

# Chapter 44

## Deep-Seabed Mining

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**Abstract** Deep-seabed mining (DSM) is an emerging marine industry that presents particularly complex challenges due to its multi-faceted political, economic, technological, scientific, environmental, social, industrial and legal aspects, all of which must be addressed to achieve commercially viable results. Furthermore, these aspects are either governed by or must take into account the burgeoning regulatory regime promulgated by the International Seabed Authority under the auspices of the 1982 United Nations Convention on the Law of the Sea, which also governs regional and national DSM regimes. This chapter briefly reviews the international DSM management regime and identifies innovative approaches to these myriad challenges that may also assist in informing the responsible development of other new deep-sea industries.

**Keywords** United Nations Convention on the Law of the Sea • Deep-seabed mining • International Seabed Authority • The Area • Marine minerals • Environmental impact assessment • Common heritage of mankind

### 44.1 Introduction

Deep-seabed mining (DSM) is an emerging marine industry that presents particularly complex challenges due to its multi-faceted political, economic, technological, scientific, environmental, social, industrial and legal aspects, all of which must be addressed to achieve commercially viable results. Furthermore, these aspects are either governed by or must take into account the burgeoning regulatory regime promulgated by the International Seabed Authority under the auspices of the 1982 United Nations Convention on the Law of the Sea, which also governs regional and national DSM regimes. This chapter briefly reviews the international DSM

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management regime and identifies innovative approaches to these myriad challenges that may also assist in informing the responsible development of other new deep-sea industries.

## **44.2 Central Issue: Why Is Management Required?**

Management is required because DSM is one of the many uses of ocean space, which “are closely interrelated and need to be considered [and therefore managed] as a whole.” (United Nations Convention on the Law of the Sea 1982, Preamble).

## **44.3 What Are The Management Requirements and What Are The Challenges?**

In keeping with the focus of this Handbook, this chapter addresses environmental management requirements and challenges facing DSM. Management of DSM is required to “promote peaceful use ..., the equitable and efficient utilization of [these resources], ... and the study, protection and preservation of the marine environment”. (*Ibid.*) Deep-seabed mining presents particularly complex challenges: it features multi-faceted political, economic, technological, scientific, environmental, social, industrial and legal aspects that must all be managed to achieve environmentally responsible and commercially viable results. To achieve the Law of the Sea Convention’s overarching vision, DSM management will need to adopt an approach that is holistic, ecosystem-based, precautionary, inter-disciplinary, transparent, adaptive, cost-effective and inclusive of all stakeholders. This list of requirements also sets out the challenges. In keeping with the focus of this Handbook, this chapter addresses only environmental management requirements and challenges facing DSM.

## **44.4 Existing International and Regional Legal and Institutional Framework on DSM**

### ***44.4.1 International Legal: The 1982 United Nations Convention on the Law of the Sea***

The 1982 United Nations Convention on the Law of the Sea (LOSC) covers DSM both inside and outside national jurisdiction. The LOSC has 167 parties out of—currently—193 members of the United Nations as of 25 June 2016. It is our planet’s “Constitution for the Oceans” (Koh 1983). Comprised of 320 Articles and 9 Annexes, and now accompanied by two Implementing Agreements, one wholly

devoted to DSM, the LOSC is probably the longest and most complex multi-lateral treaty extant. It is also, so far, the most powerful and comprehensive multi-lateral treaty governing human activities on this planet. This is because the LOSC applies where human activities, including land-based and atmospheric activities, adversely affect or are likely to adversely affect the marine environment. The concern of the LOSC's drafters for the marine environment permeates this treaty. For example, in addition to an entire chapter (Part XII, see further below) being dedicated to the marine environment, the LOSC's very first Article (i.e., Art. 1(1)(4)) sets out an all-encompassing definition of 'pollution of the marine environment':

"pollution of the marine environment" means the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities;"

Essential to the LOSC's power is the usually mandatory, unqualified, and exception-free nature of its provisions. The LOSC generally employs the mandatory verb 'shall', which is used in international treaty parlance to establish binding obligations. Such weakening phrases as 'in accordance with capabilities,' 'as appropriate,' 'as far as possible,' 'as far as practicable,' are generally absent. Exceptions in the LOSC usually apply only to "warship[s], naval auxiliary[ies], other vessels or aircraft owned or operated by a State and used...only on government non-commercial service" (LOSC Art. 236), but even in that context States must ('shall'), albeit diluted with qualifications, ensure that these vessels act consistently with the LOSC. Furthermore, LOSC Art. 309 explicitly prohibits reservations or exceptions, and LOSC Art. 310 reinforces this prohibition for States becoming parties to the LOSC. Finally, most of its provisions, including all of the environmental ones, are now considered to have codified, or to have become, customary international law (see, e.g., Oxman 1996; Birnie et al. 2009; Nordquist 2011), thereby making it exceedingly difficult under international law even for non-parties to act inconsistently with those provisions (see, e.g., Aust 2010).

