sohn et al. 2010).

2.3.3. International Seabed Authority - Strategic Plan 2019 - 2023

ISA developed and issued a strategic plan for 2019 - 2023, which is a long-term plan determining the strategic direction and purposes of the Authority (ISA, 2018). The strategic plan has guided the ISA's work to face contemporary challenges and is based on ten guiding principles, as shown in figure 4.

Figure 4

ISA´s Strategic plan 2019 - 2023 guiding principles

Note. Source ISA (2018).

According to Lodge (2019), the plan was developed in coordination with members and observers aspiring to contribute significantly to accomplishing the United Nations Sustainable Development Goals (SDG). In the same way, the plan fundaments are protecting the marine environment, using the best available techniques, and applying good practices. However, science confirmed that life is connected with seabed resources such as manganese nodules or black smoker vents. Then the controversy arises about whether delaying the decision is enough or whether a moratorium until the ISA determines what degree of serious harm we accept.

The Strategic Plan recognises the UNCLOS and the 1994 Agreement as an intricate and unitary scheme of rights, commitments and responsibilities associated with the Area's activities (ISA, 2018). The system engages States Parties, Sponsoring States, Flag

States, Coastal States, local firms, private investors, ocean environment users and interested intergovernmental and non-governmental organisations. Undeniable research and new technologies implementation increase the number of developed countries and private interests in starting DSM. Despite the Law of the Sea indicating the functions of the ISA, it seems that when many interests converge mainly on economic aspirations, decision-making is postponed.

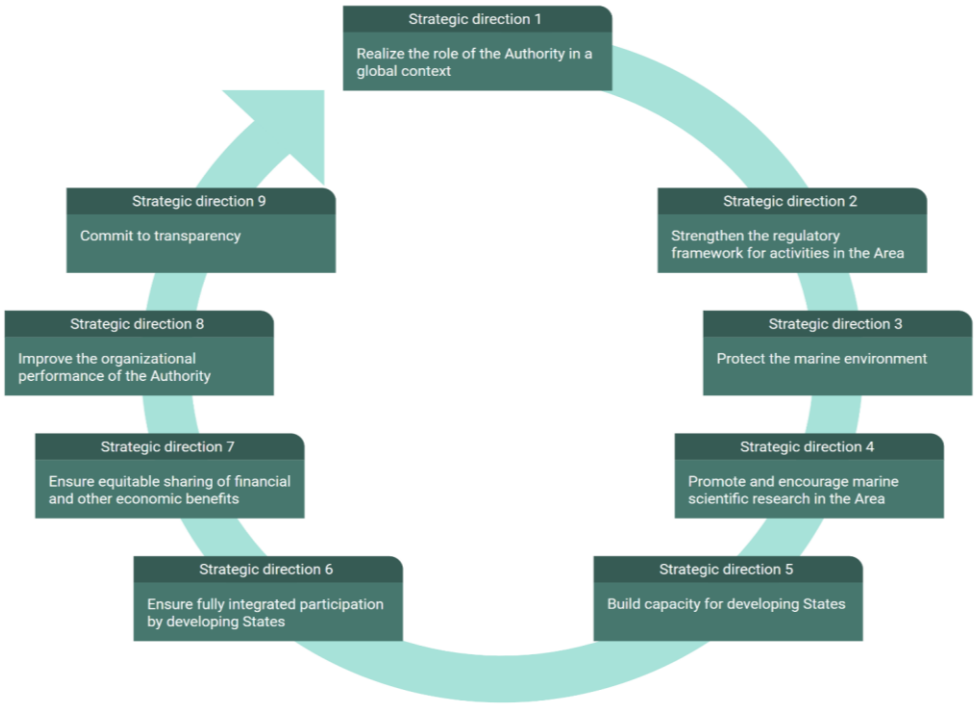
The Strategic Plan identifies the challenges among several well-known in any industrial sector, such as environmental protection, capacity building, technology transfer, transparency and developing countries' participation in the activities of the area (ISA, 2018). Nevertheless, the plan sets other very relevant challenges for decision-making. In the first place, the need for regulation of exploitation, the project refers to the legal framework of ISA's role to support its ability to regulate but mentions that this work must be analysed carefully because of the commercial interest and the development of deep-water technology (ISA, 2018). Therefore, market uncertainty and volatility are factors that drive investment and such factors are beyond ISA's competence. In the second place, the equitable sharing of benefits sounds very challenging; According to ISA (2018), the Authority should deliver a fair benefits distribution procedure from activities in the Area. This mandate follows the United Nations Convention on the Law of the Sea (1982, art. 140), which established that benefits from the Area are irrespective of States geographical location and remarks on the needs of developing countries. In addition, the equitable benefits sharing depends on the ISA´s Economic Planning Commission, which should review the tendencies and aspects influencing supply, demand and prices of minerals which could be derived from the Area, considering importing and exporting interest countries. (*United Nations Convention on the Law of the Sea*, 1982, art. 164). This challenge looks complex to overcome because neither the UNCLOS nor the Strategic Plan specifies the distribution model. In addition, exploration is costly; countries or private companies that have invested much money for decades will probably not agree to share profits in a way that they do not see profitable.

The ISA´s strategic plan settled to face identified challenges in nine strategic directions, as shown in figure 5. The first two strategic directions are the most relevant because both have a deep connection to the current worldwide scenario. The first strategic direction aims to realise the role of the ISA in an international context by aligning its

functions with SDGs, establishing strategic alliances and cooperations with pertinent global and regional organisations to improve conservation and sustainable use of ocean resources, agreeing with UNCLOS and international law (ISA, 2018). The second strategic direction is “Strengthen the regulatory framework for activities in the Area”. Accordingly, the Authority shall adopt the rules and procedures encircling every seafloor exploration and exploitation phase. According to ISA (2018), this procedure should ensure exploitation uses the best environment possible practices supported by sound business principles to stimulate investment on a level playing field. Also, the legal framework should be sensitive and capable of adapting to technological improvements. ISA should study the potential impacts given by DSM. It must carry out studies of the possible economic effects of the extraction and production of minerals in the Zone in developing countries, including the producers of those minerals that would be affected, to minimise their difficulties and help them in their economies (ISA, 2018).

Figure 5

ISA´s strategic directions 2019 - 2023



Note. The figure shows the nine strategic directives of the ISA, and the author developed the figure based on ISA (2018).

The most outstanding at this point is that the first criterion aspires to familiarise the role of ISA with the SDGs through public and private international organisations; however, the second criterion is to develop the regulations to exploit the seabed. The second strategic direction mentions the statement "best practice for environmental management", which is ambiguous and does not guarantee its environmental impact is acceptable. The strategy is a good initiative that addresses the most complex issue associated with ISA, which is the start of mining on the seabed. Still, it seems to contradict itself because the way to exploit the seabed sustainably has not been determined.

Finally, the strategic plan indicates the courses of action based on ISA's role and the global situation, especially the exploitation of the seabed. However, some aspects do not seem to bring us closer to deciding. It could be interpreted as a way to buy time in the face of pressure from the mining industry and opposition from defenders of the ocean environment around the world. However, some aspects do not seem to bring us closer to deciding.

2.3.4. The two-year deadline established in UNCLOS Part XI

The constant demographic and economic development of humanity increases the need for sources of resources. According to DW (2022) reportage, the transformation from fossil fuels to environmentally friendly energy requires minerals such as cobalt, copper and nickel; we depend on them for batteries, smartphones, laptops, electric automobiles and photovoltaic systems, among other energy storage systems. However, these resources will run out at some point. For instance, cobalt consumption demand worldwide in 2018 was 110,000 and is expected to be 217,453 by 2026 (DW, 2022). Thus, many industries such as energy, electronic equipment or vehicles are interested in minerals, which are their raw material, and without them, their businesses could be at risk.

All these economic pressures made attractive the two years deadline to approve a PW submitted by a State for exploration or exploitation, established in paragraph 15 (b) of the Annex of the Agreement on the Implementation of Part XI of the Convention. This provision acts in junction with the powers given to the ISA´s Council under UNCLOS, which mandates the Authority shall design and adopt rules and procedures based on the

principles included in the sections of the agreement related to the following aspects: The Enterprise, Technology Transfers, Financial Production, Economic Assistance and Contract Conditions (United Nations, 1994). Regarding the relationship between the 1994 Agreement and UNCLOS Part XI, it has been established that the 1994 Agreement and UNCLOS Part XI provisions shall be interpreted and applied jointly as a single instrument. Also, in case of any inconsistency between both instruments, the requirements of the 1994 Agreement shall prevail (United Nations, 1994).

Under this circumstance, the Republic of Nauru, an island located in the centre of the Pacific Ocean, requested the ISA to adopt rules and regulations within two years (Singh, 2021). The two years period started on June 30, 2021. Nauru is the first country to sponsor an exploration request contract in the Area. Nauru based their urgency because Nauru Ocean Resources Inc (NORI), a Nauruan entity sponsored by Nauru, intends to obtain approval for an exploitation working plan according to the procedures delivered in the 1994 Agreement (The Republic of Nauru, 2022). The official website of the Republic of Nauru informs that as a small island and developing country, they do not have many natural resources. In this regard, Nauru recognised deep-sea mining as an excellent opportunity for development. The state has received support in training, capacity development, and social programs (The Republic of Nauru, 2022).

2.4. Intermediate Conclusions of Chapter II

The world merchandise trade is growing fast because more countries participate in global production and consumption. Through globalisation and industrialisation, Countries reduced taxes, eliminated trade barriers, and improved merchant transport (Ma, 2020). This growth requires resources that could come from the seabed in the future. Developed countries exploit and process resources, while developing countries extract and export raw materials. Undeniably, the UNCLOS has given the world the necessary order to use the waters as a single ocean in a regulated way. However, the UNCLOS was made amid many economic interests and established after decades of discussions.

UNCLOS provides a territorial distribution of the sea that not all countries have yet accepted, which can be a problem in the search for an equitable distribution of benefits.

Whereas the ocean is interconnected, and the impacts are not only local in effect, as Tanaka (2019) mentioned, the sea is a single unit, represented by the continuity of marine spaces illustrated by the species that ignore the national borders. The inclusion of Part XI provides the guidelines for the development of seabed activities based on the most relevant principle of the seabed and its resources as a Common Heritage of Humanity that emerges as the antithesis of the principles of sovereignty and freedom.

However, almost thirty years have passed since Part XI's implementation, and the anxieties are becoming more intense yearly. As an independent agency backed by the United Nations, ISA should deal with the most aggressive pressures. Even more than when there are studies about minerals that could be exhausted in continental terrain and the seabed would be the ideal alternative for many countries and companies that require these raw materials for electric mobility. Decarbonising transport means that electromobility will create a cleaner, healthier global scenario. Therefore, the ISA has issued a strategy based on the contemporary situation that indicates the need to regulate exploitation and how the ISA contributes to the Sustainable Development Goals.

Another pressure is the 1994 Agreement provision claimed by Nauru that commits the Authority to the adoption of rules, regulations and procedures within two years of the request to facilitate the approval of a work plan carried out by a State (United Nations, 1994). This provision puts the ISA in the final instance to decide whether to grant or deny the authorisations. It could be a historic milestone for humanity. Noticeable, the countries or institutions interested in exploiting resources are those that have invested large sums of money for decades in exploration. Besides Nauru, there are many others.

