Congressional Research Service
Informing the legislative debate since 1914

Seabed Mining in Areas Beyond National Jurisdiction: Issues for Congress

Updated October 23, 2024

Congressional Research Service
https://crsreports.congress.gov
R47324

CRS REPORT
Prepared for Members and
Committees of Congress

Congressional Research Service
Informing the legislative debate since 1914

SUMMARY

R47324

October 23, 2024

Caitlin Keating-Bitonti
Specialist Natural Resources Policy

Seabed Mining in Areas Beyond National Jurisdiction: Issues for Congress

Some scientists estimate that certain mineral deposits, including those containing critical minerals, are more abundant on the seafloor than on land. This estimate, coupled with the demand for critical minerals for rapid deployment of energy transition technologies, has increased interest in the recovery of minerals from areas beyond national jurisdiction (ABNJ). Minerals may be extracted through *seabed mining*, a process that involves recovering minerals from the seafloor. Although some entities hold contracts to explore the seafloor for potential commercial recovery, deep-seabed mining (i.e., mining activities taking place at water depths greater than 200 meters) in ABNJ has yet to occur.

The potential of seabed mining in ABNJ raises several issues for Congress given the United States' demand for critical minerals and concerns about potential environmental impacts.

International and U.S. Context for Seabed Mining in ABNJ

The International Seabed Authority (ISA), established under the 1982 United Nations Convention on the Law of the Sea (UNCLOS), is an autonomous organization that regulates parties to UNCLOS conducting mineral-related activities in ABNJ. The ISA can issue contracts for exploration and exploitation of seabed mineral resources to parties to UNCLOS. In 2021, the Republic of Nauru, a small island country northeast of Australia, notified the ISA of its sponsorship of Nauru Ocean Resources and its intention to recover minerals from an ABNJ in the Pacific Ocean. Nauru's action triggered a provision that compelled the ISA to establish by summer 2023 a mining code that would allow for deep-seabed mining. As of October 2024, the ISA has not finalized its mining code.

The United States has not ratified UNCLOS and therefore cannot sponsor companies seeking ISA contracts. However, the Deep Seabed Hard Mineral Resources Act (DSHMRA; P.L. 96-283), signed into law in 1980 prior to the establishment of the ISA, authorized the National Oceanic and Atmospheric Administration (NOAA) to regulate deep-seabed mining activities (exploration and commercial recovery) of U.S. citizens in ABNJ. To date, NOAA has issued licenses to U.S.-based companies to explore the seafloor in ABNJ; it has not received applications for commercial recovery permits.

Issues for Congress

Sourcing minerals from the deep sea may limit U.S. dependency on importing land-based minerals and reduce potential supply disruptions. Unless the United States either ratifies UNCLOS, which would allow it to seek ISA contracts, or unilaterally authorizes deep-seabed mining under DSHMRA, U.S. companies may not have a clear U.S. avenue to pursue seabed mining activities in ABNJ. In the 118th Congress, some Members of Congress proposed legislation that would support sourcing seabed minerals from allied countries and developing infrastructure to process and refine those minerals domestically (e.g., H.R. 7636, H.Res. 1082). A House Armed Services Committee report (H.Rept. 118-125), which accompanied its reported version of the National Defense Authorization Act for Fiscal Year 2024 (H.R. 2670), directed the U.S. Department of Defense (DOD) to produce a report assessing the processing of seabed resources domestically. H.R. 8070 in the 118th Congress similarly would direct DOD, along with an experienced entity, to assess U.S. capabilities for refining seabed minerals for defense applications. Congress also may consider ways in which domestic critical mineral supply chains could be bolstered through partnerships with countries that hold free trade agreements with the United States.

Concerns associated with seabed mining include habitat disturbance and biodiversity loss. Some of these concerns may be specific to the habitat, species, or mining approaches proposed for a mining site. Congress may seek to improve understanding of the potential environmental impacts associated with seabed mining. H.R. 4537, introduced in the 118th Congress, would authorize NOAA to enter into an agreement with the National Academies of Sciences, Engineering, and Medicine to "conduct a comprehensive study of the environmental impacts of mining activities on the deep seabed." With an improved understanding of potential impacts, Congress might consider amending DSHMRA to make deep-seabed mining regulations more applicable to modern mining technologies and to minimize impacts to the deep sea. Other legislative proposals would direct the President to place a moratorium on deep-seabed mining (e.g., H.R. 4536 in the 118th Congress). Some Members of Congress contend the ISA mining code "should only be adopted by the [ISA] on the basis of a comprehensive scientific understanding of, and consensus on, the potential risks and impacts of deep seabed mining on ocean ecosystems" (e.g., H.R. 4536 in the 118th Congress). Congress may consider the potential consequences of U.S. ratification of UNLCOS, such as how the United States could help shape ISA regulations through formal negotiation processes and U.S. sponsorship of ISA contracts.

Contents

Figures

Tables

Contacts

Introduction

Interest in mining the seabed in areas beyond national jurisdiction (ABNJ) for deposits that contain valuable minerals, such as critical minerals, has grown in recent years for a few reasons.[1] First, increased resources and improved technologies dedicated to the exploration and mapping of the deep sea have advanced knowledge of seafloor deposits that contain minerals of interest.[2] Second, the development of technologies for systems to collect seabed minerals from the deep ocean and deliver them to ships or surface-based mining platforms has made mining the seafloor more technologically possible and potentially economically feasible.[3] Third, some seabed deposits could present an alternative source of some minerals used in energy transition technologies that otherwise may rely on terrestrial minerals sourced in certain countries of concern.[4]

Different types of energy transition technologies rely on elements found in both terrestrial deposits and seafloor deposits (e.g., cobalt, copper, manganese, nickel).[5] Some scientists estimate these minerals of interest are more abundant in seafloor deposits than in land deposits.[6] For example, some batteries—including those that power electric vehicles—commonly use nickel, cobalt, and manganese.[7] Critical minerals used in the magnets of wind turbines, the motors of electric vehicles, and stationary energy storage also occur in seafloor deposits.[8]

[1] Section 7002 of the Energy Act of 2020 (Division Z, P.L. 116-260) codifies the methodology to be used by the Secretary of the Interior to determine a list of critical minerals. In 2022, the U.S. Geological Survey (USGS) published a list of 50 critical minerals. See, Department of the Interior, USGS, "2022 Final List of Critical Minerals," *87 Federal Register 10381* (February 24, 2022).

[2] For example, the expeditions of the National Oceanic and Atmospheric Administration (NOAA) ship *Okeanos Explorer* are devoted to research to better understand biological, chemical, and physical characteristics of the ocean, which may inform environmental baselines, ocean energy and mineral resource decisions, and marine hazard assessments. NOAA, "NOAA Ship *Okeanos Explorer*: 2022 Expeditions Overview," September 27, 2022, https://oceanexplorer.noaa.gov/okeanos/explorations/2022-overview/welcome.html.

[3] U.S. Government Accountability Office (GAO), *Science & Tech Spotlight: Deep-Sea Mining*, GAO-22-105507, December 15, 2021; Massachusetts Institute of Technology, "Deep Sea Mining," https://web.mit.edu/12.000/www/m2016/finalwebsite/solutions/oceans.html; and Rosanna Carver et al., "A Critical Social Perspective on Deep Sea Mining: Lessons from the Emergent Industry in Japan," *Ocean and Coastal Management*, vol. 193 (August 2020) (hereinafter, Carver et al., "Critical Social Perspective"). Some contend deep-seabed mining cannot be profitable due to the challenges of operating seabed mining machinery at depths of between 3,500 meters and 5,000 meters, under extreme water pressure and cold temperatures. For example, see Brandon Keim, "The Dubious Economic of Deep-Sea Mining," *Nautilus*, June 7, 2023, https://nautil.us/the-dubious-economics-of-deep-sea-mining-309597/.

[4] GAO, "Deep-Sea Mining Could Help Meet Demand for Critical Minerals, But Also Comes with Serious Obstacles," *WatchBlog*, December 16, 2021 (hereinafter, GAO, "Deep-Sea Mining Could Help Meet Demand for Critical Minerals"); GAO, *Science & Tech Spotlight: Deep-Sea Mining*, GAO-22-105507, December 15, 2021; Yasuhiro Kato et al., "Deep-Sea Mud in the Pacific Ocean as a Potential Resource for Rare-Earth Elements," *Nature Geoscience*, vol. 4 (2011), pp. 535-539 (hereinafter, Kato et al., "Deep-Sea Mud"); and International Energy Agency (IEA), *The Role of Critical Minerals in Clean Energy Transition*, 2022, p. 156 (hereinafter, IEA, *Role of Critical Minerals*).

[5] Minerals can be composed of single elements (e.g., copper) or a compound of elements (e.g., olivine). This report uses the term *mineral* for those composed of an element or a compound. Olive Heffernan, "Deep-Sea Dilemma," *Nature*, vol. 571 (2019), pp. 465-469; and Kato et al., "Deep-Sea Mud."

[6] For example, James R. Hein and Kira Mizell, "Chapter 8: Deep-Ocean Polymetallic Nodules and Cobalt-Rich Ferromanganese Crusts in the Global Ocean," in *The United Nations Convention on the Law of the Sea, Part XI Regime and the International Seabed Authority: A Twenty-Five Year Journey*, eds. Alfonso Ascencio-Herrera and Myron H. Nordquist (Leiden, The Netherlands: Koninklijke Brill NV, 2022), pp. 177-197, see p. 188.

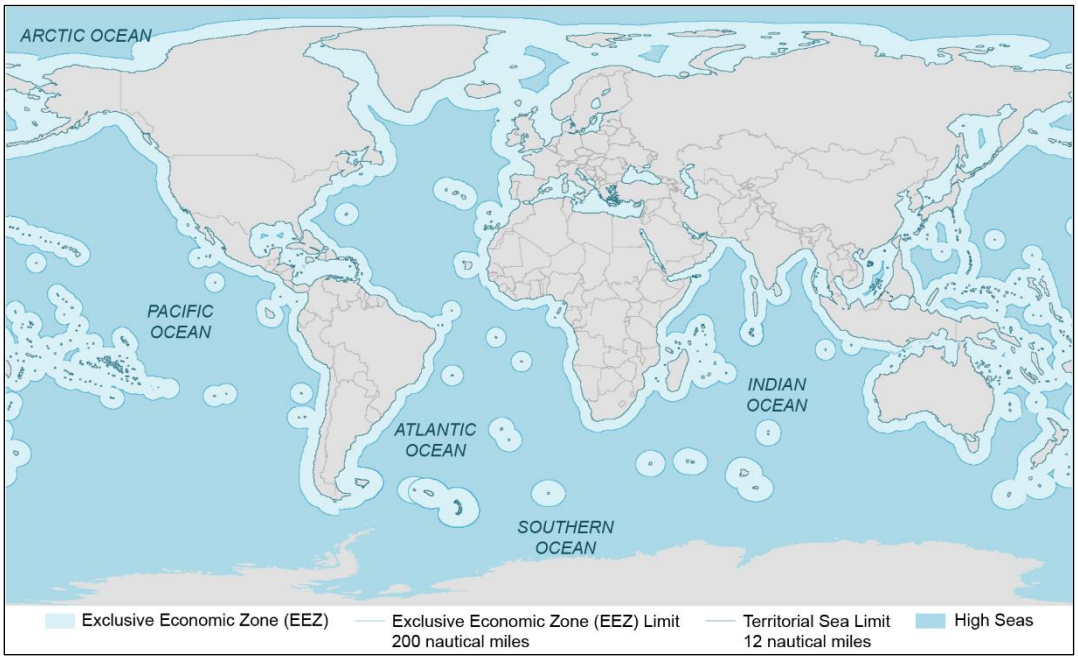
[7] IEA, Role of Critical Minerals, p. 5. For more information about critical minerals for energy technologies, see CRS Report R48149, *Critical Minerals and Materials for Selected Energy Technologies*, by Emma Kaboli.