The LOSC provides the overarching legal and institutional framework within which DSM is conducted, and it is designed to set minimum standards (see, e.g., Oxman 1996; Birnie et al. 2009; Nordquist 2011) for many aspects (e.g., flag state duties, shipping, marine environmental protection) of DSM in areas beyond national jurisdiction (ABNJ), which must be no weaker in areas under national jurisdiction (see, e.g., LOSC Arts. 94, 197, 208, 209, 211). Therefore the present chapter principally addresses the LOSC provisions applicable to DSM in ABNJ, where the legally binding environmental management regime is also most advanced. Of these provisions, the most important are LOSC Part XI, LOSC Annexes III and IV, the 1994 Implementing Agreement (IA; in force 28/07/1996; 147 parties as of 20 June 2016) and Parts XII and XIII. The IA and the LOSC are interpreted and applied as a single instrument; if the two conflict, the IA prevails (IA Annex, Art. 2).

These provisions apply to: that part of the seabed and subsoil in ABNJ denoted as the 'Area' (LOSC Art. 1(1)(1)); to 'resources of the Area', defined as "all solid, liquid, or gaseous mineral resources *in situ* in the Area at or beneath the seabed"

(LOSC Art. 133(a)); and to ‘activities in the Area’, defined as “all activities for exploration for, and exploitation of, the resources of the Area (LOSC Art. 1(1)(3). These provisions also set the jurisdiction of the International Seabed Authority (ISA; see further below), the institutional body established under the LOSC (Part XI Sect. 4; IA, Annex) to administer and regulate the Area’s activities and resources.

#### 44.4.1.1 Legal Status of the Area and Its Resources

Both the Area and its resources are the ‘common heritage of mankind’ (LOSC Art. 136), an as yet judicially undefined status. No state may “claim or exercise sovereignty or sovereign rights over any part of the Area or its resources” (LOSC Art. 137(1)) and rights in resources of the Area (i.e., minerals) are “vested in mankind as a whole,” on whose behalf the ISA acts (LOSC Art. 137(2)), but only for those specific rights. Hence, the legal status in the Area of non-mineral resources, such as, e.g., marine genetic resources, is unclear (see, e.g., Glowka 2000, 2010); this adds an additional layer of complexity to the management of the Area.

#### 44.4.1.2 Other Parts of the LOSC Relevant to Environmental Management of DSM

Environmental Aspects: Part XI, Annex III, Implementing Agreement

- Part XI (Art. 145): prevent/reduce/control pollution and other hazards to and interference with the ecological balance of the marine environment; protect and conserve the natural resources of the Area and prevent damage to the flora and fauna of the marine environment.
- Part XI (Art. 147(1)&(3)): conduct other activities in the Area and in the marine environment with reasonable regard for mineral resource related activities and *vice-versa*.
- Annex 44.III Art. 17—sets out what ISA must regulate: marine environment: (1)(b)(xii) & 2(f).
- Annex 44.III Art. 14(2): marine environmental data are not proprietary.
- IA: Preamble; Sect. 1(g),(h),(i), (k).

Environmental Aspects: Part XII (Protection and Preservation of the Marine Environment)

- Art. 192: “States have the obligation to protect and preserve the marine environment”.
- Art. 194(5): requires measures to protect and preserve rare or fragile ecosystems [and] depleted, threatened or endangered species and other forms of marine life.

- Arts. 204 & 206: require both environmental impact assessment and monitoring.
- Art. 208: marine environmental protection requirements for “seabed activities subject to national jurisdiction,” which includes the requirement that national requirements shall be “no less effective than international rules, standards and recommended practices and procedures (Art. 208(3)).
- Art. 209: marine environmental protection requirements specifically for the Area; includes flag states.
- Art. 215: enforcement of marine environmental protection rules in the Area (see also Art. 153(5) Part XI).