Before UNCLOS in 1958, the analysis of ocean governance involved legal, technical, biological, economic and political aspects. Still, the discussion focuses on benefit sharing with better technologies and more information. As mentioned above, there is a transcendental antecedent in the debate on UNCLOS: the 1969 UN resolution called "Moratorium Resolution" to postpone and seek consensus. Therefore, a similar decision could be made regarding DSM nowadays. The next chapter will develop the situation of exploration contracts and ISA's progress in regulating the Mining Code.

CHAPTER 3: OVERVIEW OF DEEP-SEA MINING

3.1. Introduction

Ever since the *Challenger* cruise ship discovered the first signs of richness on the seafloor, there have been different ways of trying to start DSM. Before UNCLOS, there were up to three interpretations of international law to favour investors. According to Churchill and Lowe (1999), Part XI was initially motivated by a desire to protect land-based economies. However, one of the biggest obstacles to accepting DSM standards in the Law of the Sea was the lack of protection for countries that have made substantial economic investments to explore the seabed, these so-called pioneer investors. UNCLOS was born without part XI that regulates the Area. Nevertheless, after a long period of negotiations, the United Nations reached the 1994 Agreement relating to the Implementation of Part XI of the UNCLOS on 10 December 1982.

Under Part XI, extensive areas are explored for over twenty years, representing costly investments from countries and multinationals waiting to extract minerals and generate profits. According to Miller et al. (2018), the exploration contracts for polymetallic nodules reach 75,000 km2, for seafloor massive sulphides till 10,000 km2, and for cobalt-rich ferromanganese crusts no more than 20 km2. However, the lack of code to implement a framework for deep sea mining is limiting because it hampers its effectiveness in practice (Long, 2021).

In 2011 Fiji recommended that the ISA initiate efforts to regulate the exploitation of resources in the Area; the ISA has been working on the Mining Code draft. After eleven years, there is still no clear decision about the future. However, a roadmap established by the Council sets the year 2023 as a goal to make serious decisions. In addition, the Nauru declaration on the 1994 Agreement pushes decision-making and contributes to the discussion of this chapter because this provision gives ISA two years to adopt the exploitation regulation.

This chapter will provide comprehensive information to analyse the current status of the regulations related to the exploitation of deep seabed minerals and explore the status of drafting the Mining Code at ISA. Therefore, this chapter describes the main drivers that

involve DSM starting from the exploration contracts already given by ISA, the Status of Mining Code and the current objectives of ISA regarding deep-sea mining.

3.2. Exploration contracts

3.2.1. Antecedents

Since ISA entered in 1994, the exploration activities for mineral resources in the Area started to be regulated under exploration contracts. ISA (2022a) informed that initially, national agencies mainly embarked on exploration activities until 2010, when private companies were involved in the polymetallic-nodule-mining industry. The establishment of Part XI brings an innovative sense by providing a "parallel system", production policies, technology transfer, financial terms of contracts and review conferences (Tanaka 2019). The parallel system is because applicants must submit two areas included in the PW; after it is approved, one of those sites is reserved for the Enterprise to be managed in favour of developing countries.

According to Tanaka (2019), before UNCLOS, the discussion faced the lack of signature by the USA and other industrialised states; the Convention seemed only between developing countries plus Iceland. Under these circumstances, UNCLOS III include special provisions for pioneer investors attached to the Convention as a Resolution. The Final Act of the Third Conference on the Law of the Sea of 1982 drew up the UNCLOS and four other resolutions. For this research, Resolutions I and II are relevant. The resolution I had the purpose of establishing the Preparatory Commission for the International Sea-Bed Authority and the International Tribunal for the Law of the Sea. Resolution II pushed the Governing initial investment in pioneer activities relating to polymetallic nodules (*United Nations Convention on the Law of the Sea*, 1982).

The first resolution established a preparatory commission composed of representatives of the signatory countries to create the ISA and its procedures. Still, it was also entrusted with the introductory provisions for investment protection (Churchill & Lowe, 1999). Meanwhile, by 1982, several mining enterprises had already been established and heavily invested in DSM (see Appendix 1). Resolution II recognises as pioneer investors

France, India, Japan, the Soviet Union and any natural or juridical person with the nationality of a signatory state of the UNCLOS that has invested before January 1983 the amount of $US 30 million dollars in pioneer activities in the Area (*United Nations Convention on the Law of the Sea*, 1982). According to Churchill and Lowe (1999), this resolution was later modified by the 1994 Agreement because they were very complex.

According to Resolution II, the states had technology transfer obligations and should detail two sites of up to 150,000 square kilometres; in case of overlap, they must solve them themselves. In these sites, the pioneers would have the right to carry out explorations, but they were obliged to submit a PW to the Authority when the agreement entered into force (*United Nations Convention on the Law of the Sea*, 1982). The companies began to worry about the change of nationality if their countries were not signatories to the Convention. In exchange for this preferential treatment for pioneers, they would have to make an initial payment of $US 250,000 and an annual payment of $US 1 million. The initiative was to keep the western mining countries close to the treaty regime. However, conservative free-market governments like the USA and UK considered interference with intellectual property and property rights unacceptable. Finally, these states rejected the commitment and did not sign the Agreement.

3.2.2. Role of ISA regarding Contracts for Exploration in the Area

The Area's prospecting, exploration, and exploitation are arranged, executed, and supervised by the ISA. The Council of the Authority has the power to adopt and apply provisionally, pending approval by the Assembly, regulations related to prospecting, exploration, and exploitation in the Area (*United Nations Convention on the Law of the Sea*, 1982, art. 162). In complying with the United Nations Convention on the Law of the Sea (1982, art. 145), the ISA should protect the aquatic environment from every activity in the Area. In this regard, the LTC is responsible for evaluating the PW submitted by the potential contractors and sending recommendations to the Council (*United Nations Convention on the Law of the Sea*, 1982, art. 165). The LTC plays a fundamental role in protecting the marine environment; although exploration effects are minimal or null, the conclusions and recommendations can be legal antecedents for future decisions.

According to ISA (2022b), the Authority has delivered detailed and substantive provisions, regulations and recommendations for assessing the environmental impacts deriving from the exploration of PMN, PMS and CFC in the Area. To improve its control, in 2020, the Authority issued an update of the recommendations for contractors to evaluate possible environmental impacts caused by the exploration of minerals in the area. This guidance describes procedures to should follow by the contractor and the Authority to acquire baseline data and monitor exploration activities. The LTC issued it to address impacts on marine biodiversity on the seabed and in the water column above it. There are three purposes determined. First, define contractors' procedures and measure the oceanographic, chemical, geological, biological and sedimentary properties to ensure adequate safeguard for the marine environment from dangerous consequences. Second, contractor report facilitation. Third, guide future contractors in preparing a PW for exploring marine minerals (ISA, 2020a).

One recent example from practice is when ISA did not endorse an EIA submitted by NORI in 2021 to explore CCZ until they fixed the environmental impact statement, particularly the EMMP (ISA, 2022e).

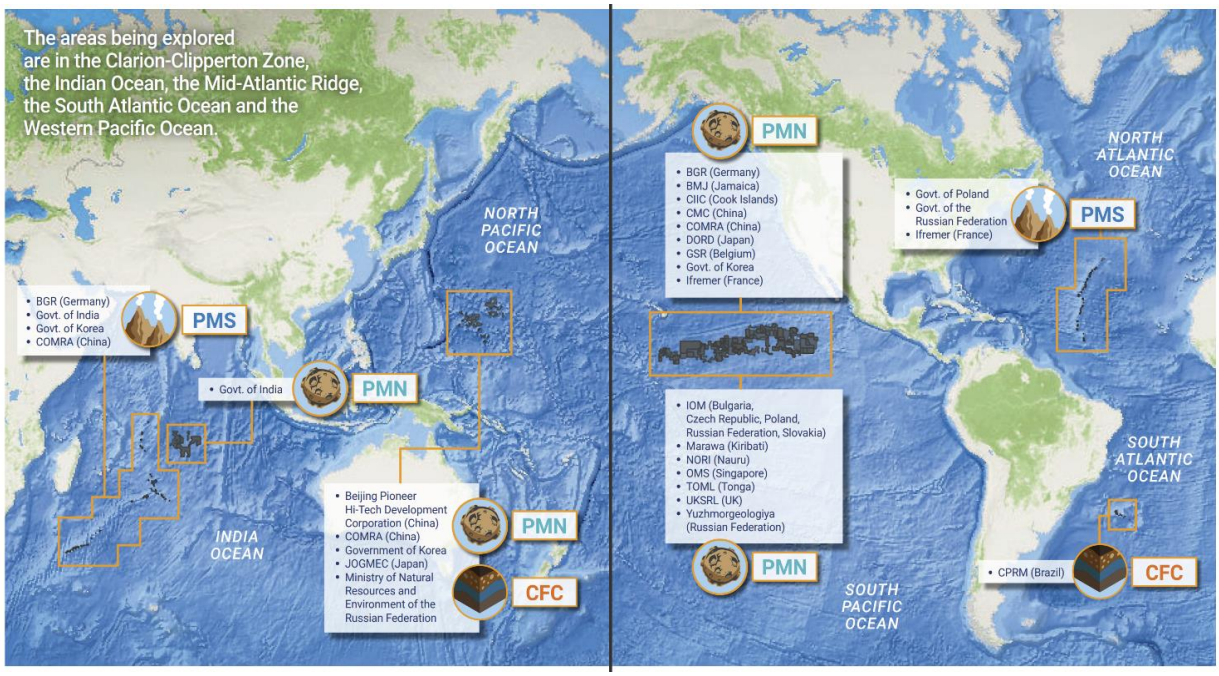
3.2.3. Status of Contracts for Exploration in the Area

The exploration contracts in the Area issued by ISA until today are 31, initially for 15 years. The Legal and Technical Committee (LTC) could evaluate and recommend the extension of the contracts. According to the ISA Annual Report (2022c), 22 contractors share the 31 contracts to exploit three types of mineral resources in the area, PMN, PMS and CFC. Exploration contracts permit geological investigations, mineral resources examination and environmental sampling studies; these activities have no considerable ecological impact or are almost null. Also, the contractors do development and mining technology tests and techniques to process minerals.

Those who wish to explore must submit a PW following the ISA procedures established by ISA (2020a), which the Authority must evaluate. The PW should include Environmental baseline Studies, Monitoring during the prospecting and exploration and Monitoring during and after testing mining components. The explored areas are located in the CCZ, the Indian Ocean, the Mid-Atlantic Ridge, the South Atlantic Ocean and the Western Pacific Ocean, as shown in figure 6.

Figure 6

Map of regions explored by contractors with ISA permission.



Note. The figure shows the world map with the areas authorised for exploration and the institutions of each country or sponsor state. The states sponsoring these contracts contain ten developing countries and six little island developing states such as the Cook Islands, Jamaica, Kiribati, Nauru, Singapore and Tonga (ISA, 2022c).

The countries currently exploring the Area are essentially the same that were part of the group of investors before UNCLOS entered into force, such as Belgium, France, Germany, India, Japan, Russia and the UK. We have an additional ten developing countries and six small island developing states, such as the Cook Islands, Jamaica, Kiribati, Nauru, Singapore and Tonga. The USA is not on the list of countries exploring the Area in the ISA report of 2022.

