Deep-sea mining: an introduction

The deep sea is the largest biome on Earth. It makes up 90% of the marine environment and plays a vital role in regulating our planetary systems, not least by absorbing and storing vast quantities of the carbon dioxide emitted into the air by human activity.

Broadly speaking, the deep sea consists of the water column below 200 meters and the seabed beyond continental shelves. It is one of the most inaccessible areas on Earth. Most of the diverse species and ecosystems it supports have adapted to the unique conditions of the deep ocean and are extremely vulnerable to human disturbance.

In addition to flora and fauna, the deep sea is also home to vast quantities of metal-rich mineral deposits. Some of these metals, such as copper, cobalt, nickel and manganese, are commonly used in industrial and electronic applications. The existence of these deposits, and the potential value of the metals they contain, makes the highly speculative new industry of deep-sea mining attractive to some.

However, in some quarters there is strong political interest to mine the deep sea in the international areas of the ocean.

There are also growing concerns about the impact that deep-sea mining could have if it commences, and about whether or how the industry could be managed to prevent damage to deep-sea ecosystems, as required under international law.

Scientific experts consider that biodiversity loss would be inevitable and irreversible if deep-sea mining were permitted (Deep-sea mining science statement, 2021; Niner et al., 2018). They urge extreme caution, due to the significant damage expected to fragile and vulnerable deep-sea ecosystems, which are both rich in biodiversity and already under stress from climate change impacts (Morato et al., 2020), bottom fisheries, pollution and plastics in the ocean (Chiba et al., 2018). Scientists also warn that deep-sea mining could risk disturbing some of the largest carbon sinks on the planet, along with the deep sea’s ability to buffer us from the worst impacts of climate change (Amon, Anderson & Levin, 2022).

State of play

Deep-sea mining is the process of retrieving mineral deposits from the deep seafloor. While experimental and exploratory work is already underway in various locations, deep-sea mining has never taken place at a commercial scale.
Studies have shown that even after small-scale experimental deep-sea mining events, carbon cycling in the deep has still not recovered after 26 years (de Jonge et al., 2020).

These concerns are supported by an increasing number of political leaders and institutions, businesses, banks and financial institutions, fisheries groups, civil society organizations and communities across the world who are calling for a pause, a moratorium, or a ban on deep-sea mining (Deep Sea Conservation Coalition, 2023).

Despite the high risks, lack of scientific knowledge, and widespread concern, the industry is lobbying hard for commercial mining contracts to be issued in the international seabed area. Thus, there is a real possibility that the deep ocean may very soon be opened up to mining.

**Threats**

There are three broad types of deep-sea habitats where metal-rich mineral deposits are formed: abyssal plains, seamounts, and hydrothermal vents. Mining activities are expected to have different impacts from site to site depending on the unique species and ecosystems in each of these habitats. If deep-sea mining is allowed to go ahead, the main threats would be:

**Destruction of deep-sea species, ecosystems and habitats:** While the technology to extract metal-rich mineral deposits is still under development, all methods currently being explored are expected to destroy habitat and ecosystems.

It is thought that the impact of polymetallic nodule mining may be even greater than expected, and could lead to an irreversible loss of ecosystem function (Simon-Liedó, 2019). In deep abyssal plains, each mining operation for polymetallic nodules is expected to strip mine 15,000 square kilometers of seabed over the course of a 30-year license, with the indirect impacts extending to or beyond 75,000 square kilometers per operation. If all 17 licenses within the Clarion Clipperton Zone, the first target area for deep-sea mining, were mined, an area the size of France could be directly impacted, destroying most of the life on, and just below, the seabed. The level and size of the operations could result in one of the largest impacts of any industrial activity on the planet (Smith et al., 2020; Back to Blue, 2022).

**Sediment disruption:** In the deep abyssal plains, mining could stir up sediment that has lain on the seabed for many thousands of years. The sediment plumes could drift far from the actual mining sites themselves, potentially smothering or killing filter feeders and other deep-sea species (Drazen et al., 2020).

**Wastewater:** Modelling by scientists indicates that the plumes of wastewater, sediment and residual metals discharged from ships during mining would flow hundreds of kilometers away from the mining sites. These plumes could impact ocean ecosystems at various depths. The metals they contain could prove toxic to some forms of marine life and, potentially, get into the marine food chain (Drazen et al., 2019).

**Noise and light pollution:** This would affect thousands of meters of the water column from the seabed to the surface. It could impact whales and other deep-diving or deep-dwelling animals that use noise and echolocation to communicate and find prey in the ocean’s depths (OceanCare, 2021).
Regulation

Deep-sea mining in the international areas of the world’s ocean is controlled by the International Seabed Authority (ISA), which was established in 1994 by the United Nations Convention on the Law of the Sea (UNCLOS). Comprising 167 Member States plus the European Union, the ISA is explicitly charged with ensuring the “effective protection” of the marine environment from deep-sea mining activities and with preventing damage to the flora and fauna of the seabed (UNCLOS, 1982, Article 145). If deep-sea mining is permitted by the ISA, according to UNCLOS, it must be done for the “benefit of mankind as a whole” (UNCLOS, 1982, Article 140), as opposed to only individual companies or countries.

However, the decision-making procedures, structure, and governance of the ISA are set up to facilitate mining. As a result, there is pressure within the ISA to adopt commercial mining regulations as fast as possible, without a clear understanding of what the environmental consequences may be (Deep Sea Conservation Coalition, 2022a).

Moreover, questions remain around who would benefit from deep-sea mining (Deep Sea Conservation Coalition, 2022b). While it may prove profitable to individual companies, current calculations of the economics of mining in deep abyssal plains, for example, suggest that the financial benefit from payments to each ISA Member State may amount to only a few hundred thousand dollars per contract each year (Roth, Kirchain & Peacock, 2020). The expenses of the ISA itself would likely be deducted from these royalty payments. Concerns over the ISA’s dual role as both a beneficiary and regulator of deep-sea mining led the UK’s House of Commons Environmental Audit Committee to conclude in January 2019 that it has a “clear conflict of interest” (House of Commons Environmental Audit Committee, 2019, p. 33). This concern has been consistently echoed by both governments and journalists (McVeigh, 2023).
Recommendations

Widespread concerns about the vulnerability of deep-sea habitats and ecosystems, the climate impacts, the scale and nature of proposed mining practices, the absence of sufficient information to conduct a thorough environmental impact assessment, lack of social license, and deficiencies in the ISA as a regulatory body combine to create a clear case that deep-sea mining should never begin. To achieve this and uphold international obligations for the protection of the marine environment, States should agree to a moratorium on deep-sea mining.

About the DSCC

The Deep Sea Conservation Coalition (DSCC) was founded in 2004 to address the need to prevent damage to deep-sea ecosystems and the depletion of deep-sea species on the high seas from bottom trawling and other forms of deep-sea fishing. The DSCC is made up of over 100 non-governmental organizations (NGOs), fishers organizations and law and policy institutes, all committed to protecting the deep sea.

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References


A small octopus near crinoid stalks. © NOAA