#### **44.4.1.3 Part XIII (Marine Scientific Research)**

- Art. 240(d): Marine scientific research is subject to Part XII (marine environmental protection) rules (see, e.g., Verlaan 2012); see also Art. 87(1) on high seas freedoms: these include marine scientific research and their exercise is not unrestricted). All high seas freedoms must be exercised with due regard for activities in the Area (Art 87(2)).
- Art. 256: Marine scientific research may be conducted in the Area (see also LOSC Art. 87(2) and LOSC Part XI Art. 143) by the ISA, States Parties and other competent international organizations.
- Arts. 242 and 243: International cooperation in general and between ISA, States Parties and Contractors in particular on marine scientific research is encouraged, especially on the marine environment and related research (International Seabed Authority 2002; see also LOSC Art. 143 on marine scientific research in the Area). This cooperation is essential for developing and implementing cumulative environmental impact management systems for DSM.

### **44.4.2 *International Legal and Institutional***

#### **44.4.2.1 International Seabed Authority**

Headquartered in Kingston, Jamaica, the ISA implements the LOSC and the IA on DSM. All LOSC parties are ISA members. The ISA has the exclusive right to manage seabed minerals in the Area, and the exclusive right to issue exploration and exploitation licenses (contracts) for minerals in the Area. At present it is not empowered to address non-mineral activities in the Area, even in areas for which it has issued an exploration (or, in future, exploitation) license for DSM activities. It is not empowered to issue licenses for activities related to non-mineral resources in the Area. The ISA observes the LOSC Art. 169 requirement to consult and cooperate with intergovernmental organizations (IGOs) and with non-governmental organizations (NGOs) recognized by the UN Economic and Social Council (ECOSOC), all

of whom may express their views, even in the annual meetings of the ISA Council and Assembly, according to procedures established by the ISA. International NGOs, both environmental and technical, participate actively in the ISA's work. Procedures to express views directly, rather than through their sponsoring state, in these latter meetings have not yet been established for DSM contractors. The UN General Assembly (UNGA) follows ISA activities closely. For example, every year the ISA Secretary General provides a report to the UNGA on the activities of the ISA in that year, the Oceans and Law of the Sea agenda item of the annual UNGA meeting always includes an item on DSM, as does the yearly report of the UN Secretary-General to the UNGA on Oceans and Law of the Sea. These are all available on the UNGA website.

#### 44.4.2.2 International Tribunal for the Law of the Sea

Established pursuant to LOSC Art. 287(1)(a) and operating according to its statute under LOSC Annex VI, the International Tribunal for the Law of the Sea (ITLOS), based in Hamburg, Germany, has 21 Judges who serve 9-year (re-electable) terms and are appointed by vote of the LOSC parties. LOSC Art. 186 established an ITLOS Seabed Disputes Chamber with 11 Judges. On DSM, the Chamber issued a pioneering Advisory Opinion (pursuant to LOSC Art. 191) on responsibilities and liabilities of states engaging in DSM (LOSC Art. 139), especially with regard to the marine environment, holding, *inter alia*, that all countries, regardless of their developmental status and financial and technical capabilities, must comply with LOSC/ISA DSM environmental regulations (International Tribunal for the Law of the Sea 2011).<sup>1</sup>

#### 44.4.2.3 International Maritime Organization

Headquartered in London, the International Maritime Organization (IMO; [www.imo.org](http://www.imo.org)) has promulgated and continues to develop and update an extensive suite of environmental and safety treaties for the global shipping community, on topics including (for environmental aspects) air pollution, anti-foulants, ballast water, chemicals, garbage, greenhouse gas emissions, noise, oil, pollution response, sewage and ship recycling (for an overview see, e.g., Verlaan 2008). The scope of the IMO's safety treaties is equally extensive. The IMO's rules implementing the treaties are usually legally binding and set minimum national standards, as do the treaties themselves. The IMO's treaties and rules govern the operation of ships that will engage in DSM. Cooperation between the ISA and IMO is formalized in a Memorandum of Understanding (MoU).

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<sup>1</sup>For an excellent scholarly overview of this groundbreaking opinion, see Freestone 2011.

#### **44.4.2.4 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter and Its 1996 Protocol**

Although its Secretariat is hosted by IMO, the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter and its 1996 Protocol (known as the London Convention and Protocol; LC/LP) constitute a separate and powerful environmental treaty system that is relevant to DSM. The LC/LP parties meet annually in London for a week, usually in the autumn. Their dedicated Scientific Groups also meet annually for a week, usually in the spring.