3.3. ITLOS advisory opinion, Case No. 17

3.3.1. Institution of Proceedings

In 2008 Nauru Ocean Resources Inc., sponsored by the Republic of Nauru, and Tonga Offshore Mining Ltd., sponsored by the Kingdom of Tonga, submitted PW to the Authority for approval (ITLOS, 2011). Both requests refer to UNCLOS on the

reservation of areas, which establishes that all submissions will cover a complete area large and economically valuable enough to allow two mining operations. The ISA shall designate which area is for the activities of the Authority through Enterprise and which is in association with developing States (*United Nations Convention on the Law of the Sea*, 1982, annexe III, art. 8). According to ITLOS (2011), in 2009, the applicants requested to postpone their applications. Later in 2010, Nauru, by an official document, asked to ISA Secretary-General to seek an advisory view from the International Tribunal for the Law of the Sea (ITLOS) on precise matters related to sponsoring states' responsibilities and liability.

Nauru argues that to participate in activities in the area as a developing country that does not have the technical and economic capacity, it must use the private sector as a sponsor. Nauru Ocean Resources Inc. initially assumed that Nauru could effectively mitigate the potential liabilities of its sponsorship. However, in some circumstances, these responsibilities may exceed the financial capacity of Nauru and other developing states. For that reason, the sponsoring States are exposed to considerable potential liabilities. Nauru considered vital clarification and guidance from ITLOS on interpreting responsibility and liability in Part XI (ITLOS, 2011).

The role of the Seabed Disputes Chamber of the ITLOS is to interpret UNCLOS Part XI exclusively. The Chamber will issue advisory opinions on legal questions arising in its activities' scope; its jurisdiction on these cases is under the United Nations Convention on the Law of the Sea (1982, art. 191). In these circumstances, the council decided to request to ITLOS an advisory opinion regarding article 191 of the United Nations Convention on the Law of the Sea. The ISA query contained three questions, which were the following.

- What are the legal responsibilities and obligations of States Parties to the Convention concerning sponsoring activities in the Area?
- What is the scope of liability of a State Party for any failure?
- What measures does a sponsoring State have to take to fulfil its responsibilities under UNCLOS and the 1994 Agreement?

ITLOS received statements from member states and stakeholders as part of the process, which will be developed in the next section.

3.3.2. Written Statements

The ISA invited member states and Intergovernmental Organisations to participate as observers in the assembly. To this end, the member states and the Intergovernmental Organisations submitted written declarations to the Chamber. The countries that submitted written statements were the United Kingdom, Nauru, the Republic of Korea, Romania, the Netherlands, the Russian Federation, Mexico, Germany, China, Australia, Chile, and the Philippines. The Chamber also received a joint statement from Greenpeace International and the World Wide Fund for Nature, requesting that these Non-Governmental Organizations (NGOs) participate in the proceedings as *amici curiae* (friends of the court). However, the Chamber decided not to admit it or include the written declarations in the case file. Only send it to the Member States and the Authority (ITLOS, 2011).

Simons et al. (2010), on behalf of Greenpeace International and the World Wide Fund for Nature, highlights aspects considered relevant to this research's objective. For instance, the deep sea is of great interest to science for its various ecosystems, including some genetic resources that may be useful for medicine. Adequate liability governance is crucial to ensure that activities in the Area are taken out for the benefit of all humankind. DSM is a high-risk activity due to the difficulty operating at tremendous depths and the lack of knowledge in this zone. Hydrothermal vents, which have also been considered potential extraction zone, play a vital role for some species with a high range of endemism. Indeed, some theories assure that life originated in the vents (Simons et al., 2010).

Simons et al. (2010) conclude that member states sponsoring activities in the area must act diligently through detailed legislation governing activities, monitoring, and a claim system that compensates victims of failure. The sponsoring state must provide additional economic funds if the operator proves inadequate resources. Finally, the memorial presented by Greenpeace International and the World-Wide Fund for Nature did not refuse DSM because of the framework of what was asked regarding sponsoring states' responsibilities and liability.

3.3.3. Advisory Opinion

The Chamber is obliged to interpret treaties under the Vienna Convention on the Law of Treaties of 1969, which specifies general rules of interpretation, such as the principle of good faith. The Law of Treaties sets the use of complementary means of understanding, including treaty preparations, circumstances of its conclusion when the performance leaves the meaning ambiguous or obscure and when conducted to a result that is manifestly absurd or unreasonable (*Vienna Convention on the Law of Treaties*, 1969, Part III).

Regarding the first question relative to the obligations of sponsoring states, the Chamber determined that the “Sponsorship” concept is a critical element of deep-sea activities. Under UNCLOS, the role of the sponsoring State contributes to the correct application of the principle of the common heritage of humanity. The most relevant point of the first question is about the meaning of the expression "responsibility to ensure"; it establishes a mechanism of responsibilities and obligations of the states regarding activities in the area but only binding to subjects of international law that have been accepted. The duties of the sponsoring States are not only to ensure due diligence. Under UNCLOS, the sponsoring States have “direct obligations” such as the following: to assist the Authority in the control of activities in the Zone; apply a precautionary measure; use the best environmental practices; take action in the event of an emergency and ensure the availability of compensation resources concerning pollution damage; and the obligation to carry out ecological activities and impact assessments (ITLOS, 2011).

The second question is about the scope of the responsibility of a State Party for any breach. The Chamber answered it through the applicable provisions. According to UNCLOS, a State Party shall not be liable for damages caused by any breach by the sponsored party if the State Party has taken all necessary and appropriate measures to ensure effective compliance. The third question to the Chamber is about the steps a sponsoring State must take to fulfil its responsibility under UNCLOS. After reviewing the provisions of UNCLOS, the Chamber determined that in the system of duties and obligations of the sponsoring State, “necessary and appropriate measures” have two different but interconnected roles. First, these measures ensure the contractor's performance of its obligations under the Agreement and the established contract.

Second, they also exempt the sponsoring State from liability for damages caused by the sponsored contractor. This clarification encourages states to sponsor projects.

The following section will develop the so-called Mining Code that, according to ISA (2022d), has been developed transparently and carried out through public consultations by the LTC.

3.4. Mining Code

3.4.1. Legal background

The Area's exploitation is arranged, executed, and supervised by the ISA on behalf of humanity as a whole (*The United Nations Convention on the Law of the Se*a, 1982, art. 153.1). Then, it is forbidden for States and entities to execute DSM activities unilaterally. As mentioned earlier, nowadays, small islands appear as sponsor states; for them, DSM is an opportunity to improve their economy. These interests could be from large transnationals sponsored by small countries to pressure the release of mining regulations.

The United Nations Convention on the Law of the Sea (1982, art. 153.2) established that only specific actors could apply to execute DSM operations in the Area. Such actors are the Enterprise, in association with States Parties, or state companies or natural or juridical persons who possess the nationality of States Parties or are effectively handled by them or their nationals when sponsored by such States. Currently, ISA permits only exploration activities; the process for executing mining activities has not been issued.

Regarding exploitation of seafloor Dingwall (2021) identified two critical elements of the UNCLOS regime. The first is the Area and its resources as the common heritage of humanity, and DSM benefit must be for all humanity. In this sense, the DSM system must equally consider the developed and developing countries' interests. Therefore, the effective participation of developing countries shall be promoted, and it must be effective. The second key element is marine environment protection. Fundamentally, States and entities are prohibited from executing DSM activities unilaterally. The most significant challenge here is that a few countries have enough power to carry out

exploration and start conducting exploitation. While developing countries do not have that technical or economic capacity.

According to ISA (2019a), the development of the Mining Code started in February 2016, when the First Working Draft of the Regulation and Standard Contract Terms on Exploitation for Mineral Resources in the Area was issued. Then in August 2017, the Draft Regulation on the Exploitation of Mineral Resources in the Area was issued. Subsequently, in June 2018, the Authority shared the Revised Draft Regulations on the Exploitation of Mineral Resources in the Area. Finally, in its twenty-fifth session, the Council of the International Seabed Authority issued the draft Regulations on the exploitation of mineral resources in the Area, which will be developed in the following section (ISA, 2019b).

3.4.2. Status of Mining Code

In 2019, the ISA council delivered the draft regulation for exploiting mineral resources in the area. The LTC has prepared this project that comprises thirteen parts, ten annexes, and four appendices. Due to the length of this investigation, this study will focus on the most relevant matters associated with the research aims. The issues described in this section are the PW, Rights and obligations of Contractors, Protection and preservation of the Marine Environment and Closure plans.

- Plans of Work (Part II of the regulation draft)

  The PW covers all concerns related to its application for approval; all applicants can be just the company or member states. According to ISA (2019b), the request form must contain a Mining Work Plan, Financing Plan, State of Environmental Impact, Emergency Response and Contingency Plan, Health and Safety Plan and a Maritime Security Plan, Training Plan, Environmental Management and Monitoring Plan (EMMP), and Closure Plan.

- Rights and obligations of Contractors (Part III of the regulation draft)

  The exploitation contract is arranged between the Authority and the Applicant once the Council approves the PW. The exploitation contract grants exclusive rights to the contracting party to explore and exploit a specific resource as agreed

in the PW and only in the authorised mining area (ISA, 2019b). The contract does not empower the contracting party to carry out operations in another part of the Area. The Authority would not allow another entity to explore or exploit the same category of resource during the term of the contract (ISA, 2019b). However, in coordination with the contracting party, the Authority will ensure that another entity does not operate in the contracted area.

The contracts are initially signed for 30 years maximum, considering the economic expectations of DSM and the suitable time for the building of extraction and processing facilities on a commercial scale. The draft regulation allows the contract extension as long as it is sent to the General Secretary one year before the end of the contract (ISA, 2019b). The amount of time allowed in the contract seems impressive because a lot can change in that time frame. For instance, resource demand, technological improvements, and alternative sources of minerals could even be found. In the same way, contractors can change their priorities due to a change in leadership, political or economic influence.

- Protection and preservation of the Marine Environment (Part IV of the regulation draft)

  The Mining Code draft creates the Environmental Compensation Fund to prevent, limit or remedy any damage in the Area arising from DSM. The funds may promote research, education and training in marine mining engineering, environmental protection and restoration. It also includes the following provisions that guarantee adequate protection of the marine environment as follows;

  - Obligations relating to the Marine Environment

    This provision is a preventive approach established in Principle 15 of the Rio Declaration (United Nations, 1992). It will promote trust and transparency in evaluating and managing the environmental consequences of the exploitation of the seabed (ISA, 2019b). It must apply the best available techniques and suitable environmental practices.

The most robust available scientific evidence must be integrated to make the right decisions.

- Preparation of the Environmental Impact Statement and the EMMP.

  This rule details the obligations related to the Environmental Impact Statement, which reports the results of the PW's Environmental Impact Assessment (EIA). The EIA describes the impact of planned activities on the environment, including impacts on biodiversity (IISD, 2022); It is a process of identification, prediction and evaluation of the potential environmental, socioeconomic, and cultural effects to define mitigation actions. In addition, the rule established an Environmental Monitoring and Management Plan to ensure that Environmental Effects satisfy the environmental rate goals and standards for DSM operation.

- Pollution control and management of waste

  This regulation determines that the contracting party must take the corresponding measures to prevent, reduce and control contamination in the Area following the EMMP. In the same way, it is prohibited to dump or unload mining waste except when the safety of the ship, installation or human life is at risk (ISA, 2019b).

