ORRAA Policy Brief:
Deep Seabed Mining

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Every time scientists explore the deep seabed, new species of animals and microbes are revealed. Their connections to the life in the water column above them remain a mystery. Knowledge about the quantity of carbon sequestered in the seabed has not yet been calculated. Less than a year ago, a profound discovery was announced: the deep sea is the second source of oxygen production, challenging the consensus that it is only produced through photosynthesis. The discovery of "Dark Oxygen" -oxygen produced in complete darkness on the deep ocean floor-[1] is one more example of how limited our understanding of the deep sea is.

We know more about the surface of the Moon than we do about the deep seabed.

The deep seabed also contains mineral deposits and metals in the form of polymetallic nodules, polymetallic crusts and sulphides. Interest in deep-seabed mining (DSM) has grown in recent decades, driven by a growing understanding of the distribution of seafloor mineral deposits, technological advancements that make exploration and exploitation more feasible, as well as increasing demand for metals.

Proponents of DSM aim to extract these deposits from the seafloor through large-scale industrial mining activity operating at depths ranging from 200 to 6,500 meters. Yet the scope of potential impacts, and the risks that such large-scale industrial extraction poses to these fragile habitats and the biodiversity in the water column above them, remain unknown.

The DSM regime is at a crossroads:

- The first half of 2025 has been marked by a contentious 30th Session of the International Seabed Authority (ISA), where the ongoing negotiations on DSM exploitation rules, economic benefit-sharing mechanisms, and internal governance issues took center stage.
- As of the United Nations Ocean Conference in June (UNOC3), a total of 38 countries are now calling for a moratorium or precautionary pause on DSM.
- An Executive Order signed by U.S. President Trump promotes DSM within and beyond national jurisdictions, with one mining company submitting an exploitation license in international waters through the US Seabed Mining Code.

[1] https://www.nature.com/articles/s41561-024-01480-8

Why is this important?

The vast majority of deep-sea marine scientists, and a growing list of 38 countries (as of August 2025), from Palau to France, are advocating for a DSM moratorium, a precautionary pause, or an outright ban. Given the scientific unknowns and potential collateral damage from opening the deep seabed to massive industrial extraction, as well as emerging climate, ocean and human rights risks, these countries argue for the application of a highly precautionary way forward.

DSM will likely face significant challenges, including technological failure, unforeseen expenditures, environmental risks, and costly litigation battles. Given these financial uncertainties and the scale of investment required, the projected returns appear uncertain –as do the potentially small and economically insignificant royalty payments that States would potentially receive from them[2]. The potential release of sequestered carbon and compounding already-existing threats to marine biodiversity from ocean heating, pollution and acidification, make DSM not environmentally or economically defensible.

In addition to these clear risks from DSM, a precautionary approach also presents opportunities. Pausing DSM could support stronger ocean governance, particularly of the high-seas. It could also help prioritise deep-sea research and support the development of partnerships on capacity building and technology transfer. Ultimately, a pause will strengthen the Ocean as living capital. By investing in its sustainability, we invest in our own health and the shift towards a regenerative and sustainable blue economy.

Growing Opposition

A 2022 report by the UN Environment Programme Finance Initiative (UNEP-FI) states that "**in their current form, there is no foreseeable way in which the financing of deep-sea mining activities can be viewed as consistent with the Sustainable Blue Economy Finance Principles"**.[3] The report provides a detailed overview of the potential reputational, regulatory and operational risks associated with DSM, and outlines how financial institutions should focus on alternative strategies such as reducing the environmental footprint of terrestrial mining and supporting a transition to a circular economy.

The International Capital Market Association and the International Finance Corporation echoed this in their Blue Bond Guidance[4], stating that investments in "non-renewable extractive industries (e.g. offshore oil and gas, dredging, and deep-sea mining) are therefore excluded" from the definition of the sustainable blue economy in supporting the issuance of credible blue bonds.

[2] https://www.sciencedirect.com/science/article/pii/S0308597X23000994?via%3Dihub
[3] https://www.unepfi.org/publications/harmful-marine-extractives-deep-sea-mining/
[4] https://www.icmagroup.org/assets/documents/Sustainable-finance/Bonds-to-Finance-the-Sustainable-Blue-Economy-a-Practitioners-Guide-September-2023.pdf

Recommendations

ORRAA echoes the concerns of a growing number of financial institutions, businesses, governments, scientists, and civil society organisations with regard to the lack of a full understanding of the environmental, social and economic risks of DSM. ORRAA is also concerned that robust regulatory frameworks are not in place to enable the International Seabed Authority to manage this activity in a transparent, accountable, inclusive, equitable and environmentally responsible manner. As such, ORRAA recommends:

- **Governments:** Support a precautionary pause on DSM until at least 2030 in 'the Area' (the seabed in areas beyond national jurisdictions); and not allow DSM within their jurisdictions. ORRAA country members, including Canada, Fiji, Palau and the UK, and observers Germany, France and Mexico, have officially supported a precautionary pause or an outright ban on DSM in international waters. Within their jurisdictions, Canada, Palau, the UK (Tristan de Cunha), and the USA (American Samoa, California, Guam, Hawaii, Oregon, Washington) do not allow DSM.