[8] Ibid.

This report focuses on deep-seabed mining activities that could take place in ABNJ (**Figure 1**).[9] The report outlines the history of international agreements that establish guidelines and standards for deep-seabed mining activities and provide protection to the marine environment in ABNJ. It also outlines domestic regulations for U.S. interests pursuing seabed-mining activities in ABNJ. The report then discusses potential seabed mining impacts to ocean ecosystems. Finally, this report discusses issues for Congress, including U.S. participation in international agreements regarding deep-seabed mining, possible tradeoffs about domestic versus foreign supplied minerals, the potential for domestic processing of seabed minerals to bolster U.S. critical mineral supply chains, research to improve knowledge of environmental baseline data for deep-sea habitats, and calls for a moratorium on deep-seabed mining.

Figure 1. Illustration of High Seas and Exclusive Economic Zone Boundaries

High seas apply to areas beyond national jurisdiction (ABNJ)



Source: Illustration created by CRS using the Sovereign Limits database (sovereignlimits.com). Data are updated quarterly by the Sovereign Limits, and data used for this illustration were most recently updated on October 1, 2022.

Notes: Figure is an illustration and is not for official purposes of identifying ABNJs, exclusive economic zones (EEZs), or territorial sea limits. Boundaries of coastal countries' national jurisdictions (i.e., EEZs) are illustrated in light blue. Areas beyond national jurisdiction (i.e., the *high seas*) are illustrated in dark blue. As defined in the United Nations Convention on the Law of the Sea (UNCLOS), the territorial sea extends up to 12 nautical miles; the EEZ extends up to 200 nautical miles from the baseline of low sea level (usually near the coastline); and the high seas apply to "all parts of the sea that are not included in the [EEZ], in the territorial sea or in the internal waters of a State, or in the archipelagic waters of an archipelagic State" (see, UNCLOS Articles 3, 57, and 86). Peru claims a single maritime zone of 200 nautical miles, which it refers to as a *maritime domain*, not an

[9] The United Nations Convention on the Law of the Sea (UNCLOS) established national boundaries for coastal nations that extend to an adjacent *territorial sea*, which extends up to 12 nautical miles from the baseline of the coast of a nation. The territorial sea includes the *exclusive economic zone* (EEZ), which extends up to 200 nautical miles from the baseline of low sea level (usually near the coastline). See United Nations, *United Nations Convention on the Law of the Sea of 10 December 1982, Overview and Full Text*, https://www.un.org/depts/los/convention_agreements/convention_overview_convention.htm. Although the United States has not ratified UNCLOS, it generally has abided by the convention's terms, as dictated by Presidential Proclamation 5030. See "Proclamation 5030: Exclusive Economic Zone of the United States of America," 48 *Federal Register* 10605 (March 10, 1983).

EEZ; for the purposes of this figure, Peru is shown with an EEZ. Antarctica does not have a territorial sea or an EEZ because it is not a sovereign nation and its governance is carried by the Consultative Nations of the Antarctic Treaty.

Background on Seabed Mining

Seabed mining is a process of extracting sediment and mineral resources from the seafloor. In general, water depths less than 200 meters occur within nations' exclusive economic zones (EEZs), to which a coastal nation may claim sovereign rights for the purpose of exploring and exploiting the natural resources of its continental shelf.[10] Seabed mining activities occurring within a nation's EEZ are regulated by that nation's domestic law.[11] In the United States, the seaward boundary of coastal states is generally three nautical miles offshore,[12] and certain states and territories prohibit seabed mining within their waters (e.g., American Samoa, California, Hawaii, Oregon, Washington).[13] An emerging subset of seabed mining is *deep-seabed mining*, or *deep-sea mining*, which occurs at water depths of 200 meters or greater.[14] Water depths greater than 200 meters generally occur in areas beyond the EEZ. This report focuses on seabed minerals found beyond the outer continental shelf in ABNJ.

Deep-seabed mining was first explored in the 1960s, with commercial test mining for metal-rich nodules on the seabed starting in the 1970s.[15] In 1994, the International Seabed Authority (ISA) was created under the United Nations (UN) Convention on the Law of the Sea as an autonomous organization to regulate and control deep-seabed mining activities taking place in ABNJ.[16] The ISA can issue exploration and exploitation (i.e., commercial recovery) contracts for three types of deep-seabed mineral deposits (**Table 1**).[17] The technologies and machinery to extract raw seabed material vary depending on the type of mineral deposit (**Table 1**).[18] Once the seabed material is extracted, it would be transported to land for mineral processing.

[10] UNCLOS Article 77.1.

[11] The Bureau of Ocean Energy Management (BOEM) is the federal agency authorized to oversee mineral leasing in the U.S. outer continental shelf.

[12] Submerged Lands Act (43 U.S.C. §§1301 et seq.).

[13] Or. Rev. Stat. § 196.405 (1991); S.B. 5145, 67th Leg., Reg. Sess. (Wash. 2021); A.B. 1832, 2021–2022 State Leg., Reg. Sess. (Cal. 2022); S.B. 2575, 32nd Leg., Reg. Sess. (Haw. 2024); and Office of Governor Lemanu P.S. Mauga, Exec. Order No. 006-2024: An Order Implementing a Moratorium on Deep Seabed Mining Exploration and Exploitation Activities (Am. Sam. Jul. 24, 2024), https://www.americansamoa.gov/_files/ugd/4bfff9_cea25f51dcb84d0bbe5bbac7db513477.pdf.

[14] For example, International Union for Conservation of Nature (IUCN), *Deep-Sea Mining*, Issues Brief, May 2022, https://iucn.org/sites/default/files/2022-07/iucn-issues-brief_dsm_update_final.pdf. Hereinafter, IUCN, "Deep-Sea Mining").

[15] Helen Scales, *The Brilliant Abyss* (New York: Atlantic Monthly Press, 2021), p. 184.

[16] UNCLOS Article 156.

[17] International Seabed Authority (ISA), "Exploration Contracts," https://www.isa.org.jm/exploration-contracts/.

[18] Kathryn Miller et al., "An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps," *Frontiers in Marine Science*, vol. 4 (2018); and Helen Scales, *The Brilliant Abyss*, (New York: Atlantic Monthly Press, 2021), pp. 192-193.

Table 1. Types of Common Seabed Mineral Deposits and Proposed Mining Methods

Type of Seabed Mineral Deposit	Deposit Description	Minerals	Occurrences	Proposed Mining Method
Polymetallic Nodules	Precipitate as concentric thin layers around small, hard fragments (e.g., shark tooth) that have settled onto the seafloor. Over millions of years, the layers can accumulate to form potato-shaped rocks that range in size from 2 to 20 centimeters.	**Cobalt**, copper, **manganese**, and **nickel**; metallic **REEs**.	Abyssal plains, such as the Clarion-Clipperton Fracture Zone in the Pacific Ocean.	Remotely operated collector vehicle fitted with caterpillar-like tracks that uses a water stream aimed at nodules laying on the seafloor to create a pressure drop and suction effect to lift sediment with nodules into a collector system; autonomous underwater vehicle that hovers over the seafloor and uses robotic arms with a vision system to pick individual nodules from the seafloor.
Polymetallic Sulfides or Seafloor Massive Sulfide	Precipitate from hydrothermal fluids at hydrothermal vent sites, typically along seafloor spreading ridges.	Copper, gold, iron, lead, silver and **zinc**.	Mid-Atlantic Ridge, Red Sea, East Pacific Rise, Galapagos Rift, and Juan de Fuca and Gorda Ridges (located off the Pacific Northwest coast of North America).	Remotely operated mining machine that cuts and/or drills into the hard substrate of the hydrothermal vent chimney to extract internal minerals.
Ferromanganese Crusts or Cobalt-rich Crusts	Precipitate as crusts onto hard surfaces (e.g., rocks) from seawater rich in dissolved metals occurring in volcanically active regions, such as seamounts and ridges.	**Cobalt**, **manganese**, **nickel**, and **platinum**; metallic **REEs**.	All ocean basins. Also occur at shallower depths within countries' exclusive economic zones.	Remotely operated mining machine that scrapes across the surfaces of geologic features to remove surficial mineral crusts.

Sources: Allseas, "Hidden Gem," https://allseas.com/equipment/hidden-gem/; Department of the Interior, U.S. Geological Survey (USGS), "2022 Final List of Critical Minerals," 87 *Federal Register* 10381, February 24, 2022; Impossible Metals, Inc., "Robotic Collection System," https://impossiblemetals.com/technology/robotic-collection-system/; International Seabed Authority (ISA), "Minerals: Polymetallic Nodules," https://www.isa.org.jm/exploration-contracts/polymetallic-nodules; ISA, "Minerals: Polymetallic Sulphides," https://www.isa.org.jm/index.php/exploration-contracts/polymetallic-sulphides; ISA, "Minerals: Cobalt-Rich Ferromanganese Crusts," https://www.isa.org.jm/index.php/exploration-contracts/cobalt-rich-ferromanganese; Wendy Laursen, "The Nodule Collectors Are Lining Up, Ready to Go," Maritime Magazine, March 2024, https://www.maritimemagazines.com/offshore-engineer/202403/the-nodule-collectors-are-lining-up-ready-to-go/; Lisa Levin et al., "Defining 'Serious Harm' to the Marine Environment in the Context of Deep-Seabed Mining," *Marine Policy*, vol. 74 (2016), pp. 245-259; and The Metals Company, "Nodules," https://metals.co/nodules/.

Notes: REEs = rare earth elements. Critical minerals as determined by the USGS are bolded. These three types of seabed mineral deposits are of commercial interest. The list of minerals is not exhaustive and includes common minerals of commercial interest. Minerals may not all occur simultaneously in an ocean deposit and the quality and quantity of minerals within a deposit may vary geographically across the global ocean.