- Compliance with EMMP and performance assessments

  This section indicates three aspects; first, to comply with the EMMP, the environmental effects of the activities and the measures taken to protect the marine environment must be reported annually. Second, contractors must run evaluations of their EMMP to verify that they are working correctly. Third, contractors must have a contingency and emergency response plan (ISA, 2019b).

- Closure Plan

  According to the draft regulation, the closure plan establishes the contracting party's obligations when the awarded area is decommissioned. The objective of the closure plan is for the impacted area to be reincorporated into the life cycle

following the best practices and available techniques. However, in thirty years, many things can change or evolve, for example, the economic perspective of the great powers, the world economy, interests in mineral resources or even there could be new, more attractive sources of resources.

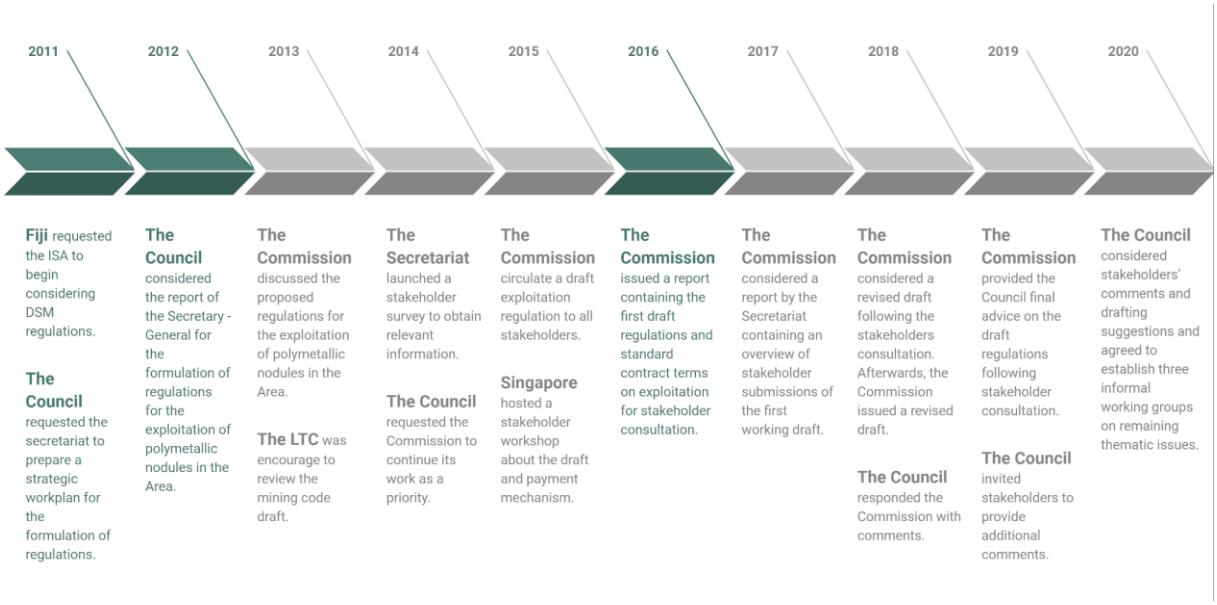
3.4.3. ISA efforts to establish the Mining Code

The year after the issuance of the draft regulation for the exploitation of the seabed, the ISA Council recognised the need to move forward with discussions about a draft of mineral resource exploitation regulations in the Area (ISA, 2020b). In this regard, the Council created three Informal Working Groups (IWG) unrestricted to observers and stakeholders to advance discussions concerning the draft regulations for DSM in the Area. These groups' mandates are as follows; the first group covers protection and preservation of the marine environment; the second group should work on inspection, compliance and enforcement; the third group shall focus on institutional matters, including ISA role, timelines, and stakeholders' participation. ISA (2020b) states that the IWG shall only meet during the Council sessions; no parallel meetings are allowed. Also, IWG will be unrestricted to observers and stakeholders. The Council established that the regional groups for facilitating each IWG would nominate an individual to act as a facilitator; the facilitator should moderate the discussions during Council sessions. Finally, the directive indicates that the IWG shall report on the progress in the next session of the Council.

On the other hand, in August 2021, on the 26th Session, the Council delivered the Secretariat-General report about the status of draft regulations on the exploitation of mineral resources in the Area. Moreover, the report presents a proposed roadmap for 2022 and 2023 (ISA, 2021a). This report includes a review of the development process from 2017 to February 2020, highlighting a stakeholder's suggestion regarding implementing standards and recommendations that should be developed together with the regulatory text. In addition, the document presents a historical timeline of regulatory development from 2011 to 2020 that was edited for this research and shared in figure 7 (ISA, 2021a). The timeline begins when Fiji submits a statement requiring the Council to develop a standard for exploitation of resources in the Area, active participation of LTC and evidence of consultations, workshops and suggestions with stakeholders.

Figure 7

Timeline of regulatory development from 2011 to 2020



Note. Information extracted from ISA (2021a).

Finally, this timeline confirms that there has been an effort by ISA and stakeholders to move forward with DSM regulation. However, the enormous amount of technical information, the different interests and the COVID-19 pandemic have delayed the progress. In concise, the council has proposed creating working groups to advance discussions on the draft regulation. It has established a roadmap to finish the Mining Code before the 2023 deadline given by Nauru's request.

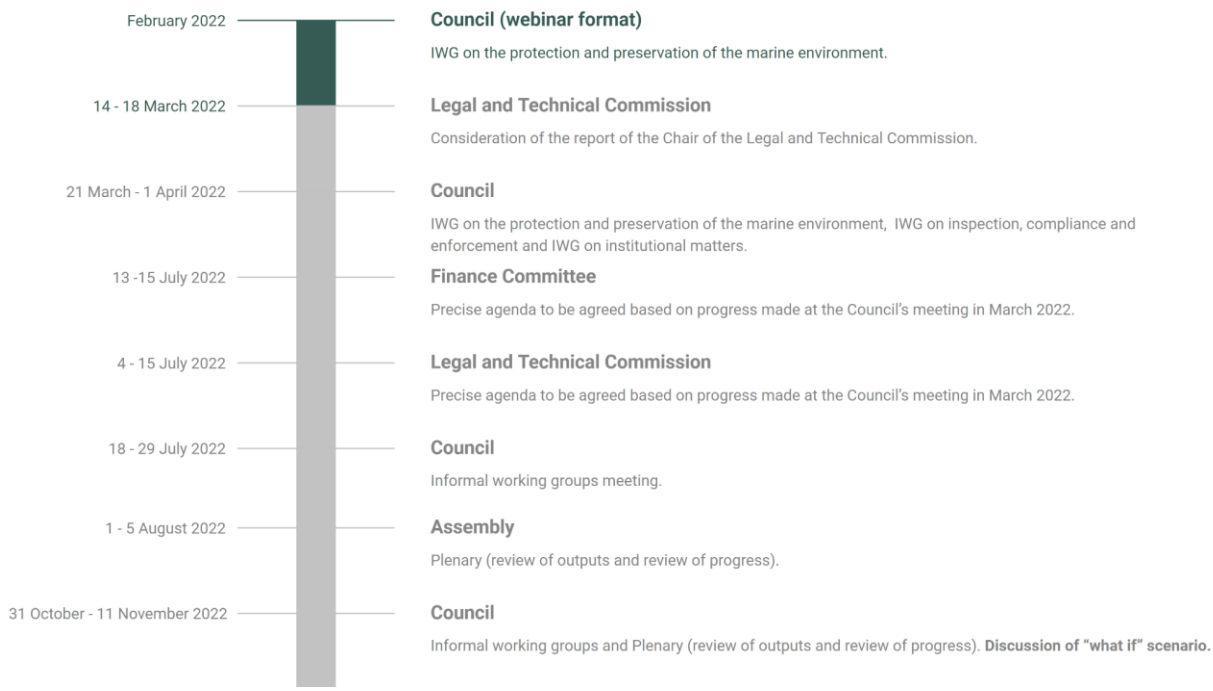
3.4.4. Proposed road map for 2022 and 2023

As mentioned above, the Republic of Nauru notified the Council of the intention of Nauru Ocean Resources Inc., an entity sponsored by Nauru, to submit a PW for exploration in the area on June 25, 2021. Nauru bases its request on the provisions of the annexe to the Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, when a State intends to request the approval of a WP to exploit resources in the area and requests the Authority officially, the Council must complete the adoption of said rules, regulations and procedures within two years from the application (United Nations, 1994). Under these circumstances, the Secretary-General presented a proposed road map for 2022 and

2023 during the 26th session of the ISA Council. This initiative aims to develop a robust and holistic regulatory framework that can comply with the two-year term (before July 9, 2023), as shown in figure 8.

Figure 8

Road map for the twenty-seventh session of the Council of the ISA in 2022



Note. Information extracted from ISA (2021a).

For this aim, it is required that the Council allocate more time and financial resources (ISA, 2021a). Consequently, the statement given by the President of the Council regarding the work of the Council in the 26th session pointed out that the roadmap has been revised; it will include precise dates, a tentative agenda and details on the modalities of the established working groups (ISA, 2021b). Also, the President's statement indicates that the roadmap will be reviewed at the end of the last Council meeting in 2022 to take stock of the progress in formulating the regulatory framework for exploitation (ISA, 2021b).

During the year 2022, no decisions have been found regarding the draft of the Mining Code; as previously announced, it should be discussed in the next session of the Council

at the date of writing this document. However, the roadmap indicates that the topic "what if scenario" will be discussed at the end of negotiations. This discussion could reach a consensus on the Mining Code.

3.5. Intermediate Conclusions of Chapter III

The extensive areas explored over twenty years represent costly investments from countries and multinationals; both are waiting to extract minerals and generate profits. These countries and private companies have followed the exploration authorisation process established by ISA. The exploration governance has been in operation since ISA was launched. It is an effective process because member states comply and follow. However, verifying if what happens does not cause the reported impact on the ocean's depths is difficult. Although ISA has indeed promoted substantial provisions for assessing the environmental impacts of exploration, the potential effects of exploitation are extremely more devastating than the impacts of exploration. In both cases, we cannot see the activities being done in the most remote areas.

According to the United Nations Conference on Environment and Development of 1992, called the Rio Declaration, States must widely apply the precautionary approach to protect the environment according to their capabilities. Where there are severe or irreversible damage hazards, the lack of complete scientific certainty shall not be a reason for postponing cost-effective measures to prevent environmental degradation (United Nations, 1992). Thus, environmental degradation is validated in exchange for profit. In this context, the question arises as to what ecosystem loss we are willing to accept and how this benefit will be distributed if the Area's resources are a Common Heritage of Humankind.

Based on Fiji's request that ISA starts thinking about a standard for seabed mining in 2011, there have been several meetings, and tasks have been delegated to the technical committees of the Authority. Also, stakeholders were included to reach a draft that involved all possible aspects, even more so when the island of Nauru requested that the Mining Code be delivered, arguing the 1994 Agreement. DSM carries a potential risk of harm; accordingly, Nauru requested ISA clarification on Sponsor States' responsibilities and legal obligations. Also, about the extent of a State Party's

responsibility for any breach, including what steps a sponsoring State must take to meet its duties under UNCLOS and the 1994 Agreement.