- **Private sector**: Financial institutions to develop policies to exclude financing or investing in companies involved in DSM[5], and other businesses to develop procurement policies that exclude deep-sea minerals from their supply chains.[6] Additionally, we recommend signing up to the Business Statement Supporting a Moratorium on Deep Sea Mining -led by ORRAA member WWF-, and the Global Financial Institutions Statement to Governments on Deep-Seabed Mining -led by the Finance for Biodiversity Foundation. ORRAA private sector members BNP Paribas, Deutsche Bank, Lloyds, Mirova, Salesforce and Standard Chartered have made formal commitments not to finance DSM or source from deep-sea minerals.

[5] Financial institutions' policies on DSM can be found here (Planet Tracker), and a list of DSM companies here (DSMC and WWF).
[6] In support of this, shareholders of publicly traded companies can leverage the power of stock ownership to promote dialogue and file resolutions under jurisdictional rules to support an exclusion on sourcing minerals from DSM.

A Deeper Dive

The International Seabed Authority

The legal framework for the regulation of DSM is dependent on whether deposits are located within or beyond national jurisdiction, as established under the UN Convention on the Law of the Sea (UNCLOS).[7] The "Area" encompasses over 60% of the ocean floor, is deemed the common heritage of humankind and is regulated by the International Seabed Authority (ISA). Part of the ISA's mandate is to "ensure the effective protection of the marine environment from harmful effects that may arise from deep-seabed related activities". This includes issuing contracts for both scientific exploration and future potential exploitation of mineral resources. Although commercial DSM has not yet begun, the ISA has entered into 15-year contracts for the exploration of mineral resources with 22 contractors, including countries and private companies.

ISA country members have divergent visions on whether to support a precautionary pause on DSM, on the content of the draft rules to address environmental impacts, the type and amount of royalties for mining rights, and how to monitor compliance, among other substantial issues. The most recent developments within the ISA are summarised in the following timeline:

- **2021:** The Pacific Island state of Nauru was the first country to seek permission from the ISA to begin commercial DSM. It triggered a provision for the ISA to establish, within two years, the rules, regulations, and procedures (RRPs) that would allow for DSM.

- **2023:** Not having met the two-year deadline, the ISA continued to work on creating the RRPs, with a "view to adopting" them in 2025.[8] However, a company could still seek ad hoc approval to mine the deep seabed despite the absence of regulations. The Metals Company stated that it would reserve the right to do so.

- **2025:** TMC USA (subsidiary of The Metals Company) submitted an application for an exploitation license in the international seabed. It was not through the ISA's regime, but through US domestic law, following the release of the US Executive Order "Unleashing America's Offshore Critical Minerals and Resources".[9] The ISA Secretary General's response was clear: "***Any unilateral action would constitute a violation of international law and directly undermine the fundamental principles of multilateralism, the peaceful use of the oceans and the collective governance framework established under UNCLOS".*** The ISA released a Q&A to clarify its position regarding these developments. With an agenda that focused on additional negotiations of the draft exploitation rules, the economic benefit-sharing mechanisms, and internal governance issues, the ISA's 30th Session did not accomplish the adoption of the rules.

[7] https://portals.iucn.org/library/sites/library/files/documents/2018-029-En.pdf
[8] https://www.isa.org.jm/wp-content/uploads/2023/07/2314552E.pdf
[9] https://www.whitehouse.gov/presidential-actions/2025/04/unleashing-americas-offshore-critical-minerals-and-resources/

The Fallacy of Clean Energy Demand

Arguments in support of DSM include the economic potential of these seabed resources for clean energy infrastructure and the potential environmental and social gains of scaling down land-based mining.[10] The reality, however, is that the deep-sea contains many of the most pristine, biodiverse, and poorly studied ecosystems on Earth. DSM risks degrading ocean ecosystems from the seabed to the water column, impacting food webs and fisheries that are key to food security and livelihoods, affecting the carbon storage potential of ocean sediments, and disrupting the newly discovered process of dark oxygen production.[11]

Building a new global energy system depends not only on scaling-up renewable energy, but also on developing less mineral-intensive technologies, finding a way to source and use the required minerals in a sustainable way that does not degrade nature or up-end existing carbon sinks. Advances in electric vehicle (EV) battery technologies are a notable example. These have led to the widespread use of EV batteries that do not use cobalt, nickel or manganese – the primary metals that mining companies seek to mine from the deep sea. These technologies now represent 40% of the global EV battery market [12], undermining arguments that DSM is necessary to support this growing market.