Although the LC/LP exclude “the disposal {or storage—LP} of wastes or other matter directly arising from, or related to the exploration, exploitation and associated off-shore processing of seabed mineral resources” (LC Art. III(1)(c); LP Art. 1(4)0.3), the LC/LP and the ISA share environmental concerns with regard to DSM that will benefit from cooperative approaches; an MoU between them is under discussion. Note also the recent work by the LC/LP and the Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) on the disposal at sea of land-based mine wastes (see, e.g., GESAMP 2015).

### ***44.4.3 Regional Institutional***

#### **44.4.3.1 South Pacific**

The ISA’s work informed the development of the Pacific/ACP States Regional Legislative and Regulatory Framework for Deep Sea Minerals Exploration and Exploitation (Secretariat of the Pacific Communities (SPC) and European Union (EU) 2012) and underpins the current work on the SPC/EU Pacific Island Regional Environmental Management Framework For Deep Sea Minerals Exploration And Exploitation (Secretariat of the Pacific Communities SPC and European Union EU 2016), to be completed in late 2016. For an overview of environmental management requirements in a commercial context (see Secretariat of the Pacific Communities SPC 2013). Although the study focuses on the South Pacific, the environmental advice is generally applicable. See <http://gsd.spc.int/dsm/index.php/publications-and-reports> for all.

#### **44.4.3.2 European Union**

The work of the European Union (EU) on DSM environmental management is also informed by the ISA’s activities. In addition to the South Pacific template legislation described above, MIDAS | Managing Impacts of Deep Sea Resource Exploitation, a multi-disciplinary EU-funded research program to investigate environmental impacts of extracting mineral resources from the deep sea, will develop recommendations for best practice in the mining industry and concomitant legislation. Set up

in November 2013 for 3 years, MIDAS has 32 European partners of scientists, industry, social scientists, lawyers, NGOs and Small/Medium-sized Enterprises; its final report is due in late 2016 (MIDAS 2016).

## 44.5 Central Management Instruments and Strategies

The ISA develops legally binding regulations governing DSM. So far these address the exploration for polymetallic ferro-manganese nodules (International Seabed Authority 2000/2013), cobalt-rich ferro-manganese crusts and polymetallic sulphides. The ISA is now developing exploitation regulations for these resources, in which it is employing an innovative international consultation process. Because the Area's resources are the common heritage of mankind, the ISA decided to consult mankind on how these resources are to be exploited and their proceeds allocated (see, e.g., International Seabed Authority 2015a; Center for International Law 2015). All responses to ISA consultations are on the ISA website.

The ISA sponsors research, workshops, and technical publications (see, e.g., International Seabed Authority 2011a) on DSM, all available on the ISA website. Much of the ISA's technical activity is channelled through its Legal and Technical Commission (LTC). Composed of 25 (in 2016) scientists and lawyers, and holding 2 week-long meetings annually (usually February and July) in Jamaica, the LTC has an increasingly heavy workload. For example, it reviews draft regulations and recommendations, examines and recommends actions by the ISA Council on applications for work in the Area, monitors and comments on the contractors' work in the Area through the annual reports the latter must submit (see, e.g., International Seabed Authority 2015b), and deals with the implementation of the extensive marine environmental protection duties imposed by the LOSC for DSM activities (see, e.g., International Seabed Authority 2001b/2010/2013).

The ISA's principal management challenge at present is the implementation of the LOSC's environmental requirements for DSM. It has developed extensive regulations, guidelines and recommendations accordingly, initially for exploration, which are kept under review to ensure that best practices are applied as they are created and evolve. Further instruments are now being developed for exploitation. Extensive environmental data are needed, to establish a baseline and to monitor operations during and after mining. The ISA must engage in both regional and local environmental management of the Area, including assessment and management of cumulative and local impacts of DSM (see, e.g., International Seabed Authority 2001a).

The areas requiring regional management are huge: for example, the 6-million-km<sup>2</sup> Clarion-Clipperton Zone (CCZ) in the Northeast Pacific Ocean, covers the currently most prospectively interesting DSM resource (polymetallic ferro-manganese nodules) in the world's oceans, and is likely to be the first part of the ABNJ to be mined. For an area the size of the CCZ, and with (as of 25 June 2016) 16 different contractors from 20 different countries, this is a daunting challenge. The ISA's CCZ Environmental Management Plan (International Seabed Authority 2011b; Lodge



et al. 2014) is the first international effort to address DSM on such a scale in an environmental context. Similar areas requiring ISA management are also found in the Atlantic and Indian Oceans. The temporal DSM environmental management scale is another challenge: biological processes in the deep sea are poorly known and extremely slow. After mine closure, for example, long-term (at least 15 years) monitoring of mined and control sites is likely to be needed.

