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A Deep Dive into Private Governance of Deep-Sea Mining

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ABSTRACT

Modern, information-driven economies need rare-earth metals for everything from laptop computers to cellular phones. Society will require more of these metals for the solar panels, wind turbines, and storage batteries necessary to convert electricity systems to renewable energy. The deep sea contains large amounts of high-quality, rare-earth metals that companies and nations are increasingly interested in mining. The International Seabed Authority (ISA) is authorized under the United Nations Convention on the Law of the Sea (UNCLOS) to permit and regulate deep-sea mining of the seafloor outside of national jurisdiction (the "Area"), and the ISA is currently developing regulations to issue the first contract allowing deep-sea mining. Deep-sea ecosystems are, however, understudied, and their functioning, diversity, sensitivity, and value are poorly understood. As a result, the initial ISA regulations—intended to protect deep-sea ecosystems—may not effectively address all environmental harms associated with mining in these environments. This Note proposes that private environmental governance mechanisms, like supply chain contracts and credit agreements, can fill regulatory gaps as they emerge or extend regulations into national waters if deep-sea mining commences. Private environmental governance only requires agreement between contracting parties as opposed to the approval of a large, potentially contentious, regulatory body like the ISA. Thus, private contractual requirements can quickly fill gaps in or extend the ISA regulatory regime as new information on the environmental impacts of deep-sea mining emerges. If corporations in the retail, technology, or automobile industry recognize the importance of sustainable rare-earth metal production and consumption, they can contract to either find alternative, recycled sources for their technology or minimize the impact of their operations on the deep sea.

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The Intergovernmental Panel on Climate Change (IPCC) recommends limiting global warming to only 1.5˚C above pre-industrial temperatures.[1] At current greenhouse gas emissions, the IPCC predicts global temperatures will reach this threshold within the next ten to thirty years unless drastic preventive action is taken.[2] Renewable energy grids and electrified transportation, heating, and cooling systems have the potential to rapidly transition global

1. *Summary for Policymakers of IPCC Special Report on Global Warming of 1.5˚C Approved by Governments*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (Oct. 8, 2018), https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/ [https://perma.cc/NR3G-PMHF].

2. Jeff Tollefson, *IPCC Says Limiting Global Warming to 1.5˚C Will Require Drastic Action*, 562 NATURE 172, 172–73 (2018).

economies away from fossil fuels and lower greenhouse gas emissions.[3] The solar panels, windmills, and electric cars needed to transition society away from coal or natural gas power plants and internal combustion engines will require large amounts of rare-earth metals.[4] These metals—cobalt, molybdenum, and platinum, for example—are essential for photovoltaic cells to capture sunlight, for magnets within wind turbines, and for batteries capable of storing large amounts of energy for the days without sun or wind.[5] As a result, demand for these minerals is currently soaring.[6]

China dominates rare-earth metal mining and has historically mined and processed more than 95 percent of all rare-earth metals globally.[7] After China withheld supplies from Japan in 2017 in response to escalating diplomatic relations between the two countries, other countries and multinational corporations developed an interest in finding alternative sources of rare-earth metals.[8] Brazil, Malaysia, Australia, and parts of Greenland are all potential new sources.[9] Significant environmental problems are, however, associated with rare-earth metal mining and processing.[10] Open-pit mines disrupt the surface of local ecosystems and pollute surrounding areas.[11] Rare-earth metal deposits on land are also often bound in a matrix with other minerals, so mining operations must process the matrix after mining to

3. *Id.*; *see* David Roberts, *The Global Transition to Clean Energy, Explained in 12 Charts*, VOX, https://www.vox.com/energy-and-environment/2019/6/18/18681591/renewable-energy-china-solar-pv-jobs [https://perma.cc/7NQF-43HF] (June 26, 2019, 9:42 AM); Michael P. Vandenbergh & Jonathan M. Gilligan, *Forks in the Road*, 31 DUKE ENV'T L. & POL'Y F. 163, 167–71 (2020).

4. *See* Nicola Jones, *A Scarcity of Rare Metals Is Hindering Green Technologies*, YALE ENV'T 360 (Nov. 18, 2013), https://e360.yale.edu/features/a_scarcity_of_rare_metals_is_hindering_green_technologies [https://perma.cc/NEG6-9B6Q]; *Critical Mineral Commodities in Renewable Energy*, U.S. GEOLOGICAL SURV. (June 4, 2019), https://www.usgs.gov/media/images/critical-mineral-commodities-renewable-energy#Solar%20Panels [https://perma.cc/UUB5-FCYX].

5. *See* Jones, *supra* note 4.