Regulations for Deep-Seabed Mining in Areas Beyond National Jurisdiction

Several international bodies and agreements address deep-seabed mining activities that could occur in ABNJ. Some of these regulate international exploration and exploitation of seabed minerals or provide guidance to prevent harm to the marine environment. The following sections describe the international bodies and agreements that regulate deep-seabed mining in ABNJ, as well as relevant U.S. domestic laws.

United Nations Convention on the Law of the Sea and the 1994 Agreement

In 1982, the UN Convention on the Law of the Sea (UNCLOS) established a framework governing activities on, over, and under the world's ocean. A recurring theme throughout UNCLOS is the "protection and preservation of the marine environment."[19] UNCLOS specifies that necessary measures be taken to protect the marine environment with respect to certain activities. For example, Article 145 states,

> Necessary measures shall be taken in accordance with this Convention with respect to activities in the Area to ensure effective protection for the marine environment from harmful effects which may arise from such activities. To this end the Authority shall adopt appropriate rules, regulations and procedures for *inter alia*:
>
> (a) the prevention, reduction and control of pollution and other hazards to the marine environment, including the coastline, and of interference with the ecological balance of the marine environment, particular attention being paid to the need for protection from harmful effects of such activities as drilling, dredging, excavation, disposal of waste, construction and operation or maintenance of installations, pipelines and other devices related to such activities;
>
> (b) the protection and conservation of the natural resources of the Area and the prevention of damage to the flora and fauna of the marine environment.

In 1982, the United States and some other industrialized countries did not sign the convention or announced they could not ratify it without important changes to Part XI of UNCLOS, which deals with deep-seabed resources in ABNJ.[20] UNCLOS refers to resources recovered from ABNJ as *minerals*, which includes all solid, liquid, or gaseous mineral resources as well as polymetallic nodules at or beneath the seabed.[21] UNCLOS also considers minerals collected from ABNJ as common heritage of mankind, meaning seabed resources are available for everyone's use and benefit, including Small Island Developing States, Landlocked Developing Countries, and Least

[19] For example, see UNCLOS's Preamble and Part XII: "Protection and Preservation of the Marine Environment."

[20] Bernard Gwertzman, "U.S. Will Not Sign Sea Law Treaty," *New York Times*, July 10, 1982, p. 5.

[21] UNCLOS Article 133.

Developed Countries.[22] The Reagan Administration was not comfortable with some of these seabed mining provisions.[23]

In 1994, the UN General Assembly adopted a resolution opening the Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea (the *1994 Agreement*), which amended UNCLOS Part XI by removing many of the provisions objectionable to industrialized nations.[24] Following the adoption of the 1994 Agreement, UNCLOS entered into force. In October 1994, President Clinton submitted UNCLOS and the 1994 Agreement as a package to the Senate for advice and consent to ratification. To date, the Senate has not ratified UNCLOS or the 1994 Agreement, but members of the executive branch have stated that some (but not all) portions of UNCLOS reflect customary international law.[25] For example, Presidential Proclamation 5030 established the EEZ of the United States in accordance with UNCLOS and "assert[ed] the sovereign rights and jurisdiction of the United States in its EEZ and confirm[ed] the rights and freedoms of all states, as provided under international law."[26]

International Seabed Authority

UNCLOS established the ISA, an autonomous organization that regulates and controls mineral-related activities in ABNJ for parties to UNCLOS.[27] According to the ISA, it has a "mandate to ensure the effective protection of the marine environment from harmful effects that may arise from deep-seabed-related activities."[28] Deep-seabed activities include exploration of the seabed and exploitation of seabed mineral resources. Parties to UNCLOS are ipso facto members of the ISA.[29] As a UN member nation, the United States has an observer delegate status at the ISA.[30]

As of October 2024, the ISA had issued 31 exploration contracts to public and private mining enterprises for seabed mineral resources.[31] The ISA has never rejected an application for an exploration contract.[32] The ISA has issued 17 exploration contracts for polymetallic nodules in the Clarion-Clipperton Zone (CCZ; **Figure 2**).[33] The CCZ is estimated to contain more copper, cobalt, nickel, and manganese than all known land deposits combined.[34] Because the United

[22] UNCLOS Articles 136, 140, and 141.

[23] Bernard Gwertzman, "U.S. Will Not Sign Sea Law Treaty," *New York Times*, July 10, 1982, p. 5.

[24] For more information about UNCLOS implementing agreements, see CRS In Focus IF12578, *Implementing Agreements Under the United Nations Convention on the Law of the Sea (UNCLOS)*, by Caitlin Keating-Bitonti and Matthew C. Weed.

[25] In the past, some Members of Congress have expressed concerns regarding the ability of an international organization to regulate a commercial activity (i.e., deep-seabed mining) and distribute revenues from such activity.

[26] "Proclamation 5030: Exclusive Economic Zone of the United States of America," 48 *Federal Register* 10605 (March 10, 1983).

[27] ISA, "About ISA," https://www.isa.org.jm/about-isa/.

[28] Ibid.

[29] As of October 2024, the ISA had 170 members (169 states and the European Union). The lists of ratifications of, accessions and successions to UNCLOS and related Agreements can be viewed at http://www.un.org/Depts/los/reference_files/chronological_lists_of_ratifications.htm.

[30] The U.S. delegation to the ISA includes representatives from the Department of State's Bureau of Oceans and International Environmental and Scientific Affairs, NOAA, BOEM, and USGS.

[31] ISA, "Exploration Contracts," https://www.isa.org.jm/exploration-contracts/.

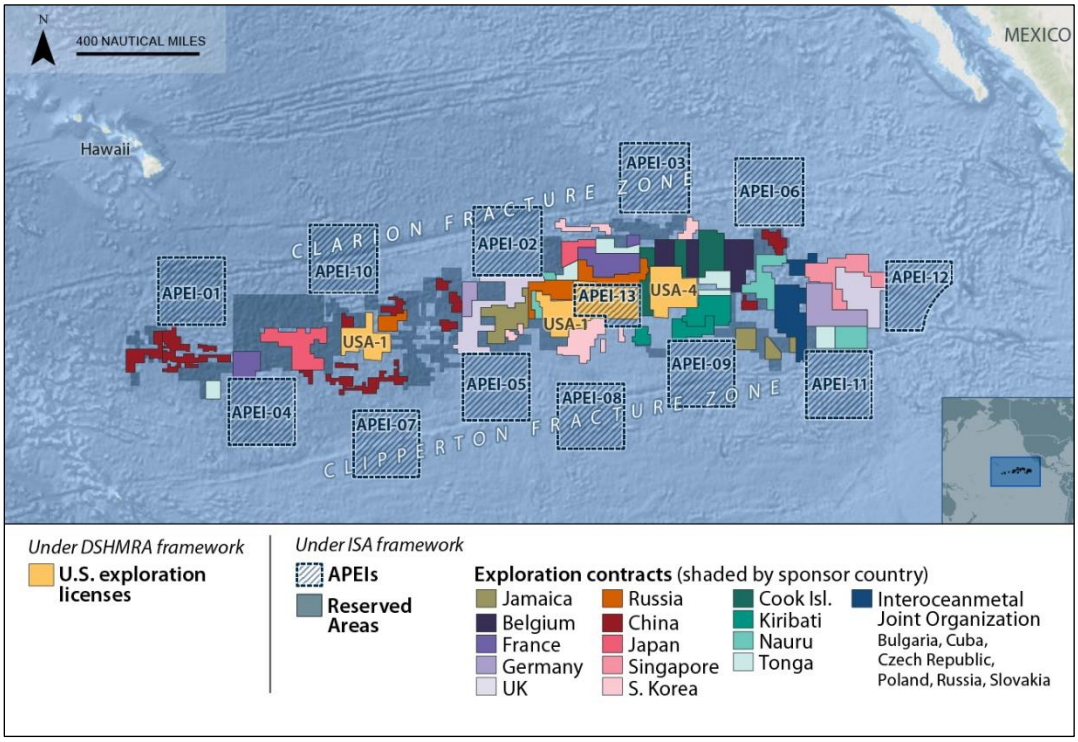
[32] Greenpeace, "Media Briefing: International Seabed Authority 29th Session," July 16, 2024, https://www.greenpeace.org.uk/news/media-briefing-international-seabed-authority-29th-session/.

[33] See CRS Infographic IG10053, *Seabed Mining in the Clarion-Clipperton Zone*, by Caitlin Keating-Bitonti, Corrie E. Clark, and Emma Kaboli.

[34] For example, Olive Heffernan, "Deep-Sea Dilemma," *Nature*, vol. 571 (2019), p. 467.

States is not a party to UNCLOS, the United States cannot sponsor companies interested in seeking ISA contracts for exploration or exploitation of seabed mineral resources through the ISA system. Under domestic law, the United States has authorized exploration licenses to U.S.-based companies in the CCZ (see "Deep Seabed Hard Mineral Resources Act and Other Applicable U.S. Laws," below).[35]

Figure 2. Clarion-Clipperton Fracture Zone (CCZ)



Source: Map created by CRS using International Seabed Authority, "Maps," https://www.isa.org.jm/exploration-contracts/maps/; National Oceanic and Atmospheric Administration, *Deep Sea Mining: A Report to Congress*, 1995, p. 6; and ESRI.

Notes: APEI = Areas of Particular Environmental Interest, which refers to no-mining zones as designated by the International Seabed Authority (ISA) to protect the full range of biodiversity and habitats; DSHMRA = Deep Seabed Hard Mineral Resources Act (30 U.S.C. §§1441 et seq.); and UK = United Kingdom. Most commercial interest in deep-seabed mining focuses on the CCZ. The CCZ is approximately 1.7 million square miles (up to 3.4 miles beneath the ocean's surface), spanning an area as wide as the continental United States on the Pacific seafloor. Since 2001 ISA has awarded 17 exploration contracts for polymetallic nodules in the CCZ. In addition to APEIs, the ISA also designates reserved areas to ensure developing countries have access to mineral resources in areas beyond national jurisdiction. The National Oceanic and Atmospheric Administration (NOAA) issued two exploration licenses in the CCZ in 1984 that have been extended through June 2027 pursuant to DSHMRA. For more information about ISA exploration contracts and U.S. exploration licenses issued by the NOAA pursuant to DSHMRA in the CCZ and the duration of these contracts and U.S. licenses, see CRS Infographic IG10053, *Seabed Mining in the Clarion-Clipperton Zone*, by Caitlin Keating-Bitonti, Corrie E. Clark, and Emma Kaboli.