Accordingly, the ITLOS recommendation in response to this requirement clarifies relevant aspects of the responsibilities and duties of the sponsoring States. The responsibility rests not on the sponsoring state. This clarification benefits which States and industries decide to invest or not in activities in the zone. In this process, the opinion of the NGOs about Nauru´s questions did not reject DSM and pronounced the responsibility and obligations of the sponsoring States. However, more than twelve years have passed since the Advisory Opinion; new research may influence updating the position of these NGOs. It should be noted that the environmental assessment and the PW have solid content on prevention. However, it is much more complex to put into practice, and it is something that should not happen.

The decision to approve the Mining Code or take another alternative should consider the key elements governing decisions over DSM: the Area and its resources as the common heritage of humanity and marine environment protection. Here arises a controversial aspect about the meaning of "benefit for all humanity." From here follows an undetermined factor about how profits can be distributed. Consequently, one of the most significant challenges for the ISA is the differences between technical and budget between developed and developing countries. Both exploration investments and the 1994 Agreement put pressure on the release of the Mining Code. Amid these controversial needs, it is also relevant to analyse the impacts that the DSM can cause today; in this sense, the ISA has participated in its technical committees and has formed three committees led by the member states.

The ISA roadmap is an established path that points to the beginning of exploitation. This roadmap could reach a consensus on the Mining Code, but it does not mean that it is decisive in reaching a final decision on exploiting the seabed because it considers a "what if topic" to be discussed in the next council meeting. On the contrary, it is proposed worldwide to opt for a moratorium, which will be discussed in the next chapter.

CHAPTER 4: PROPOSAL FOR A MORATORIUM ON DEEP-SEA MINING

4.1. Introduction

The protection of the marine environment in the Area is regulated by the United Nations Convention on the Law of the Sea (1982, art. 145); the provision mandates adequate protection for the marine environment from harmful consequences from anthropological activities. To this aim, ISA should govern the Area to prevent, reduce, and control pollution and any interference with the ecological equilibrium of the marine environment. Alongside, ISA shall pay special attention to harmful impacts of drilling, dredging, excavation, waste disposal, construction and operation or maintenance of installations, pipelines and other devices related to activities in the seabed. These extraction operations were contemplated decades ago. Indeed, these activities are in UNCLOS Part XI. Nowadays, said operations such as drilling, dredging or disposal of waste continue to be contemplated today. Therefore, the technological advance of new, less invasive techniques has not changed much, except for automation.

The ISA evaluates exploration and exploitation applications and monitoring mining activities on the sea floor. Until today the ISA approved 31 fifty years contracts to 22 contractors in the seabed to explore polymetallic nodules, polymetallic sulphides and cobalt-rich ferromanganese crusts (ISA, 2022a). Therefore, there is a rising need for exploitation regulations on the sea floor that is still under development by ISA. On the other hand, many institutions have declared themselves in favour of a global moratorium on all deep-seabed mining activities. According to WWF (2022), DSM should not start until the environmental, social and economic risks are comprehended and all alternatives to deep sea resources have been investigated. However, Willaert (2020) deduces that issuing a draft Mining Code signals the game's current state. The primary concern of this chapter is the environmental impacts, the ISA´s response, and the calling for a Moratorium on DSM. Finally, this chapter delivers intermediate conclusions to support the research objectives to identify the best approach to achieving governance of the deep seabed.

4.2. Impacts of deep-sea exploitation

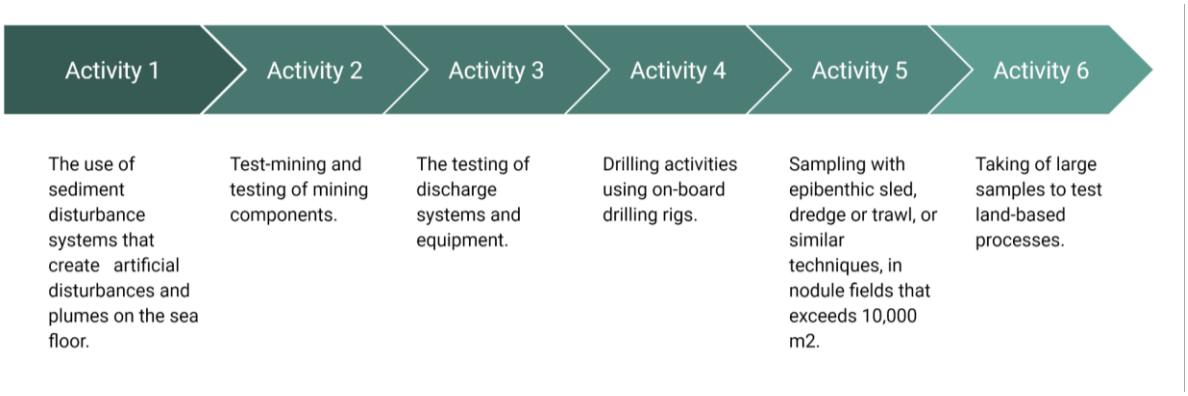
4.2.1 Preventive measures of the ISA

According to the recommendations established by the ISA for assessing the possible environmental impacts arising from the exploration of marine minerals in the Area, the contractors must report the results of their environmental monitoring annually. Besides, when they apply for approval of a PW, they must expound a programme for oceanographic and environmental baseline studies (ISA, 2020a). However, ISA has not yet an inspector body capable of supervising activities at the sea bottom, despite exploration contracts being issued since 2001 (Willaert, 2021a).

The ISA designated the LTC as the organ responsible for keeping updates and constantly revising environmental regulations, standards and guidelines (ISA, 2022c). One of the recommendations issued by LTC in 2019 was to specify the activities that compulsorily require EIA for exploration described in figure 9. Also, the ISA have the Deep Data portal to make accessible all the reports and collected information.

Figure 9

Activities requiring an EIA



Note. Environmental baseline studies entail collecting data on physical oceanography, chemical oceanography, geological properties, biological communities, bioturbation and fluxes to the sediment. The author developed the graph based on ISA (2022c).

4.2.2 Associated marine environment

According to Willaert (2021b), several DSM companies assure seabed mining is the most acceptable option to provide base metals for moving forward to a circular economy and decarbonisation. Still, the unavoidable impact on the seafloor constitutes the main concern because it currently cannot be precisely assessed. However, science confirmed that life is connected with seabed resources such as manganese nodules or black smoker vents, as shown in Figures 10 and 11. This life would be devastated by the mining of resources from the seabed; paradoxically, the goal most linked to the role of ISA among seventeen SDGs is number 14, called life below water which aims to significantly reduce marine pollution of all kinds by 2025 (United Nations, 2022).

Figure 10

Associated fauna with Manganese nodules

Note. The figure demonstrates a remotely operated vehicle holding a manganese nodule with associated fauna (Miller et al., 2018).

Figure 11

Black smoker vent with deep sea shrimps

Note. Deep sea shrimps in a black smoker on the mid-Atlantic ridge (Miller et al., 2018).

4.2.3 Extraction process

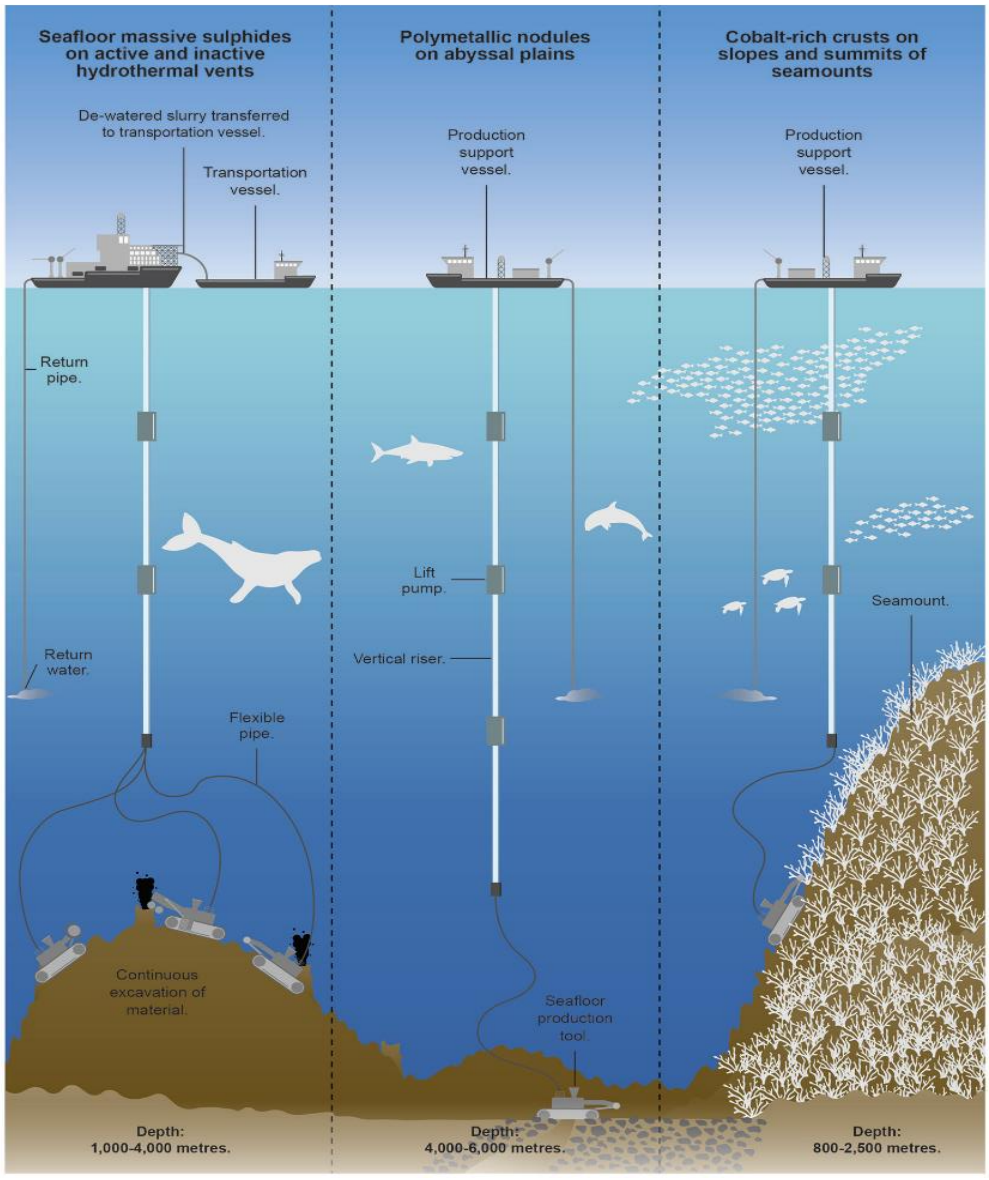
Willaert (2021a) advises onsite inspections using remote real-time monitoring technology as a priority, drawing inspiration from monitoring techniques used in other industries. According to ISA (2022c), one of the priorities for ISA is advancing technology to support sustainable DSM in the Area. To this aim, the Secretariat arranged a meeting of experts in coordination with the National Oceanography Centre (NOC) of the United Kingdom in November 2021. ISA informed that the reunion focused on new intelligent technologies such as automation and artificial intelligence. Also, the efforts to accomplish net zero carbon emissions along the oncoming DSM value chain were discussed (ISA, 2021c). In this context, since no standard regulates mining, the machinery has not been fully developed because, first, it must meet the requirements held in the tentative Mining Code.