## 44.6 Best Practices

- Wide-ranging, transparent consultations with stakeholders.
- Preservation reference zones and impact reference zones in mining areas.
- Large-scale collaborative international marine environmental research programs.
- Adaptive management principles applied to environmental impact assessment.
- Standardization of environmental data and information collection and reporting.
- Incorporation of environmental impact assessment in legislative framework to support precautionary approach during assessment and execution of DSM.
- Design of DSM methods and technology to minimize environmental impacts.

The Code for Environmental Management of Marine Mining developed by the International Marine Minerals Society ([www.immsoc.org/code](http://www.immsoc.org/code)) takes a useful approach to this rapidly evolving subject. It sets broad directions in a context of shared values (i.e., it does not prescribe specific practices), provides benchmarks to develop and implement environmental management plans, and offers advice on best fit-for-purpose environmental practices.

## 44.7 Status and Results of Management Efforts, Perspectives and Next Steps

The ISA decided (International Seabed Authority 2015c) to embark on its LOSC-mandated (Art. 154) operational review, as its current structure, staffing, and budget are under increasing strain from the burgeoning number of exploration licenses under its management (27 as of 15 December 2015, for the three currently most prospectively interesting categories of deep-sea mineral resources (i.e., nodules, sulphides and crusts), located over large swathes of the deep seabed in the Pacific, Atlantic and Indian Oceans). The exploration licenses are for 15 years; seven of these licenses, all for nodules in the CCZ, will expire in 2016 (6) and 2017 (1). Applications for extensions of these licenses are being received by the LTC, as per the requirements set by the LOSC for granting extensions to exploration licenses. The annual reports of the contractors conducting exploration under ISA license must also be reviewed by the LTC.

The exploitation regulations must be developed and adopted with some urgency, as DSM cannot begin without them, and several of the contractors hope to begin

exploitation within approximately the next seven years (as per May 2016). The next draft of the exploitation regulations is expected to be presented at the next annual meeting of the ISA in July 2016.

The ISA recognizes that its operations urgently need to be adjusted to cope with these growing demands. An interim report on the Art. 154 review will be presented to the ISA in July 2016, and the final report, including draft recommendations, in July 2017.

The issue of potentially conflicting activities in the Area is being addressed by the UN General Assembly, which on 19 June 2015 approved by UNGA Resolution A/RES/69/292 (currently available as A/69/L.65) a recommendation by the *Ad Hoc* Open-ended Informal Working Group [on] ..... Conservation and Sustainable Use of Marine Biological Diversity Beyond Areas of National Jurisdiction (BBNJ Working Group) the development of a third, legally binding, LOSC implementing agreement: this one is for conservation and sustainable use of marine biological diversity in BBNJ (<http://www.un.org/Depts/los/biodiversityworkinggroup/>). This instrument will regulate in ABNJ: marine genetic resources (including benefit-sharing); area-based management tools (e.g., marine protected areas, environmental impact assessments, capacity-building), and transfer of marine technology. The ISA will be intensively involved in these discussions.

Other useful aspects of the ISA's marine environmental management work for other emerging marine sectors to follow include: the elaboration of State environmental responsibility and liability rules, especially their equal applicability to all states regardless of their level of economic development; the practical application under conditions of great uncertainty of the precautionary approach; development of a realistic operational definition of *cumulative* environmental impact in light of the actual context, such as the extent of the area (e.g., in the CCZ: ~6 million km<sup>2</sup>), its spatial and temporal environmental variability (e.g., spatially, in the CCZ, E-W; N-S), and where and when mining will occur and over what part of a given concession.

At the regional and national level, it is important to ensure that the requirements for environmentally responsible DSM as promulgated by the ISA are translated into consistent, effective and fully implemented and enforced legislation that is no less effective than the ISA's requirements.

Early, sustained, pro-active, well-informed and constructive engagement at the international, regional and national levels by all stakeholders is essential.

The LOSC mining provisions and their implementation by the ISA are central to useful developments in law of the sea and international law for all emerging—and existing—marine activities.

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