The ISA has yet to develop a regulatory regime for extraction of seabed minerals and therefore has not issued exploitation contracts. The issuance of exploitation contracts would include

[35] For more information about U.S. exploration licenses in ABNJ, see CRS In Focus IF12608, *U.S. Interest in Seabed Mining in Areas Beyond National Jurisdiction: Brief Background and Recent Developments*, by Caitlin Keating-Bitonti and CRS Infographic IG10053, *Seabed Mining in the Clarion-Clipperton Zone*, by Caitlin Keating-Bitonti, Corrie E. Clark, and Emma Kaboli.

information about mining operations and actions to minimize harm to marine habitats and species at the proposed site.[36] In 2014, the ISA began to draft standards and guidelines for exploitation of seabed minerals in ABNJ and initially set a self-imposed deadline of 2020 for the release of its "Mining Code," which was delayed due to the Coronavirus Disease 2019 pandemic.[37]

In June 2021, the Republic of Nauru, a small island country located northeast of Australia in the Pacific Ocean, notified the ISA of its sponsorship of Nauru Ocean Resources (a subsidiary of The Metals Company, a Canadian firm) and its intention to mine the CCZ by early 2026.[38] The Republic of Nauru claimed its efforts to mine the seabed would support the global transition to clean energy technologies and would help reduce carbon emissions.[39]

The Republic of Nauru's application triggered a legal provision within UNCLOS that compels the ISA to establish standards and guidelines for mining deep-sea resources while minimizing environmental risks.[40] According to the provision, commonly referred to as the *two-year rule*, the ISA must finalize its deep-seabed mining regulations within two years (i.e., by summer 2023).[41] The ISA did not meet this two-year deadline and pushed the deadline to 2025.[42] Outstanding matters to be considered within the ISA's regulations for exploitation of seabed minerals could include the following, for example:

- Threshold of environmental harm to apply when assessing applications, including knowledge of environmental baseline data
- Processes relating to the preparation and evaluation of environmental plans
- Monitoring programs
- Environmental performance guarantees
- Environmental compensation fund
- Adjacent coastal states and transboundary harm[43]

On August 2, 2024, the ISA Assembly elected Leticia Carvalho as the next Secretary-General of the ISA.[44] Carvalho is expected to start her term at the ISA in January 2024, replacing Michael

[36] ISA, "Protection of the Marine Environment," https://www.isa.org.jm/protection-of-the-marine-environment/.

[37] Ibid; and Helen Scales, *The Brilliant Abyss*, (New York: Atlantic Monthly Press, 2021), p. 187.

[38] ISA, "Letter Dated 30 June 2021 from the President of the Council of the International Seabed Authority Addressed to Members of the Council," ISBA/26/C/38, July 1 2021; and The Metals Company (TMC), "NORI-D Project – Nauru Ocean Resources Inc.," https://metals.co/nori/.

[39] Republic of Nauru, "Statement Delivered by His Excellency David Adeang, President of the Republic of Nauru at the 29th Session of the International Seabed Authority," July 30, 2024, https://www.isa.org.jm/wp-content/uploads/2024/07/National_Statement-by-H.E.-David-Adeang_ISA-Assembly.pdf.

[40] United Nations, Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, July 28, 1994, https://www.un.org/depts/los/convention_agreements/texts/agreement_part_xi/agreement_part_xi.htm. Hereinafter, 1994 Agreement.

[41] Pradeep Singh, "The Two-Year Deadline to Complete the International Seabed Authority's Mining Code: Key Outstanding Matters That Still Need to Be Resolved," *Marine Policy*, vol. 134, no. 104804 (2021).

[42] The ISA Council intends to adopt exploitation regulations during the 30th session of the ISA, which will take place in 2025. ISA, *Decision of the Council of the International Seabed Authority on a Timeline following the Expiration of the Two-year Period Pursuant to Section 1, Paragraph 15, of the Annex to the Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea*, ISBA/28/C/24, July 21, 2023, https://www.isa.org.jm/wp-content/uploads/2023/07/2314552E.pdf. Dates for the 30th Session of the ISA can be found at https://www.isa.org.jm/sessions/30th-session-2025/.

[43] Ibid.

[44] ISA, "ISA Assembly Elects Ms. Leticia Carvalho of Brazil as a New Secretary-General," August 2, 2024, https://www.isa.org.jm/news/isa-assembly-elects-ms-leticia-carvalho-of-brazil-as-a-new-secretary-general/.

Lodge, who is expected to complete his second four-year term as Secretary-General at the end of 2024.[45] Carvalho has been reported as saying commercial-scale deep-seabed mining should not start until environmental regulations are finalized, which could take several years.[46]

The London Convention

The principal international agreements that address marine pollution are the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, known as the *London Convention*,[47] and the 1996 Protocol to the London Convention, known as the *London Protocol*.[48] The United States is a party to the London Convention and is not a party to the London Protocol. Under Article XII of the London Convention, parties pledge to take measures to protect the marine environment against pollution. Included among the list of pollution sources are "wastes or other matter directly arising from, or related to the exploration, exploitation and associated off-shore processing of sea-bed mineral resources."

Deep Seabed Hard Mineral Resources Act and Other Applicable U.S. Laws

In 1980, Congress enacted the Deep Seabed Hard Mineral Resources Act (DSHMRA; P.L. 96-283) as an interim measure to allow U.S. citizens to proceed with seabed mineral exploration and recovery until an international regime was in place (i.e., UNCLOS).[49] The 96th Congress stated among the findings of DSHMRA that "the nations of the world, including the United States, will benefit if the hard mineral resources [, including nickel, copper, cobalt, and manganese,] of the deep seabed beyond limits of national jurisdiction can be developed and made available for their use."[50] Further, the 96th Congress stated the purposes of DSHMRA are to "encourage the successful conclusion of a comprehensive [UNCLOS],"[51] and to "assure that such exploration and recovery activities are conducted in a manner which will encourage the conservation of such resources, protect the quality of the environment, and promote the safety of life and property at sea,"[52] among others. For example, the act directed the National Oceanic and Atmospheric Administration (NOAA) to "expand and accelerate a program assessing the effect on the environment from exploration and commercial recovery activities," including the long- and short-term effects on deep-seabed species in ocean areas where deep-seabed mining activities likely would occur.[53]

DSHMRA establishes a framework for authorizing U.S. citizens to explore for and recover minerals from the seabed in ABNJ. Congress authorized NOAA to issue exploration licenses and

[45] Ibid.

[46] Todd Woody, "A Fraught Election Just Reshaped the Next Steps for Deep Sea Mining," *Bloomberg*, August 2, 2024, https://www.bloomberg.com/news/articles/2024-08-02/a-fraught-election-just-shaped-the-next-steps-for-deep-sea-mining.

[47] Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), London, December 29, 1972, in force August 30, 1975, 1046 UNTS 138.

[48] 1996 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Protocol), November 7, 1996, in force March 24, 2006, 36 ILM 1.

[49] 30 U.S.C. §1401(b)(3). The Deep Seabed Hard Mineral Resources Act (P.L. 96-283) refers to UNCLOS as the *Law of the Sea Treaty*.

[50] 30 U.S.C. §1401(a).

[51] 30 U.S.C. §1401(b)(1).

[52] 30 U.S.C. §1401(b)(4).

[53] 30 U.S.C. §1419(a).

commercial recovery permits to U.S. citizens for deep-seabed mining activities.[54] After NOAA receives an application by an entity seeking an exploration license or commercial recovery permit and before it issues the license or permit, NOAA is required to prepare and publish an environmental impact statement for its issuance of the license or permit.[55] The National Environmental Policy Act (42 U.S.C. §§4321-4347) is the source of the substantive requirements for preparing an environmental impact statement.

The lack of accession by the United States to UNCLOS does not preclude NOAA from issuing exploration licenses or commercial recovery permits pursuant to DSHMRA.[56] In 1984, NOAA issued exploration licenses for four sites located in the CCZ, predating the establishment of the ISA in 1994.[57] NOAA has not issued any exploration licenses since 1984, although the agency has approved extension requests. To date, two exploration licenses (USA-1 and USA-4), both held by Lockheed Martin, remain active pursuant to DSHMRA and in effect through June 2, 2027 (**Figure 2**).[58] NOAA has not issued commercial recovery permits under DSHMRA, and such activity is not anticipated in the near future.[59] Commercial recovery permits issued by NOAA may not be recognized by parties to UNCLOS, and it is possible the ISA could issue exploitation contracts to a company sponsored by a nation party to UNCLOS in the same area.[60] Without the United States being a party to UNCLOS, U.S. citizens issued licenses or permits by NOAA would have no legal recourse to protect their claim to explore and/or recover seabed minerals in ANBJ.

U.S. companies pursuing deep-seabed mining activities in ABNJ may be subjected to other U.S. federal laws, including the Marine Mammal Protection Act (16 U.S.C. §§1361-1423h). In addition, Section 109(e) of DSHMRA provides that any discharge of a pollutant from a vessel or other floating craft associated with deep-seabed mining activities is subject to the provisions of the Clean Water Act (33 U.S.C. §§1251-1387).[61]

Potential Marine Environmental Impacts of Seabed Mining

The potential effects of seabed mining on the marine environment remain incompletely understood. This is in part because commercial-scale deep-seabed mining in ABNJ has yet to occur.

[54] 30 U.S.C. §1412. 15 C.F.R. §970 and 15 C.F.R. §971.

[55] 30 U.S.C. §1419(d).

[56] Email correspondence between CRS and NOAA, November 23, 2022 (hereinafter, CRS correspondence with NOAA).

[57] The ISA became operational in 1996. For more information about NOAA-issued exploration licenses in ABNJ, see CRS In Focus IF12608, *U.S. Interest in Seabed Mining in Areas Beyond National Jurisdiction: Brief Background and Recent Developments*, by Caitlin Keating-Bitonti.

[58] NOAA, "Deep Seabed Mining: Approval of Exploration License Extensions," 87 *Federal Register* 52743, August 29, 2022.

[59] CRS correspondence with NOAA; and NOAA, "Deep Seabed Hard Mineral Resources Act," https://www.gc.noaa.gov/documents/gcil_dshmra_summary.pdf.

[60] CRS correspondence with NOAA.

[61] 30 U.S.C. §1419(e).

Seabed mining companies have worked with scientists to collect environmental and biological data in deep-sea areas with potential for mineral deposits.[62] These companies are collecting and sharing these data with the ISA—a requirement of ISA exploration contracts—in part to understand the potential impacts of seabed mining activities.[63] Although scientists have worked with seabed mining companies to establish *environmental baselines*, some stakeholders may perceive their scientific research as a potential conflict of interest.[64] While some may call for a third party or independent scientific institution to collect deep-sea data, this type of research may be cost prohibitive for such researchers.[65]

Mineral deposits occur across different ocean environments and would require different machinery and technology to collect seabed material (see **Figure 3** in the textbox, below), which means it may be challenging to extrapolate understanding of marine environmental impacts from one area of the ocean to another. Some potential seabed mining impacts to the marine environment are described below.