System to lift materials dealing with extreme water pressures transporting harvested minerals from the button to the surface through thousands of kilometres. However, industrial collecting machinery is underway and probably will cause damage to the environment. Miller et al. (2018) explain that each proposed DSM extraction ideas have a similar operations concept of using a collector, a lifting system and logistic ships

involved in offshore processing and transporting ore. Figure 12 shows that the most common mineral collection systems involve remotely operated vehicles to extract deposits from the seabed using mechanical or pressurised water drills (Miller et al., 2018).

Figure 12

A schematic shows the processes involved in deep-sea mining for the three main mineral types. Schematic, not to scale.

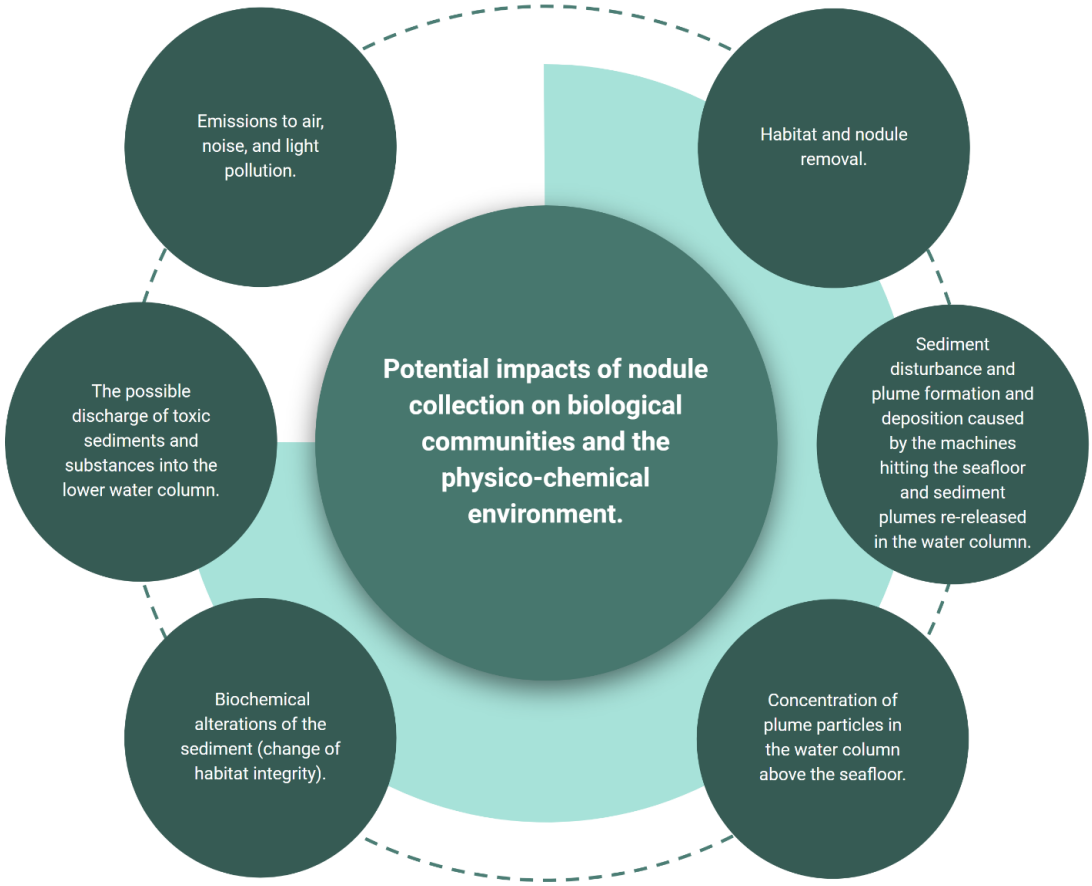


Note. Mining for SMS at hydrothermal vents would require mechanical extraction of the ore and transportation to a support vessel to extract the necessary materials. Harvesting nodules like potato-sized from deposits on the seafloor and then pumping the collected material to a surface vessel through a vertical riser pipe is challenging. Machinery will not smoothly pick up the minerals (Miller et al., 2018).

According to Filho et al. (2021), Patania II, a prototype nodule collector vehicle, went to depth within the framework of an investigation to determine potential impacts and manoeuvrability conditions on the seabed. The tests were carried out in the CCZ at 4,400 meters depth. The results are complex to analyse due to the scale and the fact that it only operated in a small area of 0.1 square kilometres. However, results determined by Patania II confirm potential impacts on biological communities and physicochemical environments (Figure 13).

Figure 13

Potential impacts of nodule collection on biological communities and the physicochemical environment.



Note. The author developed the graph based on Filho et al. (2021).

The main concerns of experts about DSM are the loss of unique and ecologically significant species, the production of large, persistent sediment plumes, the interruption

of relevant ecological processes connecting midwater and benthic ecosystems, the resuspension and liberation of sediment, metals and toxins into the ocean, and noise pollution from industrial activity on the ocean floor (Deep-sea Mining Statement, 2022). According to a marine expert statement calling for a pause to DSM, exploitation will add to current stressors. The result is irreversible biodiversity and ecosystem loss.

4.3. Initiatives of a Moratorium on deep-sea mining

It is undeniable that the seafloor is full of resources. However, technical challenges to environmentally friendly exploitation have not been solved until today. The machinery to collect the minerals industrially will cause damage to the environment. The ISA Strategic Plan 2019 - 2023 explains the importance of environmental protection. Likewise, provide information regarding creating Regional Environmental Management Plans (REMPs). Initially established a REMP for the Clarion-Clipperton Zone (CCZ). The plan has generated nine areas of interest to protect its biodiversity; these areas occupy a space of 1.4 million square kilometres protected from exploitation (ISA, 2022c). However, that does not protect the entire ecosystem of the seabed. DSM operations will undoubtedly cause adverse and harmful effects on the marine ecosystem (Lallier & Maes, 2016).

According to Willaert (2021b), the exploitation phase is approaching, and calls for a moratorium on DSM have increased recently. For example, paradoxically, the government of Fiji, which was the one who recommended the issuance of the exploitation standard in 2011, supported by Vanuatu, asks for a 10-year moratorium (Doherty, 2019). Nevertheless, the ISA does not have a moratorium on its agenda. In this regard, the campaigns against DSM are increasing inland and the sea, led by Non-Governmental Organizations. In 2021 Greenpeace International organised a protest against the Belgium company Global Sea Mineral Resources, which owns the autonomous vehicle described above, Patania II. In addition, this NGO report that civil societies and activists joined the claim for a moratorium on DSM in the Pacific, which includes Papua New Guinea, Fiji, and Vanuatu mentioned before (Greenpeace, 2021).

Petitions in favour of a moratorium also come from civil society; in Canada, thousands of people have signed a petition to Parliament asking the Government of Canada to

support the moratorium on deep-sea mining in 2022 (Mining Watch, 2022). In addition, a large number of experts vigorously recommend by a signed petition a pause in deep sea exploitation until enough reliable information is collected. These experts, as scientists, argued that they deeply value evidence-based decision-making. Particularly about DSM in the circumstances linked to global decisions that could open up a new ocean border to large-scale industrial resource exploitation. DSM puts the ocean at risk of large-scale and definitive loss of biodiversity, ecosystems, and ecosystem functions (Deep-sea Mining Statement, 2022).

Regarding the legal aspects of DSM, Filho et al. (2021) highlight that in 2018 the European Parliament established a rule favouring the request for a moratorium. The Resolution called to support a moratorium on commercial DSM licenses. The European Commission urged that European Unión (EU) countries stop sponsoring ISA contractors and stop DSM on their continental shelves. According to Filho et al. (2021), the precautionary principle would apply. A moratorium on DSM would apply when there is evidence of severe and irreversible damage. The request is until the impacts of DSM and possible risks will fully knowledgeable (European Parliament, 2018).

4.4. Intermediate Conclusions of Chapter IV

According to United Nations (2022), the conditions of temperature, chemistry, currents, and life drive the global systems of the world's oceans, making the planet habitable. The correct management of the ocean is essential for humanity and for counteracting the effects of climate change. Today, we are prime and real-time spectators of the evolution of the Mining Code for DSM. Therefore, after reviewing the background of UNCLOS, its discussion, and the inclusion of Part XI, DSM will undoubtedly backfire on target 14.

The gradual depletion of land resources and the increasing demand for base metals such as nickel, copper and cobalt have led to significant interest from governments and commercial entities in the deep seabed. Beyond the boundaries of national jurisdiction, which extend to the outer limits of the continental shelf, the seabed and subsoil comprise the ‘Area’ (*The United Nations Convention on the Law of the Se*a, 1982, preamble and art. 134 LOSC, 1982). The growing demand for metals and minerals to meet global demand has put the exploitation of the seabed on the agenda since 2011. However, some

voices claim that this need should not have an environmental cost. Alternative solutions have been proposed combining innovation, recycling, and repair to meet the industry's demand for raw materials without mining the seabed.

Although the consequences of DSM are well analysed by experts that conclude deep sea mining would cause irreversible damage and disrupt living and non-living components of the seafloor ecosystem. Stakeholders in deep sea mining exploitation consider the minerals from the deep sea the best option for a circular economy. During that time, ISA had developed a policy of transparency regarding DSM. Still, this controversial situation nowadays leads the ISA to define whether it will issue the Mining Code or discuss a moratorium. However, a moratorium on DSM is not on its agenda. Under these circumstances and parallel to ISA meetings, initiatives worldwide try to stop exploitation before DSM irreversibly devastated ecosystems.

As was mentioned before, the devastation level of DSM impacts is confirmed by science. Such as degradation, destruction or elimination of seafloor habitat, many before they have been discovered and understood. In addition, the transport of ore slurries in pipelines from the bottom to the ocean surface could originate physiological and behavioural stress to ocean mammals and other marine species. Finally, this decision would be a historic milestone. For better or worse, the decision is in the hands of the ISA and the Member States. If it is determined to exploit the seabed, the operations must be monitored in real-time and guarantee the most negligible impact. This ability is not yet developed.

CHAPTER 5: CONCLUSION AND APPROACHES

5.1. Key findings of the study

According to Hein et al. (2012), since 2000, the world's utilisation of numerous rare metals has grown, but reserves have not consistently been trustworthy because few major producers exist (see Appendix 2). These resources are considered part of the strategy to get a circular economy. Despite decades of experience in deep seabed exploration and exploration regulations, the environmental impact assessment and Mining Code draft seem to cover all aspects. The decision to start exploitation activities has not yet been made because the exploitation of resources in the Area will devastate entire ecosystems. In addition, the Area's exploitation activities are high risk due to the magnitude of the necessary facilities and machinery.

ITLOS (2011) clarify that activities in the Area include the recovery of minerals from the seabed and their elevation to the sea surface; also, others are directly related, such as disposal in the sea of materials without commercial interest. Given the lack of resources, the possibility of extracting them from untouched places begins to appear very tempting for powers and multinationals with economic capacity. Also, some developing countries see DSM as a potential economic activity as sponsoring States. ITLOS cleared up State Party liability regarding responsibilities and obligations under UNCLOS. However, the awareness to protect ecosystems brings alternative solutions such as innovation, recycling and repair to provide the technology industry's raw materials.

The consequences of DSM will be the degradation, destruction or elimination of seafloor habitats, including some that have not yet been discovered or studied. The route to the start of DSM was sped up when Nauru claimed the two-year deadline established in the 1994 Agreement. From the author’s perspective, it is not the ultimate factor in starting DSM operations under a Mining Code. A pause is possible at the political level, where much interest moves around. In addition, the start of DSM could change the worldwide economic balance. That means favouring the most advanced mining countries.