[10] https://www.irena.org/Publications/2023/Jul/Geopolitics-of-the-Energy-Transition-Critical-Materials
[11] https://www.nature.com/articles/s41561-024-01480-8
[12] https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-vehiclebatteries

Understanding the Opportunities of a Precautionary Pause on DSM

While the risks of DSM provide enough reasons not to start this industrial activity, we must also recognise the opportunities that come from choosing not to pursue it. An expert reflection paper by the Deep Sea Conservation Coalition[13] outlines four key opportunity areas:

1. Global Ocean Governance

A precautionary pause would allow the ISA to become a steward of the deep sea, meeting its obligations under international law to act on behalf and in the best interest of humankind as a whole. The need to protect the Ocean has been recently reaffirmed with the adoption of the Agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ Agreement, or High Seas Treaty). The ISA can help advance the implementation of this Agreement.

2. Deep-Sea Scientific Research

Relieved of its focus on mineral exploitation, a precautionary pause would allow the ISA to prioritise its mandate for advancing marine scientific research, spearheading the necessary multi-state deep-sea expeditions to study and map the vast abyssal floor and share the findings with the world. Thus, ISA's multilateral processes would leverage international collaboration for new deep-sea science, prioritising the participation of developing states and facilitating equitable knowledge-sharing.

3. Capacity-Building

Decoupled from the DSM agenda, the ISA could transform its approach to capacity-building and technology transfer into one that serves the interests of humankind. It could redirect efforts toward building scientific and technical capacity to increase understanding of deep-sea ecosystems and the essential benefits they provide, and to address the inequities in ocean science that undermine the participation of the Global South in global ocean governance.

4. Economics

The ISA could unlock significant economic opportunities by prioritising long-term sustainability over short-term gains. Investing in research to understand the economic value of deep-sea ecosystems, fostering durable economic development, and attracting reliable ocean finance would pave the way for a regenerative and sustainable blue economy. This approach would optimise sustainable ocean use, create high-quality jobs, preserve essential ecosystem services and protect the Ocean as living capital.

[13] https://deep-sea-conservation.org/wp-content/uploads/2025/04/Opportunities-for-the-ISA-under-a-Deep-Sea-Mining-Moratorium-Report.pdf

Understanding the Risks of DSM

From a purely financial perspective, DSM risks billions of corporate value. It is far more prudent to avoid DSM until its impacts are fully assessed and can be prevented.[14] DSM risks degrading ocean ecosystems, harming fisheries that we depend on, disrupting food webs, and reducing the Ocean's ability to store carbon. As our scientific understanding of deep-sea ecosystems grows, it becomes increasingly clear that we must leave the ocean floor undisturbed.

1. Financial risk and corporate value destruction

Multiple perspectives lead to the conclusion that DSM is not a financially sound decision. Planet Tracker[15] found that from a natural capital standpoint, preserving the planet's abyssal plains is worth at the very least ten times more than exploiting them. If companies mined polymetallic nodules, it could destroy USD$30-132 billion of corporate value. That is three to thirteen times the combined GDP of all Pacific Island Small Island Developing States. DSM is expected to significantly degrade ecosystem services and destroy value for humankind as a whole. These impacts are estimated to contribute to at least another USD$465 billion of value destruction, primarily as a result of habitat destruction.

Subsea mining equipment providers may see some gain, but the mining sector itself would face significant value destruction. This is due to high operational costs and increased capital costs for existing land-based mining, facing competition from DSM. Countries most dependent on mining these minerals on land risk USD560 billion in export earnings per year.[16]

2. Impacts on marine ecosystems

The deep sea contains many of the most pristine, biodiverse, and poorly studied ecosystems on our planet. DSM would result in physical damage to these systems – wherein mining vehicles on the sea floor impact habitat, seafloor structure, and non-mobile organisms such as sponges. It is unclear how long it takes a mined seabed to recover from the physical impacts alone.[17] A recent study evaluated a former 40-year-old DSM test site and found that mining tracks remained clearly visible, with impacts persisting over decades[18]. DSM also runs risks of broader ecosystem damage from the disturbance of sediments, which will impact water quality and turbidity. Discharged wastewater and sediments as part of the mining process result in plumes throughout the water column that can spread for miles,[19] possibly affecting biodiversity and fisheries. Finally, the noise and light pollution from DSM equipment and processes can negatively impact both fish and megafauna such as whales.