Some species inhabiting the deep sea live under cold conditions without sunlight and survive on little food.[66] To be successful under such conditions, deep-sea species have low metabolic rates—they move slowly, live for a long time, and take many years to reproduce.[67] In general, these traits mean species may be slow to recover from disturbances, making them potentially vulnerable to deep-sea exploitation activities, such as seabed mining, and making the deep-sea environment potentially susceptible to biodiversity loss.[68]

Sediment dispersal by seabed mining machinery disturbing seafloor deposits has the potential to impact environments immediate and adjacent to the mined area (see **Figure 3** in the textbox, below).[69] The distance to which sediment disperses through the water column primarily depends

[62] For example, TMC, "The Metals Company Partners with Global Research Institutions to Advance Deep-Sea Science Program," August 2020, https://metals.co/deepgreen-partners-with-global-research-institutions-to-advance-deep-sea-science-program/.

[63] ISA, Decision of the Council of the International Seabed Authority Relating to Amendments to the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area and Related Matters, ISBA/19/C/17, July 22, 2013; ISA, Decision of the Assembly of the International Seabed Authority Relating to the Regulations on Prospecting and Exploration for Polymetallic Sulphides in the Area, ISBA/16/A/12/Rev.1, November 15, 2010; and ISA, Decision of the Assembly of the International Seabed Authority Relating to the Regulations on Prospecting and Exploration for Cobalt-rich Ferromanganese Crusts in the Area, ISBA/18/A/11, October 22, 2012. The ISA stores and makes the data collected by seabed mining companies publicly available at https://data.isa.org.jm/isa/map/.

[64] For example, Elham Shabahat, "'Antithetical to Science': When Deep-Sea Research Meets Mining Interests," *Mongabay*, October 4, 2021, https://news.mongabay.com/2021/10/antithetical-to-science-when-deep-sea-research-meets-mining-interests/. Knowledge of the environmental baseline condition of a proposed site for seabed mining can be used to predict the effects of mining activities or assess the impacts to the marine environment.

[65] For example, Laura Ruth, "Gambling in the Deep-Sea," *EMBO reports*, vol. 7, no. 1 (2006), pp. 17-21.

[66] NOAA, "What Conditions Exist for Life in the Deep Ocean?," https://oceanexplorer.noaa.gov/facts/deep-habitat.html.

[67] Craig R. McClain et al., "Energetics of Life on the Deep Seafloor," *Proceedings of the National Academy of Sciences*, vol. 109, no. 38 (2012), pp. 15366-15371; and Robert Danovaro, "The Deep-Sea Under Global Change," *Current Biol*ogy, vol. 27, no. 11 (2017), pp. R461-R465.

[68] Holly Niner et al., "Deep-Sea Mining with No Net Loss of Biodiversity—An Impossible Aim," *Frontiers in Marine Science*, vol. 5 (2018) (hereinafter, Niner et al., "Impossible Aim"); and Daniel Jones et al., "Biological Responses to Disturbance from Simulated Deep-Sea Polymetallic Nodule Mining," *PLOS One*, vol. 12, no. 2 (2017) (hereinafter, Jones et al., "Biological Responses").

[69] Rahul Sharma, "Environmental Issues of Deep-Sea Mining," *Procedia Earth and Planetary Science*, vol. 11 (2015), pp. 204-211 (hereinafter, Sharma, "Environmental Issues"); Diva Amon et al., "Assessment of Scientific Gaps Related to the Effective Environmental Management of Deep-Sea Mining," *Marine Policy*, vol. 138 (2022), pp. 1-22 (hereinafter, Amon et al., "Assessment of Scientific Gaps"); Niner et al., "Impossible Aim"; and NOAA, *Deep Sea Mining: A Report to Congress*, 1995, p. 12 (hereinafter, NOAA, *1995 Report to Congress*).

on the presence of ocean currents and, if near the surface of the ocean, wave energy. Suspended sediment in the water column could reduce water quality and clarity. The dispersion of seafloor sediment may threaten certain groups of benthic (i.e., living on or within the seafloor) invertebrate organisms in specific ways:

- *Deposit feeders*, organisms that feed on organic matter that settled onto the seafloor, may be impacted by sediment diluting or burying their food resources.[70]
- *Suspension feeders* (also known as *filter feeders*), organisms that filter small food particles directly from the water, may be affected by suspended sediment clogging the water column.[71]

An additional concern for benthic organisms is that seabed mining machinery could crush, smother, or disperse them while disturbing their habitats.[72]

The removal of nodules and other hard mineral resources from the seabed also may impact species living or depending on these resources.[73] For example, some organisms require a hard surface, such as a mineral nodule, to attach their bodies to in order to live and grow. Some species of sponges and some microbes live on seabed nodules,[74] and a species of deep-sea octopus lays its eggs on sponges attached to seabed nodules.[75] Because deep-sea nodules form over millions of years,[76] their removal in an area of the seafloor could equate to the permanent loss of a part of the marine habitat that some deep-sea species depend on for their survival.[77]

Noise and vibration associated with seabed mining operations may affect the behaviors of marine mammals and other animals living near the ocean's surface.[78] Sound waves travel through the ocean approximately four times faster than they can travel through air and could increase the ambient background noise level in areas up to 500 kilometers away from the mining site, potentially impacting animals in that radius.[79] Noise pollution from mining operations may mask communication and echolocation sounds of cetaceans (whales, porpoises, and dolphins), affecting their abilities to detect and avoid predators and to find food and mates.[80] It also may cause temporary or permanent hearing loss in some marine mammals and may increase their stress levels.[81]

The processing of recovered seabed material at the ocean surface and its transport to land may have impacts near or at the ocean surface. For example, seabed material may be processed on a

[70] Sharma, "Environmental Issues."

[71] Ibid.

[72] Niner et al., "Impossible Aim"; and Sharma, "Environmental Issues."

[73] Levin et al., "Defining 'Serious Harm.'"

[74] Amon et al., "Assessment of Scientific Gaps."

[75] Autun Purser et al., "Association of Deep-Sea Incirrate Octopods with Manganese Crusts and Nodule Fields in the Pacific Ocean," *Current Biology*, vol. 26 (2016), pp. R1268-R1269.

[76] ISA, *Polymetallic Nodules*, 2022, https://www.isa.org.jm/wp-content/uploads/2022/06/eng7.pdf.

[77] Helen Scales, *The Brilliant Abyss*, (New York: Atlantic Monthly Press, 2021), p. 192.

[78] Christine Erbe et al., "The Effects of Ship Noise on Marine Mammals—A Review," *Frontiers in Marine Science*, vol. 6 (2019). Hereinafter, Erbe et al., "The Effects of Ship Noise on Marine Mammals—A Review." For an additional overview of noise and vibration impacts on marine animals, see CRS Report R47894, *Potential Impacts of Offshore Wind on the Marine Ecosystem and Associated Species: Background and Issues for Congress*, coordinated by Caitlin Keating-Bitonti.

[79] Rob Williams et al., "Noise from Deep-Sea Mining May Span Vast Ocean Areas," *Science*, vol. 377 (2022), pp. 157-158.

[80] Erbe et al., "The Effects of Ship Noise on Marine Mammals—A Review."

[81] Ibid.

production support vessel (PSV) or surface-based mining platform and seafloor sediment discarded back into the ocean may cloud the near surface water column (see **Figure 3** in the textbox, below), potentially inhibiting photosynthesis in some plankton.[82] Collected seabed material and water also may potentially overflow off the PSV or mining platform.[83] In addition, ship traffic associated with seabed mining operations may pose a threat to animals living near the ocean's surface. The increased potential for a vessel strike is one concern.[84] Another concern would be the discharge of ballast water and other wastes, including marine debris, from mining vessels.[85]

Some extractive activities (e.g., seabed mining) could disturb the natural processes (i.e., microbes) that regulate carbon in the deep sea in addition to existing carbon buried in deep-sea sediments.[86] Some scientists speculate that activities that affect carbon burial in sediments could have "far-reaching effects on carbon sequestration that in turn is connected to climate regulation,"[87] and others have stated that "deep seabed mining may be directly at odds with current climate goals if such regulatory services [provided by microbial communities] are degraded."[88] Other stakeholders state that the scale at which seabed mining would take place would have minimum impact on net deep-sea carbon storage.[89]

Proponents of seabed mining that is "properly managed with appropriate governance safeguards" argue that sourcing minerals from the deep sea has the potential to have less pollution (e.g., tailings, waste), impacts on freshwater sources, and social impacts (e.g., human fatalities, injuries, health effects) compared with traditional land-based open-pit and underground mining.[90] Instances of terrestrial mining have been associated with drinking water contamination, air pollution, and alteration of landscapes, among other impacts.[91] The potential primary impacts of seabed mining would be on the marine organisms and ocean carbon storage, which could have secondary effects on humans.

---

[82] Sharma, "Environmental Issues."

[83] For example, ISA, *CARMUS Inspection Report 01/2023*, February 21, 2023, pp. 33-34, https://www.isa.org.jm/wp-content/uploads/2023/02/ISA_inspection_report_NORI_mining_collector_system_test.pdf.

[84] NOAA, "Understanding Vessel Strikes," https://www.fisheries.noaa.gov/insight/understanding-vessel-strikes.

[85] For example, PEW, "Vessel Waste a Growing Challenge in the Northern Bering Sea and Bering Strait," October 10, 2018, https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2018/10/vessel-waste-a-growing-challenge—in-the-northern-bering-sea-and—bering-strait.

[86] For example, Kathryn Miller et al., "Challenging the Need for Deep Seabed Mining From the Perspective of Metal Demand, Biodiversity, Ecosystem Services, and Benefit Sharing," *Frontiers in Marine Science*, vol. 8 (July 2021), pp. 1-7, see p. 4 (hereinafter Kathryn Miller et al., "Challenging the Need for Deep Seabed Mining"); and Beth Orcutt et al., "Impacts of Deep-sea Mining on Microbial Ecosystem Services," *Limnology and Oceanography*, vol. 17, no. 7 (2020), pp. 1489-1510, see p. 1499 (hereinafter Beth Orcutt et al., "Impacts of Deep-sea Mining on Microbial Ecosystem Services").

[87] Kristen F. Thompson et al., "Seabed Mining and Approaches to Governance of the Deep Seabed," *Frontiers in Marine Science*, vol. 5 (December 2018), pp. 1-12, see p. 7. *Carbon sequestration* refers to the process of removing carbon dioxide from the atmosphere and storing it in carbon stocks (e.g., deep-sea sediments, soil, plant vegetation).