The ISA timeline confirms that there has been an effort by ISA and stakeholders to move forward with DSM regulation. However, supported by their evidence-based decision-making, the scientists recommend that no rule be issued to exploit the seabed. They argue the application of the precautionary approach, as reflected in principle 15 of the Rio Declaration. This activity will cause damage to the seafloor environment that will destroy the harvest field; that recovery process is longer than a thousand years. Under these circumstances, the arising controversy is whether humanity is willing to accept to destroy this last untouched ecosystem.

As mentioned above, there are countries to request a 10-year moratorium; recognised NGOs have also been pronounced against DSM's beginning, aware that the mining code could advance in the next session at the end of 2022 as planned in the ISA roadmap. Both sides have enough reasons to support their positions on starting or postponing DSM. Therefore, the author concludes that a moratorium should be negotiated until a technology that is less destructive to the marine environment or alternative minerals sources are sought.

5.2. Potential Approaches to the Research Questions

5.2.1. Regulation that governs the activities in the Area and Mining Code's current status

The Law of the Sea supplies a lawful frame to ensure global cooperation in marine matters, safeguarding the common international community's interest; UNCLOS is governed under the freedom principle, sovereignty principle and shared heritage of humankind principle (Tanaka, 2019). However, during this investigation, it has been identified that the negotiations prior to UNCLOS significantly influenced economic aspects over environmental ones.

UNCLOS requires practical and adequate safeguards for the oceanic environment. In this regard, the agreement relative to UNCLOS Part XI created the International Seabed Authority (ISA) to govern every single mineral activity in the area on behalf of humankind, ensure the adequate preservation of the marine environment from damaging consequences that could arise from actions on the seabed. ISA is regulated by thirty

articles, the most extensive section of UNCLOS Part XI. According to its functions, ISA has issued exploration regulations but not exploitation. ISA is following a Roadmap culminating in the Mining Code discussion in November 2022.

5.2.2. Potential balanced approach to deep seabed exploitation governance

ISA released its Strategic Plan and the Roadmap to point to exploitation as a goal. Throughout the research, ISA decisions seem to have inconsistent criteria; for instance, the ISA mining regulation draft takes care of several steps before authorising the mining operations. However, it is not aligned with its strategic directions that mention "best practice for environmental management", which is ambiguous and does not guarantee its environmental impact is acceptable. A historical precedent allows us to think that it is not always decided by economic benefit. The UN resolution of 1969, called the “Moratorium Resolution”, was a transcendental decision in the background of the provisions of the UNCLOS; in this way, the pressures dissipated. This antecedent opens the possibility that it can be repeated.

DSM is about the Common Heritage of Humanity, and seabed mining differs from land mining. The ITLOS advisory opinion points out that in land mining, a State only risks losing what it already has as its natural environment. On the other hand, if a developing State can be held responsible for activities in the Zone, the State could lose more than it owns (ITLOS, 2011).

There is currently a dispute over whether or not we should start mining. Instead, to reach a potential balanced approach to deep seabed exploitation governance, we need to find a way to advance consensus. The position of science and academia must join the authorities, governments and stakeholders. Faced with so much evidence and risk of loss and that there is no urgent need for resources today, the author proposes that the moratorium be discussed as a global solution to a worldwide problem.

5.3. Research main contributions.

The research provides a holistic vision of the antecedents and status of the DSM code and the environmental impacts of seafloor exploitation. The document reviews the ISA developed on the Mining Code draft and has considered the scientific proposals supported by numerous voices worldwide about adopting a moratorium on seabed mining.

5.4. Limitations of the study.

The vast technical information supporting and refusing DSM limits the investigation. It should be noted that the meetings proposed by the ISA roadmap for this year have not yet ended, with the most critical session pending in November 2022.

5.5. Recommendations for future research.

Considering the world's population increase, the demand for metal devices, possibly from marine mineral deposits, will rise. It would be relevant to investigate the international conflicts that could arise from the political pressure of industrialised countries versus the moratorium proposal.

References

Basir, S., & Abd Aziz, S. (2020). Undelimited Maritime Areas: Obligations of States under Article 74(3) and 83(3) of UNCLOS. Indonesian Journal of International Law, 18(1), 63-82.

Boschen, R. E., Rowden, A. A., Clark, M. R., and Gardner, J. P. A. (2013). Mining of deep-sea seafloor massive sulphides: a review of the deposits, their benthic communities, impacts from mining, regulatory frameworks and management strategies. Ocean & Coast. Manage. 84, 54–67. Doi: 10.1016/j.ocecoaman.2013.07.005

Buffett, B., & Archer, D. (2004). Global inventory of methane clathrate: Sensitivity to changes in the deep ocean. *Earth and Planetary Science Letters*, *227*(3), 185-199. https://https://doi.org/10.1016/j.epsl.2004.09.005

Christiansen, S., Currie, D., Houghton, K., Müller, A., Rivera, M., Schmidt, O., Taylor, P., and Unger, S., Towards a contemporary vision for the global seafloor – implementing the common heritage of mankind, Heinrich Böll Foundation, Berlin, 2019.

Churchill, R. & Lowe, A. (1999). *The Law of the Sea*, *Melland Schill studies in international law* (3rd ed.) Manchester University Press. 9780719043826

De Almeida, L. B. (2020). Ocean law in times of health emergency: Deep seabed mining contributions and its fear of overexploitation. *Indonesian Journal of International Law*, *18*(1), 1-22. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=edshol&AN=edshol.hein.journals.indjil18.3&site=eds-live&scope=site&custid=ns056238

Deep-sea Mining Statement (2022). Marine Expert Statement Calling for a Pause to Deep-Sea Mining, available at https://www.seabedminingsciencestatement.org [accessed 22 August 2022].

Deutsche Welle, (2021, September). *Will deep-sea mining save us from climate change?* [Video file]. YouTube. https://www.youtube.com/watch?v=9iy5jEHWykQ&t=2s

Dingwall, J. (2021). Commercial Mining Activities in the Deep Seabed beyond National Jurisdiction: The International Legal Framework. The Law of the Seabed: Access, Uses, and Protection of Seabed Resources, edited by Catherine Banet, *The International Journal of Marine and Coastal Law*, *37*(1), 139. Doi: https://doi.org/10.1163/15718085-bja10065

Doherty, B., (2019). *Collapse of PNG deep-sea mining venture sparks calls for moratorium.* The Guardian, 15 September 2019; available at

https://www.theguardian.com/world/2019/sep/16/ collapse-of-png-deep-sea-mining-venture-sparks-calls-for-moratorium; [accessed 21 August 2022].

Doyle, L. James (2017, April 30). Continental margin. Encyclopedia Britannica. https://www.britannica.com/science/continental-margin.

European Parliament. European Parliament Resolution of 16 January 2018 on International Ocean Governance: An agenda for the Future of Our Oceans in the Context of the 2030 SDGs. 2018. Available online: https://www.europarl.europa.eu/doceo/ document/TA-8-2018-0004_EN.html [accessed 21 August 2022].

Filho, W., Rimi Abubakar, I., Nunes, C., Platje, J., Gokcin Ozuyar, P., Will, M., Nagy, G., Al-Amin, A., Hunt, J., Li, C., Li, C., Xu, X., (2021). Deep Seabed Mining: A Note on Some Potentials and Risks to the Sustainable Mineral Extraction from the Oceans. Journal of Marine Science and Engineering. 9. 10.3390/jmse9050521.

Gazis, I., & Greinert, J. (2021). Importance of spatial autocorrelation in machine learning modelling of polymetallic nodules, model uncertainty and transferability at the local scale. *Minerals (2075-163X), 11*(11), 1172. https://10.3390/min11111172

Greenpeace, 'Deep Sea mining industry confronted at sea for first time by Greenpeace' (6 April 2021) available at: https://www.greenpeace.org/international/press-release/47077/ deep-sea-mining-industry-confronted-sea-first-time-Greenpeace [accessed 21 August 2022].

Haldar, S. K. (2018). Chapter 1 - mineral exploration. In S. K. Haldar (Ed.), *Mineral exploration (second edition)* (pp. 1-23). Elsevier. https://https://doi.org/10.1016/B978-0-12-814022-2.00001-0

Hein, J., Mizell, K., Koschinsky, A., and Conrad, T. (2013). Deep-ocean mineral deposits as a source of critical metals for high- and green-technology applications: comparison with land-based resources. Ore Geol. Rev. 51, 1–14. DOI: 10.1016/j.oregeorev.2012.12.001

Hein, J.R., Koschinsky, A. & Kuhn, T. Deep-ocean polymetallic nodules as a resource for critical materials. *Nat Rev Earth Environ* 1, 158–169 (2020). https://doi.org/10.1038/s43017-020-0027-0

International Institute for Sustainable Development, [IISD], (2022). *EIA: Essentials*, available at https://www.iisd.org/learning/eia/ [accessed 17 August 2022].

International Seabed Authority [ISA], (2018). The decision of the Assembly of the International Seabed Authority relating to the strategic plan of the Authority for the period 2019−2023, ISBA/24/A/10, 27 July 2018, available at https://isa.org.jm/files/files/documents/isba24_a10-en.pdf [accessed 08 August 2022].

International Seabed Authority [ISA], (2019a). The Mining Code: Draft Exploitation Regulations, available at https://isa.org.jm/mining-code/draft-exploitation-regulations [accessed 18 August 2022].

International Seabed Authority [ISA], (2019b). Draft regulations on exploitation of mineral resources in the Area, ISBA/25/C/WP.1, 22 March 2019, available at https://isa.org.jm/files/files/documents/isba_25_c_wp1-e_0.pdf [accessed 16 August 2022].

International Seabed Authority [ISA], (2020a). 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.1, 30 March 2020, available at https://isa.org.jm/files/files/documents/26ltc-6-rev1-en_0.pdf [accessed 12 August 2022].

International Seabed Authority [ISA], (2020b). The decision of the Council concerning working methods to advance discussions on the draft regulations for exploitation of mineral resources in the Area, ISBA/26/C/11, 21 February 2020, available at https://isa.org.jm/files/files/documents/isba_26_c_11-2002804e_0.pdf [accessed 15 August 2022].

International Seabed Authority [ISA], (2021a). Status of the draft regulations on exploitation of mineral resources in the Area and proposed road map for 2022 and 2023, ISBA/26/C/44, 23 August 2021, available at https://isa.org.jm/files/files/documents/ISBA_26_C_44-2112033E.pdf [accessed 18 August 2022].

International Seabed Authority [ISA], (2021b). Statement by the President of the Council on the work of the Council during its resumed twenty-sixth session, ISBA/26/C/13/Add.1, 14 December 2021, available at https://isa.org.jm/files/files/documents/ISBA_26_C_13_Add.1-2119396E_1.pdf [accessed 18 August 2022].

International Seabed Authority [ISA], (2021c). ISA-NOC expert meeting defines pathways to advance innovation and technology development for sustainable exploitation of deep-sea minerals in the Area, available at https://www.isa.org.jm/news/isa-noc-expert-meeting-defines-pathways-advance-innovation-and-technology-development [accessed 20 August 2022].