6. *See id.*

7. Mike Ives, *Boom in Mining Rare Earths Poses Mounting Toxic Risks*, YALE ENV'T 360 (Jan. 28, 2013), https://e360.yale.edu/features/boom_in_mining_rare_earths_poses_mounting_toxic_risks [https://perma.cc/AJU5-3E8K].

8. *Id.*

9. *See id.*

10. Mass. Inst. of Tech., *Environmental Damage*, MISSION 2016: THE FUTURE OF STRATEGIC NATURAL RESOURCES, https://web.mit.edu/12.000/www/m2016/finalwebsite/problems/environment.html [https://perma.cc/9PRJ-4Q5E] (last visited Feb. 13, 2021).

11. *Id.*

isolate the rare-earth metals from other minerals.[12] This processing can generate large amounts of toxic byproducts that mining companies must properly treat and store.[13] As a result, many nations and companies are in search of alternative sources of abundant or higher quality rare-earth metals in attempts to generate competition in the metals market and lower the environmental costs of mining.[14]

The deep seafloor is likely the world's largest untapped source of high-quality rare-earth metals and may be a crucial source for the continued development and proliferation of renewable technologies.[15] Exploratory surveys suggest high-quality rare-earth metals are plentiful in at least three distinct habitats on the deep seafloor.[16] To mine these deposits, however, mining companies must develop technology that can operate at extreme depths in the most remote environments on the planet.[17]

Because so little is known about deep-sea ecosystems, the environmental consequences of deep-sea mining are difficult to predict.[18] Due to the challenges of studying remote and inhospitable environments—and the depths at which these ecosystems exist—the composition, diversity, and functions of deep-sea ecosystems are poorly understood relative to terrestrial and shallow-water ecosystems.[19]

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12. *See* Michael Standaert, *China Wrestles with the Toxic Aftermath of Rare Earth Mining*, YALE ENV'T 360 (July 2, 2019), https://e360.yale.edu/features/china-wrestles-with-the-toxic-aftermath-of-rare-earth-mining [https://perma.cc/9TWM-HSTG].

13. *See id.*

14. *See* Nils Zimmermann, *Your 2030 Electric Vehicle Is Parked on the Bottom of the Ocean*, DEUTSCHE WELLE (May 28, 2020), https://www.dw.com/en/your-2030-electric-vehicle-is-parked-on-the-bottom-of-the-ocean/a-53530969 [https://perma.cc/Y5FA-P86S].

15. *See id.*

16. *See* Kathryn A. Miller, Kirsten F. Thompson, Paul Johnston & David Santillo, *An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps*, FRONTIERS MARINE SCI., Jan. 2018, at 1, 2; Charles Roche, *Industrial Mining in the Deep Sea: Social and Environmental Considerations*, MIN. POL'Y INST. (May 14, 2015), http://www.mpi.org.au/wp-content/uploads/2015/05/May-2015-Duke-Uni-Webinar-Mining-the-sea-MPI-web-version.pdf [https://perma.cc/2CVZ-WP2Z].

17. *See* Kate Baggaley, *These Fearsome Robots Will Bring Mining to the Deep Ocean*, NBC NEWS, https://www.nbcnews.com/mach/innovation/these-fearsome-robots-will-bring-mining-deep-ocean-n724901 [https://perma.cc/P2GM-D3ED] (Feb. 27, 2017, 9:01 AM).

18. *See* Miller et al., *supra* note 16, at 2, 12.

19. *See* Wil S. Hylton, *History's Largest Mining Operation Is About to Begin*, ATLANTIC, https://www.theatlantic.com/magazine/archive/2020/01/20000-feet-under-the-sea/603040/ [https://perma.cc/N9QQ-2NUX](last visited Jan. 25, 2022); *How Much of the Ocean Have We Explored?*, NAT'L OCEAN SERV., https://oceanservice.noaa.gov/facts/exploration.html [https://perma.cc/KHF8-ZLNR] (Feb. 26, 2021); Holly J. Niner, Jeff A. Ardron, Elva G. Escobar, Matthew Gianni, Aline Jaeckel, Daniel O. B. Jones, Lisa A. Levin, Craig R. Smith, Torsten Thiele, Phillip J. Turner, Cindy L. Van Dover, Les Watling & Kristina M. Gjerde, *Deep-Sea Mining with No Net Loss of Biodiversity–An Impossible Aim*, FRONTIERS MARINE SCI., Mar. 2018,

Without a real understanding of environmental baselines and the resilience and recovery capacity of the ecosystems on the deep seafloor, scientists and environmental groups are concerned that deep-sea mining will have substantial, potentially devasting and permanent consequences on life in the deep sea.[20]

This Note details the possible legal mechanisms to limit the environmental impacts of rare-earth metal mining on deep-sea ecosystems. Part I provides background information on the metals needed for the global transition to renewable energy sources, the three deep seafloor habitats in which those metals are most abundant and of the highest quality, and the technology needed to mine them. Part II then introduces and analyzes the private, national, and international legal regimes that can impose environmental protections on the collection of rare-earth metals. Finally, Part III proposes that supply chain contracts, resource agreements, and other forms of private environmental governance can serve as important extensions and gap-fillers to emerging international regulations and further mitigate the environmental consequences of deep-sea mining.