[88] Kathryn Miller et al., "Challenging the Need for Deep Seabed Mining," p. 4

[89] For example, Beth Orcutt et al., "Impacts of Deep-sea Mining on Microbial Ecosystem Services," p. 1499; and Seaver Wang, "No, Collecting Seafloor Metals Won't Wreck the Ocean Carbon Cycle," *The Breakthrough Institute*, July 9, 2024, https://thebreakthrough.org/issues/energy/no-collecting-seafloor-metals-wont-wreck-the-ocean-carbon-cycle.

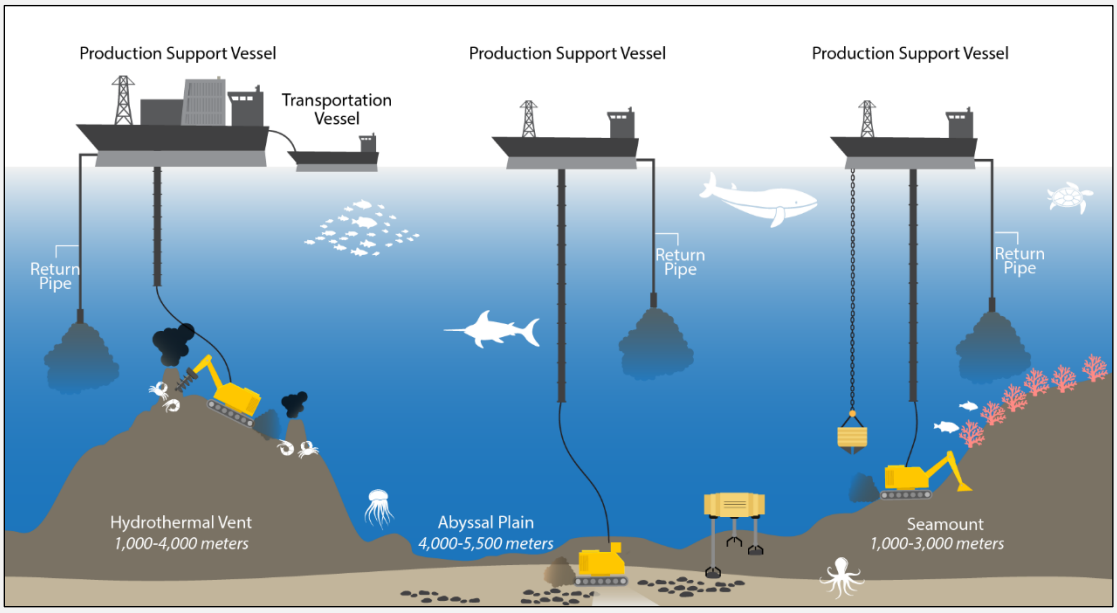
[90] For example, Daina Paulikas et al., "Life Cycle Climate Change Impacts of Producing Battery Metals from Land Ores versus Deep-Sea Polymetallic Nodules," *Journal of Cleaner Production*, vol. 275 (2020), p.17.

[91] For example, Aboka Yaw Emmanuel et al., "Review of Environmental and Health Impacts of Mining in Ghana," *Journal of Health and Pollution*, vol. 8 (2018), pp. 43-52.

Proposed Seabed Mining Operations

While no commercial-scale seabed operations currently take place in areas beyond national jurisdiction, **Figure 3** illustrates some of the machinery proposed to mine polymetallic sulfides deposits at hydrothermal vents, ferromanganese crusts at seamounts, as well as machinery and technologies proposed to collect polymetallic nodules from the deep-sea abyssal plain.

Figure 3. Proposed Machinery and Technology for Collecting Seabed Minerals



Source: Illustration created by CRS, modifying figure 4 in Kathryn Miller et al., "An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps," *Frontiers in Marine Science*, vol. 4 (2018) and using Allseas, "Hidden Gem," https://allseas.com/equipment/hidden-gem/; International Seabed Authority, *CARMUS Inspection Report 01/2023*, February 21, 2023, pp. 1-38, https://www.isa.org.jm/wp-content/uploads/2023/02/ISA_inspection_report_NORI_mining_collector_system_test.pdf; Impossible Metals, Inc., "Robotic Collection System," https://impossiblemetals.com/technology/robotic-collection-system/; and Wendy Laursen, "The Nodule Collectors Are Lining Up, Ready to Go," Maritime Magazine, March 2024, https://www.maritimemagazines.com/offshore-engineer/202403/the-nodule-collectors-are-lining-up-ready-to-go/

Notes: Proposed mining machinery, collection vessels, and autonomous underwater vehicles for seabed mining operations at hydrothermal vents, on the deep-sea abyssal plain, and at seamounts. Depths depicted in meters refers to the typical depth at which these seafloor features (and potential mineral deposits) are located below the surface of the ocean. Some seabed mining approaches require a production support vessel (PSV) and a transport vessel. A PSV launches the mining machinery or collector vehicle and provides power to it while operating on the seafloor. Collected seabed material is lifted via a riser pump to the PSV, where the desired seabed material would be separated from water and sediment. The water and sediment is returned to the ocean via a return pipe. A transportation vessel would ship the seabed material to land where it would be processed and refined into useable metals.

For polymetallic sulfides (or seafloor massive sulfide) deposits at hydrothermal vents, remotely operated mining machines have been proposed to cut and drill into the the hydrothermal vent chimney to crush and extract internal minerals. The resulting slurry (i.e., mix of water and crushed material) would be transported via a riser pump to a production support vessel (PSV). At the ocean surface, the fine crushed material would be separated from the water. The water and discarded material would be returned to the ocean at an unspecified water depth via a return pipe, creating a sediment plume at the discharged depth.

For ferromanganese crusts (or cobalt-rich crusts) at seamounts, remotely operated mining machines have been proposed to scrape across the surfaces of the seamount (or other geologic features) to remove surficial mineral crusts. The resulting slurry would be transported via a riser pump to a PSV. At the ocean surface, the fine crushed

material would be separated from the water. The water and discarded material would be would be returned to the ocean at an unspecified water depth via a return pipe, creating a sediment plume at the discharged depth. In addition, large whole rock material has been proposed be lifted in buckets to a PSV.

For polymetallic nodules, remotely operated collector vehicles fitted with caterpillar-like tracks use a water stream aimed at nodules laying on the seafloor to create a pressure drop and suction effect to lift sediment with nodules into a collector system. Some companies have proposed using sonar technology on the collector vehicles to identify the location of nodules. As a vehicle moves across the seafloor, a diffusor at the rear of the vehicle would emit seafloor sediment back into the environment, forming a sediment plume. The slurry (i.e., mix of water, sediment, and nodules) would be transported via a riser pump to a PSV. At the ocean surface, nodules would be separated and the sediment and water mix would be returned to the ocean at an unspecified water depth via a return pipe, creating a sediment plume at the discharged depth. One company has proposed an autonomous underwater vehicle (AUV) that hovers over the seafloor and uses robotic arms with a vision system to pick individual nodules from the seafloor. Once the AUV is full, it would return to the support vessel to offload nodules and have its battery recharged.

For each of these three seabed mineral deposits, the desired material would be transported to a processing and refining facility on land.

Source: Allseas, "Hidden Gem," https://allseas.com/equipment/hidden-gem/; Deep Sea Mining, "Mining Subsea Minerals – How It Works," https://deepseamining.ac/how_it_works; International Seabed Authority, *CARMUS Inspection Report 01/2023*, February 21, 2023, pp. 1-38, https://www.isa.org.jm/wp-content/uploads/2023/02/ISA_inspection_report_NORI_mining_collector_system_test.pdf; Impossible Metals, Inc., "Robotic Collection System," https://impossiblemetals.com/technology/robotic-collection-system/; Lisa Levin et al., "Defining 'Serious Harm' to the Marine Environment in the Context of Deep-Seabed Mining," *Marine Policy*, vol. 74 (2016), pp. 245-259; Wendy Laursen, "The Nodule Collectors Are Lining Up, Ready to Go," Maritime Magazine, March 2024, https://www.maritimemagazines.com/offshore-engineer/202403/the-nodule-collectors-are-lining-up-ready-to-go/; and The Metals Company, "Nodules," https://metals.co/nodules/.

Issues for Congress

Congress may be interested in how potential deep-seabed mining in ABNJ may impact deep-sea habitats and their species as well as demand for and U.S. importation of land-based minerals.[92] With respect to access to seabed minerals in ABNJ, Congress may consider the potential implications of the United States not being a party to UNCLOS or the potential benefits, or consequences, of the U.S. ratification of UNCLOS.

U.S. Importation of Land-Based Minerals and Seabed Mining Exploration Efforts by Selected Foreign Governments

Because critical minerals, including rare earth elements, can be found in land and ocean deposits, Congress could consider weighing the potential marine environmental impacts of seabed mining alongside the environmental impacts associated with terrestrial mining. Some may argue seabed mining could reduce U.S. dependency on importing certain land-based minerals, such as cobalt.[93] For example, a 2024 study by the U.S. Geological Survey (USGS) identified that China had a monopoly over cobalt battery materials.[94] China owns or finances mines in the Democratic

[92] For example, see USGS, *Mineral Commodity Summaries 2024*, January 31, 2024, pp. 1-212.

[93] For example, GAO, "Deep-Sea Mining Could Help Meet Demand for Critical Minerals;" and RAND, "Is Seabed Mining an Opportunity to Break China's Stranglehold on Critical Minerals Supply Chains?," November 21, 2022, https://www.rand.org/pubs/commentary/2022/11/is-seabed-mining-an-opportunity-to-break-chinas-stranglehold.html.

[94] According to the USGS, "in 2022 Chinese firms had control over 62% of cobalt mine materials primarily used for cobalt chemical refining, 95% control of refined commercial-grade cobalt chemicals, 92% control of battery-grade tricobalt tetroxide, 85% control of battery-grade cobalt sulfate, and 91% control of nickel–cobalt-manganese cathode (continued...)