International Seabed Authority [ISA], (2022a). Exploration contracts available at https://isa.org.jm/deep-seabed-minerals-contractors [accessed 12 August 2022].

International Seabed Authority [ISA], (2022b). Environmental Impact Assessments, available at https://isa.org.jm/minerals/environmental-impact-assessments [accessed 2 August 2022].

International Seabed Authority [ISA], (2022c). Secretary-General Annual Report 2022, available at https://isa.org.jm/secretary-general-annual-report-2022

International Seabed Authority [ISA], (2022d). The Mining Code: Draft Exploitation Regulations, available at https://isa.org.jm/mining-code/draft-exploitation-regulations [accessed 16 August 2022].

International Seabed Authority [ISA], (2022e). Report of the Chair of the Legal and Technical Commission on the work of the Commission at the second part of its twenty-seventh session, available at

https://demaribus.files.wordpress.com/2022/09/isba_27_c_16_add.1-2211211e.pdf [accessed 19 September 2022].

International Tribunal for the Law of the Sea [ITLOS], (2011). Responsibilities and obligations of States sponsoring persons and entities with respect to activities in the Area (Request for Advisory Opinion Submitted to the Seabed Disputes Chamber) List of cases: No. 17, available at https://www.itlos.org/index.php?id=109 [accessed 2 September 2022].

Lallier, L. E., & Maes, F. (2016). Environmental impact assessment procedure for deep seabed mining in the area: Independent expert review and public participation. Marine Policy, 70, 212-219. https://https://doi.org/10.1016/j.marpol.2016.03.007

Lodge, M., (2019). Foreword from the Secretary-General. International Seabed Authority Strategic Plan 2019 - 2023, available at https://isa.org.jm/files/files/documents/Strategic_Plan_Booklet.pdf.

Long, Y. (2021). The Role of the International Seabed Authority in the Implementation of "Due Regard" Obligation under the LOSC: Addressing Conflicting Activities. Journal of Territorial and Maritime Studies (JTMS), 8(1), 27-46.

Ma, S. (2020). Economic of Maritime Business (1st ed.). Routledge.

Miller K., Thompson K., Johnston P., Santillo D. (2018). An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps. Frontiers in Marine Science, 4. 2018. https://www.frontiersin.org/articles/10.3389/fmars.2017.00418

Mining Watch Canada (2022). Canadians Call for a Moratorium on Deep Seabed Mining, available at https://miningwatch.ca/news/2022/3/24/canadians-call-moratorium-deep-seabed-mining [accessed 22 August 2022].

National Centre for Biotechnology Information [NCBI, (2022). PubChem Periodic Table of Elements. Retrieved July 15, 2022, available at https://pubchem.ncbi.nlm.nih.gov/periodic-table/.

Salpin, C. (2015). The Commission on the Limits of the Continental Shelf (CLCS) and its work, available at https://www.isa.org.jm/files/documents/EN/Seminars/2015/Chile/Salpin-2.pdf

Simons, D., Van Dyke, J., Currie, D., (2010), Memorial filed on behalf of Stichting Greenpeace Council (Greenpeace International and the World Wide Fund for Nature), 13 august 2010.

Singh, P. A. (2021). The two-year deadline to complete the international seabed authority's mining code: Key outstanding matters that still need to be resolved. Marine Policy, 134, 104804. https://https://doi.org/10.1016/j.marpol.2021.104804

Schmidt, O., & Rivera, M. (2020). No people, no problem – narrativity, conflict, and justice in debates on deep-seabed mining. *Geographical Helvetica, 75*(2), 139-150. https://10.5194/gh-75-139-2020

Sohn, L., Gustafson K., Noyes, J., Franckx, E. (2010). *The law of the sea in a nutshell* (2nd ed.). West.

Tanaka, Y. (2019). *The international law of the sea* (3rd ed.). Cambridge University Press. https://10.1017/9781108545907

The Republic of Nauru. (2022). Nauru requests the International Seabed Authority Council to adopt rules and regulations within two years. http://naurugov.nr/government/departments/department-of-foreign-affairs-and-trade/faqs-on-2-year-notice.aspx

Treves, T., (2008). 1958 Geneva Conventions on the Law of the Sea, available at: https://legal.un.org/avl/ha/gclos/gclos.html [accessed 26 July 2022].

United Nations, Report of the International Law Commission on the Work of its Eight Session, 234 July 1956, Official Records of the General Assembly, Eleventh Session, Supplement No. 9 (A/3159), 1956, available at: https://legal.un.org/ilc/documentation/english/reports/a_cn4_104.pdf [accessed 26 July 2022].

United Nations, General Assembly 1105 (XI). International conference of plenipotentiaries to examine the law of the sea, 21 February 1957, available at: https://documents-dds-ny.un.org/doc/RESOLUTION/GEN/NR0/341/09/PDF/NR034109.pdf?OpenElement [accessed 26 July 2022].

United Nations, Final Act of the Second United Nations Conference on the Law of the Sea, A/CONF.19/L.15, 1960, available at: https://legal.un.org/diplomaticconferences/1960_los/docs/english/vol_1/a_conf19_l15.pdf [accessed 26 July 2022].

United Nations, General Assembly Resolution 2340 (XXII) of 18 December 1967, available at: https://legal.un.org/diplomaticconferences/1973_los/docs/english/res/a_res_2340_xxii.pdf [accessed 26 July 2022].

United Nations, General Assembly Resolution 2467 A (XXIII) of 21 December 1968, available at: https://legal.un.org/diplomaticconferences/1973_los/docs/english/res/a_res_2467_xxiii.pdf [accessed 27 July 2022].

United Nations, General Assembly Resolution 2574 D (XXVI) of 15 December 1969, available at: https://legal.un.org/diplomaticconferences/1973_los/docs/english/res/a_res_2574_xxiv.pdf

United Nations, *Vienna Convention on the Law of Treaties*, 23 May 1969, United Nations, Treaty Series, vol. 1155, p. 331, available at: https://www.refworld.org/docid/3ae6b3a10.html [accessed 8 September 2022].

United Nations, General Assembly Resolution 2750 C (XXV) of 17 December 1970a, available at: https://legal.un.org/diplomaticconferences/1973_los/ [accessed 27 July 2022].

United Nations, General Assembly Resolution 2749 (XXV) of 12 December 1970b. *Declaration of Principles Governing the Sea-Bed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction*, available at http://www.un-documents.net/a25r2749.htm#:~:text=Solemnly%20declares%20that%3A,the%20common%20heritage%20of%20mankind.

United Nations, General Assembly, *Convention on the Law of the Sea*, 10 December 1982, available at: https://treaties.un.org/doc/Publication/UNTS/Volume%201833/volume-1833-A-31363-English.pdf [accessed 27 July 2022].

United Nations, *Report of the United Nations Conference on Environment and Development,* 28 September 1992, available at: https://documents-dds-ny.un.org/doc/UNDOC/GEN/N92/836/55/PDF/N9283655.pdf?OpenElement [accessed 14 September 2022].

United Nations Agreement Relating to the Implementation of Part XI of The Convention, 28 July 1994, available at: https://www.un.org/depts/los/convention_agreements/texts/unclos/closindxAgree.htm [accessed 29 July 2022].

United Nations, (2022), *Goal 14, Life Below Water, available* at: https://www.undp.org/sustainable-development-goals#below-water [accessed 14 September 2022].

Vanreusel, A., Hilario, A., Ribeiro, P. A., Menot, L., and Arbizo, P. M. (2016). Threatened by mining, polymetallic nodules are required to preserve abyssal epifauna. Sci. Rep. 6:26808. Doi: 10.1038/srep26808

Willaert, K. (2020). Public participation in the context of deep-sea mining: Luxury or legal obligation? *Ocean and Coastal Management*, *198*. https://doi.org/10.1016/j.ocecoaman.2020.105368

Willaert, K. (2021a). All eyes on deep sea mining: monitoring and inspection of activities in the Area. *Journal of International Maritime Law*, *27*(5), 302–312.

Willaert, K. (2021b). Protest at Sea against Deep Sea Mining: Lawfulness, Limits and Remedies. *International Journal of Marine & Coastal Law*, *36*(4), 672–683. https://doi.org/10.1163/15718085-bja10077

World Wide Fund for Nature [WWF], (2022). Protecting the Seabed Before It's Too Late, available at: https://wwf.panda.org/discover/our_focus/oceans_practice/no_deep_seabed_mining/#:~:text=A%20global%20moratorium%20on%20all,sea%20minerals%20have%20been%20explored [accessed 13 August 2022]

Appendices

Appendix 1: List of Mining enterprises already established by 1982 according to Churchill and Lowe (1999).

- Association Française pour l'étude et la recherche des nodules (APFERNOD) (France)
- Deep Ocean Resources Development Company (DORD) (Japan)
- The Kennecott consortium (USA, UK, Canada, Japan)
- Ocean Mining Associates (OMA) (USA, Belgium, Italy)
- Ocean Management Inc. (OMI) (Canada, USA, Federal Republic of Germany, Japan)
- Ocean Minerals Company (USA and Netherlands)
- Indian Ocean Development Department and
- The Soviet state-owned company, Yuzhmorgeologiya

Appendix 2: World's leading producers of metals in 2010 and holders of similar metals to marine mineral deposits (in blue)

Table 2
Leading global metal producers, with China highlighted[a].
Data from Price (2010), Society of Economic Geologists Newsletter, No. 82, July 2010.

Element	Leading Producer	2nd Producer	3rd Producer
Aluminum	Australia (31%)	China (18%)	Brazil (14%)
Arsenic	China (47%)	Chile (21%)	Morocco (13%)
Cadmium	China (23%)	Korea (12%)	Kazakhstan (11%)
Chromium	South Africa (42%)	India (17%)	Kazakhstan (16%)
Cobalt	Congo (40%)	Australia (10%)	China (10%)
Copper	Chile (34%)	Peru (8%)	USA (8%)
Gallium	China	Germany	Kazakhstan
Germanium	China (71%)	Russia (4%)	USA (3%)
Gold	China (13%)	Australia (9%)	USA (9%)
Helium	USA (63%)	Algeria (19%)	Qatar (12%)
Indium	China (50%)	Korea (14%)	Japan (10%)
Iron	China (39%)	Brazil (17%)	Australia (16%)
Lead	China (43%)	Australia (13%)	USA (10%)
Lithium	Chile (41%)	Australia (24%)	China (13%)
Manganese	China (25%)	Australia (17%)	South Africa (14%)
Molybdenum	China (39%)	USA (25%)	Chile (16%)
Nickel	Russia (19%)	Indonesia (13%)	Canada (13%)
Niobium	Brazil (92%)	Canada (7%)	—
Palladium	Russia (41%)	South Africa (41%)	USA (6%)
Platinum	South Africa (79%)	Russia (11%)	Zimbabwe (3%)
Rare Earths	China (97%)	India (2%)	Brazil (1%)
Selenium	Japan (50%)	Belgium (13%)	Canada (10%)
Silver	Peru (18%)	China (14%)	Mexico (12%)
Tellurium	Chile	USA	Peru
Tin	China (37%)	Indonesia (33%)	Peru (12%)
Uranium	Canada (21%)	Kazakhstan (19%)	Australia (19%)
Vanadium	China (37%)	South Africa (35%)	Russia (26%)
Zinc	China (25%)	Peru (13%)	Australia (12%)

[a] Elements highlighted in blue are common in marine mineral deposits.