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at 1, 2–8 (describing the important ecosystem functions attributed to deep-sea ecosystems despite the fact that most species within them are unknown or unidentified).

20. *See* Eva Ramirez-Llodra, Paul A. Tyler, Maria C. Baker, Odd Aksel Bergstad, Malcolm R. Clark, Elva Escobar, Lisa A. Levin, Lenaick Menot, Ashley A. Rowden, Craig R. Smith & Cindy L. Van Dover, *Man and the Last Great Wilderness: Human Impact on the Deep Sea*, PLOS ONE, July 2011, at 1, 11–12.

I. THE DESIRE FOR AND POTENTIAL LIMITS TO DEEP-SEA MINING

A. Minerals Worth Mining for

Manganese, cobalt, lithium, and copper are rare-earth metals and are essential components in the battery-powered technologies, such as cellphones and laptops, that underpin modern, information-driven economies.[21] These same rare-earth metals are also needed to produce batteries to power electric cars.[22] Similarly, molybdenum, platinum, and tellurium are rare-earth metals that are key components of thin-film, high-efficiency photovoltaic cells used in solar panels and magnets needed for other renewable energy sources.[23] Because these green energy technologies also require batteries to store energy when the sun is not shining, the demand for cobalt, lithium, and manganese will likely rise even further.[24] For example, energy storage requirements may drive the annual demand for cobalt in 2050 up 450 percent from its 2018 level.[25] This "green demand" for rare minerals will build upon the previous interest and investment in mining precious minerals for technology and jewelry.[26]

Due to depleting land deposits, inefficient recycling of existing products containing these minerals, and the increasing demand for minerals, interest in mining the deep seafloor is rising.[27] Recent technological developments are making deep-sea mining feasible for the

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21. *See* Catherine Danley, *Diving to New Depths: How Green Energy Markets Can Push Mining Companies into the Deep Sea, and Why Nations Must Balance Mineral Exploitation with Marine Conservation*, 44 WM. & MARY ENV'T L. & POL'Y REV. 219, 248–55 (2019); Bénédicte Cenki, *Critical Minerals Are Vital for Renewable Energy. We Must Learn to Mine Them Responsibly*, THE CONVERSATION (Feb. 16, 2020, 1:55 PM), https://theconversation.com/critical-minerals-are-vital-for-renewable-energy-we-must-learn-to-mine-them-responsibly-131547 [https://perma.cc/2LA9-N6D9].

22. *See* Cenki, *supra* note 21; Zimmermann, *supra* note 14; *Critical Mineral Commodities in Renewable Energy*, *supra* note 4.

23. *See* Katia Moskvitch, *Deep Sea Mining Could Save Humanity from Climate Change Disaster. But at What Cost?*, WIRED, https://www.wired.co.uk/article/deep-sea-mining-about-to-take-off [https://perma.cc/SP7B-DCKN] (July 12, 2018).

24. *See* Cenki, *supra* note 21; *Critical Mineral Commodities in Renewable Energy*, *supra* note 4.

25. KRISTEN HUND, DANIELE LA PORTA, THAO P. FABREGAS, TIM LAING & JOHN DREXHAGE, WORLD BANK GRP., MINERALS FOR CLIMATE ACTION: THE MINERAL INTENSITY OF THE CLEAN ENERGY TRANSITION 11 (2020), http://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf [https://perma.cc/J98D-8CE8].

26. *See* Hylton, *supra* note 19.