Republic of the Congo, some of which have been associated with unsafe working conditions and forced labor.[95] Dependence on foreign sources of minerals may lead to U.S. uncertainties in supply ranging from cost instability to supply disruptions. Some stakeholders also may look to seabed mining to reduce dependence on sources with weak protective labor and environmental standards and practices.[96] In addition to seabed minerals as potential alternative sources for critical minerals, the Biden Administration identified recycling and recapture of minerals from waste or mine tailings as other options.[97]

Deep-sea resources may contribute to meeting the changing global demand for some critical minerals, such as cobalt. The ISA has issued 31 exploration contracts to public and private mining enterprises for seabed mineral resources.[98] Of these ISA exploration contracts, China currently holds five exploration contracts: three contracts for polymetallic nodules (two of these three are for the CCZ [**Figure 2**]); one contract for polymetallic sulfides; and one contract for cobalt-rich ferromanganese crusts. The Russian Federation currently holds four ISA exploration contracts: two contracts for polymetallic nodules located in the CCZ, one of which is a joint contract between six member nations of the ISA (**Figure 2**); one ISA exploration contract for polymetallic sulfides; and one ISA exploration contract for cobalt-rich ferromanganese crusts. Some Members of Congress have expressed concern about China's dominance of the global critical mineral market place, pointing to China's five ISA exploration contracts (the most of any country) and China's control over a large portion of terrestrial mines (located in China or Chinese-owned in other countries).[99] In addition to mining critical minerals, in 2022 China processed approximately 31% of the nickel, 74% of the cobalt, and 90% of rare earth elements extracted globally, including other critical minerals that may be found in seabed deposits (e.g., lithium).[100]

According to the Department of Commerce, the United States currently "lacks domestic processing and manufacturing capabilities for some critical minerals,"[101] including those derived from seabed deposits. In the 118th Congress, some Members proposed that domestic processing of seabed minerals could reduce U.S. dependence on critical minerals supplied by non-allied countries. For example, H.Rept. 118-125, the House Armed Services Committee report, which accompanied its reported version of the National Defense Authorization Act for Fiscal Year 2024 (H.R. 2670), directs the Department of Defense (DOD) to submit a report to the committee assessing the processing of polymetallic nodules domestically. The committee report notes that while the United States holds no ISA contracts, "there remains opportunity to evaluate domestic

precursor materials." Andrew L. Gulley, "The Development of China's Monopoly Over Cobalt Battery Materials," Mineral Economics (2024).

[95] Andrew L. Gulley, Erin A. McCullough, and Kim B. Shedd, "China's Domestic and Foreign Influence in the Global Cobalt Supply Chain," *Resources Policy*, vol. 62 (August 2019), pp. 317-323; and Eric Lipton and Dionne Searcey, "Chinese Company Removed as Operator of Cobalt Mine in Congo," *New York Times*, February 28, 2002 (hereinafter, Lipton and Searcey, "Chinese Company Removed").

[96] NOAA, *1995 Report to Congress*, p. 2.

[97] For example, White House, *Executive Order on America's Supply Chains: A Year of Action and Progress*, February 2022, see p. 16.

[98] ISA, "Exploration Contracts," https://www.isa.org.jm/exploration-contracts/.

[99] For example, Letter from U.S. Representative Robert J. Wittman and 30 other Members to U.S. Secretary of Defense Lloyd Austin, December 7, 2023, https://wittman.house.gov/uploadedfiles/20231207_-_wittmanstefanik_-_national_security_impacts_of_seabed_mining_-_signed.pdf.

[100] Rifat Jabbar et al., *Polymetallic Nodules and the Critical Mineral Supply Chain: A North American Approach*, Wilson Center and Hatch, 2022, p. 3, https://www.wilsoncenter.org/sites/default/files/media/uploads/documents/critical%20minerials_v2b.pdf. Hereinafter, Rifat Jabbar et al., *Polymetallic Nodules and the Critical Mineral Supply Chain*.

[101] U.S. Department of Commerce, *A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals*, June 4, 2019, p. 9, https://www.commerce.gov/sites/default/files/2020-01/Critical_Minerals_Strategy_Final.pdf.

processing and refining of seafloor resources from the contracts held by allied [UNCLOS] parties and domestic partners in international waters." Similarly, H.R. 8070 would direct DOD to study how domestic capabilities could be improved to refine polymetallic nodules for defense purposes.[102] As another example from the 118th Congress, H.R. 7636 would direct the President to direct certain federal departments to "coordinate and expedite across Federal agencies the development of infrastructure to process and refine seafloor [polymetallic] nodules within the United States." Some stakeholders have proposed Texas as a potential site for a smelting or refining facility for producing critical minerals from polymetallic nodules.[103] Some Members of Congress support a potential seabed mineral processing facility in Texas and have asked DOD to support The Metals Company's application for funding to develop a Texas processing facility.[104] For the United States to domestically process polymetallic nodules derived from ABNJ, the ISA would need to issue exploitation contracts. H.Res. 1082 introduced in the 118th Congress calls on the ISA to adopt exploitation regulations because the domestic processing and refining of critical minerals, including polymetallic nodules from the CCZ, is in the national interest of the United States.

Some countries with operating critical mineral processing facilities also have comprehensive free trade agreements with the United States. These countries may provide opportunities for collaboration enabling the United States to bolster U.S. critical minerals supply chains, including those potentially derived from seabed mining. For example, Colombia, the Dominican Republic, and South Korea have free trade agreements with the United States,[105] and each has an operating smelting facility.[106] Japan and the United States have concluded several limited trade deals, including a critical minerals agreement.[107] Japan has three operating smelting facilities.[108] The U.S. Treasury Department has designated Colombia, the Dominican Republic, Japan, and South Korea, among other countries,[109] as U.S. free trade agreement partners for the purposes of meeting critical minerals sourcing requirements in the clean vehicle tax credit under the Inflation Reduction Act of 2022 (IRA; P.L. 117-169).[110] Some companies may be interested in sourcing

[102] See section 1724 of the Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025.

[103] Rifat Jabbar et al., *Polymetallic Nodules and the Critical Mineral Supply Chain*, pp. 11-12.

[104] James Osborne, "Texas Congressmen Angling to have Deep-sea Mined Minerals Refined on the Gulf Coast," *Houston Chronical*, December 13, 2023, https://www.houstonchronicle.com/business/energy/article/deep-sea-minerals-gulf-coast-refinery-18540332.php. TMC's U.S. subsidiary, DeepGreen Resources, LLC, sought a $9 million grant under the Department of Defense's Defense Production Title III program (TMC, "TMC Commends U.S. House of Representatives for Allocating Defense Funding to Assess the Feasibility of Domestic Nodule Refining Capacity," May 23, 2024, https://investors.metals.co/news-releases/news-release-details/tmc-commends-us-house-representatives-allocating-defense-funding).

[105] Executive Office of the President, Office of the U.S. Trade Representative, "Free Trade Agreements," https://ustr.gov/trade-agreements/free-trade-agreements.

[106] Rifat Jabbar et al., *Polymetallic Nodules and the Critical Mineral Supply Chain*, p. 7.

[107] Japan is not generally considered a free trade partner outside of the Inflation Reduction Act of 2022. For more information about the U.S.-Japan Critical Minerals Agreement, see CRS In Focus IF12517, *U.S.-Japan Critical Minerals Agreement*, by Kyla H. Kitamura.

[108] Rifat Jabbar et al., *Polymetallic Nodules and the Critical Mineral Supply Chain*, p. 7.

[109] Allied or partner nations with free trade agreements with the United States also may be members of the ISA or hold ISA exploration contracts (e.g., South Korea, Singapore). For a list of countries with free trade agreements with the United States, see https://ustr.gov/trade-agreements/free-trade-agreements. Parties to UNCLOS are ipso facto members of the ISA.

[110] 26 U.S.C. §30D. For more information about the clean vehicle tax credit, see CRS In Focus IF12600, *Clean Vehicle Tax Credits*, by Donald J. Marples and Nicholas E. Buffie.

certain minerals derived from seabed mining in order to receive a clean vehicle tax credit under the IRA.[111]

U.S. Ratification of United Nations Convention on the Law of the Sea

The U.S. Senate might consider the ratification of UNCLOS.[112] In every Congress since the 115th Congress, some Members have introduced resolutions calling on the U.S. Senate to give its advice and consent to the ratification of UNCLOS.[113] Members of Congress and other stakeholders may call for the United States to join UNCLOS for several reasons related to deep-seabed mining issues. Some stakeholder proposed reasons for the United States to join or not join UNCLOS are discussed below.

Deep-Seabed Mining Activities in Areas Beyond National Jurisdiction

By ratifying UNCLOS, the United States would become a member of the ISA. As a member of the ISA, the United States could sponsor U.S. companies seeking ISA contracts. Currently, U.S. companies would have to establish a subsidiary in a nation party to UNCLOS to seek ISA contracts. For example, the United Kingdom (UK) arm of Lockheed Martin established UK Seabed Resources.[114] Through sponsorship of the UK of Great Britain and Northern Ireland, UK Seabed Resources held two ISA exploration contracts for polymetallic nodules in the CCZ.[115] On March 16, 2023, Loke Marine Minerals, a Norwegian company, acquired 100% of UK Seabed Resources.[116] This acquisition also included the transfer of UK Seabed Resources' two ISA-issued exploration contracts to Loke Marine Minerals (**Figure 2**).[117]

Some stakeholders who oppose U.S. ratification of UNCLOS contend that the United States already has the authority to explore and recover seabed minerals in ABNJ.[118] However, some U.S.-based companies may find it too risky to pursue NOAA exploration licenses for seabed mining in the absence of U.S. ratification of UNCLOS. Lack of accession by the United States to UNCLOS has not precluded NOAA from extending two DSHMRA exploration licenses to Lockheed Martin through 2027.[119] However, the ISA established an *Area of Particular Environmental Interest*—a no-mining zone that seeks to protect the full range of biodiversity and

[111] For example, see TMC, "Inflation Reduction Act Clean Vehicle Credit," August 2022, https://metals.co/inflation-reduction-act-clean-vehicle-credit/.

[112] To date, UNCLOS and the 1994 Agreement has been considered by Senate Committee on Foreign Relations three times (1994, 2003, and 2007).

[113] S.Res. 598 and H.Res. 339 in the 115th Congress; S.Res. 284 and H.Res. 454 in the 116th Congress; S.Res. 220 and H.Res. 361 in the 117th Congress; and S.Res. 466 in the 118th Congress.

[114] Reuters, "Lockheed Martin Sells Deep-Sea Mining Firm to Norway's Loke," March 16, 2024, https://www.reuters.com/markets/deals/norways-loke-buys-uk-deep-sea-mining-firm-lockheed-2023-03-16/.

[115] ISA, "Minerals: Polymetallic Nodules," https://www.isa.org.jm/exploration-contracts/polymetallic-nodules/.

[116] Loke Marine Minerals, "Loke Acquires Deep Sea Mineral Licenses in the Pacific Ocean," press release, March 16, 2023, https://lokemm.com/wp-content/uploads/LOKE-Press-release.pdf.

[117] Ibid.

[118] For example, see the Statement of Steven Groves, Bernard and Barbara Lomas Fellow, the Heritage Foundation, Washington, DC, in U.S. Congress, Senate Committee on Foreign Relations, *The Law of the Sea Convention (Treaty Doc. 103-39)*, 112th Cong., 2nd sess., May 23, June 14, and June 28, 2012, S.Hrg. 112-654 (Washington, DC: GPO, 2013), p. 191.