[14] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0320888
[15] https://planet-tracker.org/wp-content/uploads/2024/02/How-to-Lose-Half-a-Trillion.pdf
[16] https://planet-tracker.org/wp-content/uploads/2024/11/Miningfor-Trouble.pdf
[17] https://www.mdpi.com/2071-1050/13/9/5261
[18] https://www.nature.com/articles/s41586-025-08921-3
[19] https://www.greenpeace.org/usa/news/revealed-undercover-video-shows-deep-sea-mining-tests-tainted-by-pollution-and-flawed-monitoring/

3. Long-term species and fisheries disruptions

One of the most sought-after locations for DSM is the Clarion-Clipperton Zone (CCZ) in the central and eastern Pacific. In this area alone, scientists have identified more than 5,100 new animal species[20]. These play a crucial role by breaking down organic material and recycling nutrients, which contribute to the general health and productivity of marine food webs. The Pacific Ocean is also home to globally and locally important tuna fisheries, valued at over USD$7 billion annually[21]. New scientific evidence shows that as Pacific bigeye, skipjack and yellowfin tuna populations shift locations in a changing climate, this fishery and proposed DSM would significantly overlap,[22] with any unforeseen impacts putting the food security of Pacific islands and global commercial fisheries at risk.

Quantifying the exact impact of DSM on fisheries remains challenging. Planet Tracker estimates a significant negative impact, potentially reaching USD$344 million.[23] Recent studies have demonstrated the possible long-term ramifications of DSM on fisheries. In 2020, a Japanese research operation excavated a 120-meter stretch of cobalt on a seamount in the Pacific Ocean. A year later, they found that the density of fish and shrimp dropped by 43% in the area directly affected, and by 56% in adjacent areas.[24]

These impacts also have a human-rights angle. DSM might disproportionately affect Indigenous Peoples, small-scale fishers, and coastal communities. The uptake of heavy metals and toxins by marine animals and commercial fisheries may severely impact the rights to an adequate standard of health and food security of fisheries-dependent communities.[25]

4. Potential impacts on Ocean carbon sequestration

The Ocean is the world's largest carbon sink, playing a critical role in regulating the global climate. One component of the global carbon cycle is the sequestering of organic carbon in deep ocean sediments, facilitated by microscopic organisms. Disturbance of these sediments releases this stored carbon. We know that just bottom trawling in the fishing industry releases as much carbon dioxide every year as the entire aviation industry.[26] Further disturbance by DSM could accelerate this. In addition, the collective impacts of DSM on microbial ecosystem functions are not yet well understood, but it could impact carbon sequestration in deep-sea sediments.[27] In addition, the negative impacts on deep-sea biodiversity and ecosystems also affect their crucial role in carbon sequestration.[28]

[20] https://www.cell.com/current-biology/fulltext/S0960-9822(23)00534-1
[21] https://www.nature.org/en-us/about-us/where-we-work/asia-pacific/micronesia-polynesia/stories-in-micronesia-polynesia/saving-tuna-populations-in-the-pacific/#:~:text=The%20waters%20of%20the%20Western,almost%20%247%20billion%20each%20year.
[22] https://www.nature.com/articles/s44183-023-00016-8
[23] https://planet-tracker.org/wp-content/uploads/2024/02/How-to-Lose-Half-a-Trillion.pdf
[24] https://www.sciencedirect.com/science/article/abs/pii/S0960982223008151
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[27] https://aslopubs.onlinelibrary.wiley.com/doi/full/10.1002/lno.11403
[28] https://www.ohchr.org/sites/default/files/documents/issues/environment/srenvironment/activities/policy-brief-dsm-1-sre.pdf

Key Resources

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Learn More About ORRAA here.

The Ocean Risk and Resilience Action Alliance (ORRAA) is the only multi-sector collaboration connecting the finance and insurance sectors, governments, multilateral organisations, civil society, and local partners, to pioneer finance and insurance products that incentivise investment into coastal and ocean resilience, and through Nature-based Solutions.

The mission, by 2030, is to activate at least USD$500 million of investment to build the resilience of 250 million climate-vulnerable coastal people in the Global South.

ORRAA is delivering system-wide change by growing an investable product pipeline and generating the transformative investment instruments, vehicles and policies that contribute to a regenerative and sustainable blue economy. These solutions enable coastal communities and the Ocean to adapt and thrive, creating greater economic, social and cultural resilience.

To learn more about ORRAA, please visit our website: oceanriskalliance.org
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