[119] NOAA, "Deep Seabed Mining: Approval of Exploration License Extensions," 87 *Federal Register* 52743, August 29, 2022.

habitats—that partially overlaps with one of the Lockheed Martin's DSHMRA exploration licenses (refer to USA-1 in **Figure 2**).[120] Conflicting claims between DSHMRA exploration licenses and ISA contracts could potentially deter financiers from backing U.S.-authorized deep-seabed mining projects.[121]

International Seabed Authority Decisionmaking

During the negotiation of the 1994 Agreement, one permanent seat on the 36-member ISA Council was created for the country "having the largest economy in terms of gross domestic product" on the date UNCLOS entered into force.[122] When UNCLOS entered into force on November 16, 1994, the United States had the largest economy. If the United States ratified UNCLOS, the United States would occupy the only permanent seat on the ISA Council.[123] The Council establishes ISA policies, proposes rules of procedure, enters into agreements with the United Nations or other international organizations, exercises control over activities occurring on or within the seabed in ABNJ (for parties to UNCLOS), and disapproves areas for exploitation, among other powers.[124] In general, the Council makes decisions by consensus for administrative, budgetary, and financial matters, including distribution fees.[125]

The United States could formally participate in negotiations on ISA matters if it was a member of the ISA. For example, negotiations are ongoing for ISA regulations for the exploitation of mineral resources in ABNJ.[126] Some stakeholders contend that the United States should ratify UNCLOS to formally participate in the development of these regulations.[127] According to the U.S. Department of State, as an observer delegate to the ISA, United States' input has been generally respected and accepted in the drafting of the ISA's exploitation regulations.[128] In a statement made at the ISA Assembly 29th Session, the United States stated "absent a regulatory framework as provided in [UNCLOS] to ensure effective protection of the marine environment, Article 145 would be an impediment to the commencement of mining activities."[129] Other matters, such as a mechanism for the equitable sharing of financial and other economic benefits derived from deep-seabed mining activities, have yet to be developed and adopted by the ISA.[130]

---

[120] Ibid.

[121] CRS correspondence with NOAA. Some financial institutions have made statements that they will not fund exploration and extraction activities associated with deep-seabed mining. For example, see Stop Deep Seabed Mining, "Endorsers," https://www.stopdeepseabedmining.org/endorsers/ (hereinafter, Stop Deep Seabed Mining, "Endorsers").

[122] Section 3, paragraph 15(a) of the Annex to the 1994 Agreement.

[123] For example, see U.S. Congress, Senate Committee on Foreign Relations, *The Law of the Sea Convention (Treaty Doc. 103-39)*, 112th Cong., 2nd sess., May 23, June 14, and June 28, 2012, S.Hrg. 112-654 (Washington, DC: GPO, 2013), p. 222. The permanent seat is currently occupied by Italy. ISA, "The Council," https://isa.org.jm/organs/the-council/.

[124] UNCLOS Article 162.

[125] Section 3, paragraphs 2 and 4 of the Annex to the 1994 Agreement.

[126] ISA, "The Mining Code," https://www.isa.org.jm/the-mining-code/draft-exploitation-regulations-2/.

[127] For example, Dan Ackerman, "Why the U.S. Is Absent from International Seabed Mining Talks," *NPR*, March 29, 2024, https://www.npr.org/2024/03/29/1241726831/why-the-u-s-is-absent-from-international-seabed-mining-talks.

[128] Telephone conversation between CRS and the U.S. Department of State, October 17, 2022.

[129] "Statement of the United States," International Seabed Authority Assembly 29th Session, July 2024, https://www.isa.org.jm/wp-content/uploads/2024/08/United-States-item7-31July2024.pdf. Hereinafter, U.S. Statement at ISA 29th Session, July 2024.

[130] See ISA, "A Collective Vision of a Shared Future," https://www.isa.org.jm/equitable-sharing-of-benefits/.

U.S. Federal Research to Study Seabed Mining Impacts and Associated Mining Technologies

Exploration of deep-sea habitats can provide baselines for understanding whether—and to what degree—these habitats and their species are vulnerable or resilient to disturbance or change. The United States has taken the position that "a robust understanding of the marine environment and the potential impacts of seabed mining activities on the ocean, impacted species and ecological communities, and the climate" is needed to inform the ISA's exploitation regulations.[131] NOAA's 1975-1980 Deep Ocean Mining Environmental Studies Project and subsequent projects through the 1990s as directed by Congress under DSHMRA were limited to the biological effects of increased sedimentation on the seafloor.[132] In more recent years, NOAA has collaborated with the Department of the Interior's Bureau of Ocean Energy Management (BOEM) and USGS to study a 1970s test site for seabed mining equipment on the Blake Plateau, offshore the Georgia coast, "to quantify the extent of the impacts, search for visual signs of ecosystem recovery, plan for additional research, and, ultimately, inform reviews, future decisions, and mitigation measures related to deep-sea mining in other areas."[133] Congress may consider directing and/or appropriating more funding to NOAA, BOEM, USGS, and other relevant agencies, to conduct additional exploration campaigns or research studies designed to establish environmental baseline data to inform seabed mining activities.[134]

Some stakeholders have called for the implementation of environmental safeguards before ISA permits deep-sea exploitation activities.[135] Other stakeholders point to the lack of environmental baseline data for deep-sea habitats as one reason to delay or ban deep-seabed mining in ABNJ.[136] Several technology companies (e.g., Apple, Google, and Samsung) and automakers (e.g., BMW, Volkswagen, Volvo) have announced support for a moratorium on seabed minerals being used in electric vehicle batteries and other technologies until seabed mining activities can be performed in a way that protects the marine environment.[137] More than 30 foreign governments also have called for a moratorium on deep-seabed mining. Although France holds an ISA exploration license in the CCZ (**Figure 2**), France is among the governments calling for a moratorium. France's State Secretary for the Sea has said that France will continue to hold its ISA contract and use it for "more research, more science, more data" to better understand the deep sea.[138] Some Members of Congress signed a letter urging President Biden to "support a precautionary pause or

[131] U.S. Statement at ISA 29th Session, July 2024.

[132] The Deep Ocean Mining Environmental Study conducted by NOAA as directed by Congress under DSHMRA (30 U.S.C. §1419(a)) focused primarily on determining the biological effects of increased sedimentation on the seafloor that would result from seabed mining operations. See, NOAA, *1995 Report to Congress*, p. 12.

[133] NOAA, "Investigation of a Historic Seabed Mining Equipment Test Site on the Blake Plateau," September 19, 2022, https://oceanexplorer.noaa.gov/explorations/22seabed-mining/welcome.html.

[134] For example, the research campaigns of the NOAA ship *Okeanos Explorer*. NOAA, "NOAA Ship *Okeanos Explorer*: 2022 Expeditions Overview," https://oceanexplorer.noaa.gov/okeanos/explorations/2022-overview/welcome.html.

[135] For example, IUCN, "Deep-Sea Mining"; and Deep Sea Conservation Coalition, "DSCC Position Statements on Deep Seabed Mining," July 2019, https://www.savethehighseas.org/wp-content/uploads/2019/08/DSCC-Position-Statement-on-Deep-Seabed-Mining_July2019.pdf.

[136] For example, Levin et al., "Defining 'Serious Harm'"; and Amon et al., "Assessment of Scientific Gaps."

[137] As of September 2024, 58 companies have signed a business statement calling for a moratorium on deep-seabed mining. See Stop Deep Seabed Mining, "Endorsers."

[138] Elizabeth Claire Alberts, "The Deep Sea Is Vital to Protect the Ocean: Q&A with France's Herné Berville," *Mongabay*, August 2, 2023, https://news.mongabay.com/2023/08/the-deep-sea-is-vital-to-protect-the-ocean-qa-with-frances-herve-berville/.

moratorium on deep-seabed mining until and unless there is sufficient scientific information and knowledge of the deep sea."[139] Some Members of Congress introduced H.R. 4536 in the 118th Congress instructing the President to direct U.S. representatives to international organizations (e.g., the ISA) to call for a moratorium on deep-seabed mining.

Some Members of Congress proposed legislation in the 118th Congress that could improve understanding of seabed mining impacts. For example, H.R. 4537 would authorize NOAA to enter into an agreement with the National Academies of Sciences, Engineering, and Medicine to "conduct a comprehensive study of the environmental impacts of mining activities on the deep seabed and the Outer Continental Shelf." With an improved understanding of these marine environmental impacts, Congress might consider how amending DSHMRA or other laws could ameliorate some of the potential negative effects on the ocean of U.S. licensed or permitted seabed mining activities.

Congress might consider how mining technologies for the recovery of seabed minerals has evolved since DSHMRA was enacted and amend relevant aspects of the law to better reflect the potential impacts these technologies could have on deep-sea habitats and deep-sea organisms.[140] For example, Impossible Metals, Inc., a U.S. seabed mining company, is developing an autonomous underwater vehicle (AUV) fixed with robotic arms and computer vision system that would hover over the seafloor to pick up individual polymetallic nodules.[141] Impossible Metals posits their AUV would have minimum sediment disturbance compared to other collection approaches and its computer vision could help avoid nodules with attached marine life.[142]

Congress may consider the level of funding to certain federal agencies that support the research and development of seabed mining technologies. Congress could determine if agencies should receive increased levels of funding to meet certain seabed mining objectives or if current funding levels are sufficient. For example, the Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E), authorized by P.L. 110-69 (commonly known as the America COMPETES Act), supports transformational energy technology research projects. ARPA-E has funded several projects related to seabed mining, including the design and development of technologies for seabed mineral collection and monitoring systems to assess sediment disturbance associated with seabed mining.[143]

[139] Letter from U.S. Representatives Grijalva, Case, Tlaib, Huffman, Norton, McCollum, Cohen, Lofgren, Jackson, Kamlager-Dove, Garcia, and Jayapal to President Biden, June 28, 2024, https://plus.cq.com/pdf/8043575.

[140] For example, the 96th Congress stated among the purposes of DSHMRA "to encourage the continued development of technology necessary to recover the hard mineral resources of the deep seabed." See 30 U.S.C. §1401(b)(5).

[141] Impossible Metals, Inc., "Robotic Collection System," https://impossiblemetals.com/technology/robotic-collection-system/.

[142] Impossible Metals, Inc., "Frequently Asked Questions (FAQS)," https://impossiblemetals.com/frequently-asked-questions/faqs-environmental-and-social-responsibility-for-deep-sea-mining/.

[143] Department of Energy (DOE), Advanced Research Projects Agency–Energy (ARPA-E), "Deep Reach Technology," https://arpa-e.energy.gov/technologies/projects/improved-nodule-collector-design-mitigate-sediment-plumes; DOE, ARPA-E, "Artimus Robotics," https://arpa-e.energy.gov/technologies/projects/low-cost-electronics-pressure-agnostic-actuators-driving-bio-inspired; and DOE, ARPA-E, "Sequoia Scientific," https://arpa-e.energy.gov/technologies/projects/real-time-situ-sensing-sediment-properties-environmental-monitoring-deep-sea.

Author Information

Caitlin Keating-Bitonti
Specialist in Natural Resources Policy

Disclaimer