27. Danley, *supra* note 21, at 251–53.

first time.[28] In addition, the grade of some minerals, such as copper, cobalt, nickel, and gold, in the deep sea may be substantially higher than terrestrial sources of the same mineral.[29] If high-quality, deep-sea minerals become more accessible as renewable technology increases their demand, mining operations will become economically feasible.[30] Because these lucrative mineral deposits exist in vulnerable, remote ecosystems under international waters with historically no governance, the legal framework that regulates their extraction will be critical to ensure operations are sustainable.[31]

B. The Deep Sea

The deep sea and seafloor, all areas below 200 meters of seawater, are some of the least explored and understood ecosystems remaining on Earth.[32] Because much of the ocean floor is under more than 3,000 meters of water, human exploration of these areas only became possible with recent technological advances.[33] Even now, roughly 80 percent of the global ocean is unexplored.[34] Little data on the biodiversity and genetic connectivity of ecosystems in these environments are available, but the data that do exist suggest that, contrary to expectations, unique life forms can exist at these depths.[35]

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28. *See* Miller et al., *supra* note 16, at 18*; see also* Paul A. J. Lusty & Bramley J. Murton, *Deep-Ocean Mineral Deposits: Metal Resources and Windows into Earth Processes*, 14 ELEMENTS 301, 304 (2018).

29. Roche, *supra* note 16.

30. *See* Lusty & Murton, *supra* note 28, at 304–05 (discussing the many factors that influence the economic viability of deep-sea mining and suggesting that the practice will be viable in locations with high-grade minerals and where logistics are not prohibitive).

31. *See* Miller et al., *supra* note 16, 11–12.

32. *See id.* at 2.

33. *See id.*; L. M. Wedding, S. M. Reiter, C. R. Smith, K. M. Gjerde, J. N. Kittinger, A. M. Friedlander, S. D. Gaines, M. R. Clark, A. M. Thurnherr, S. M. Hardy & L.B. Crowder, *Managing Mining of the Deep Seabed*, 349 SCI. 144, 144 (2015).

34. *How Much of the Ocean Have We Explored?*, *supra* note 19. *But see* Sarah Emerson, *Why Haven't We Explored the Ocean like Outer Space?*, VICE (June 18, 2016, 2:45 PM), https://www.vice.com/en/article/pgk3z9/why-havent-we-explored-the-ocean-like-outer-space [https://perma.cc/B6SZ-N975].

35. Miller et al., *supra* note 16; Sabine Gollner, Stefanie Kaiser, Lena Menzel, Daniel O.B. Jones, Alastair Brown, Nelia C. Mestre, Dick van Oevelen, Lenaick Menot, Ana Colaço, Miquel Canals, Daphne Cuvelier, Jennifer M. Durden, Andrey Gebruk, Great A. Egho, Matthias Haeckel, Yann Marcon, Lisa Mevenkamp, Telmo Morato, Christopher K. Pham, Autun Purser, Anna Sanchez-Vidal, Ann Vanreusel, Annemiek Vink & Pedro Martinez Arbizu, *Resilience of Benthic Deep-Sea Fauna to Mining Activities*, 129 MARINE ENV'T RSCH. 76, 78–80 (2017); Andrew D. Thaler & Diva Amon, *262 Voyages Beneath the Sea: A Global Assessment of Macro- and Megafaunal Biodiversity and Research Effort at Deep-Sea Hydrothermal Vents*, PEERJ, Aug. 6, 2019, at 1, 2–4.

Despite the total absence of sunlight, limited food supply, and low metabolic rates from high water pressure and low temperature, diverse life forms and reproductive strategies have evolved to survive in or near the ocean floor.[36] Hydrothermal vents along geologic boundaries are an exception to this paradigm—the high temperatures and unique chemistry that result from the interaction of cold, deep seawater and volcanic magma create novel and extremely productive ecosystems thousands of meters beneath the ocean surface.[37] Exploration of the deep sea has not only discovered this life, but also large amounts of lucrative, rare metals like cobalt, manganese, and copper, which are increasingly scarce on land.[38]

Three deep-sea habitats and mineral deposits are most likely to be mined: (1) polymetallic nodules from the abyssal plain, (2) the crust of submerged seamounts or mountains that do not reach the ocean surface, and (3) massive seafloor sulfide deposits often associated with hydrothermal vents.[39] Each of these habitats hosts different biological species and provides unique ecosystem services which may be put at distinct risk if mined.[40]

Polymetallic nodules, which form on areas of the seafloor in water that hovers around 4°C, were last at the surface of the ocean hundreds of years ago and contain higher levels of nutrients and lower levels of oxygen than surface waters.[41] The nodules accumulate over thousands, if not millions, of years, are rich in nickel, cobalt, copper, and manganese, and may even contain platinum and tellurium.[42]

Submerged seamounts rise up from the seafloor like underwater mountains and often generate upwelling zones of deep, nutrient-rich waters that feed algae blooms at the surface, and thus connect deep-water and surface-water ecosystems.[43] This connection can

36. *See* PETER HERRING, THE BIOLOGY OF THE DEEP OCEAN 50–70, 237–38 (M.J. Crawley, C. Little, T.R.E. Southwood & S. Ulfstrand eds., 2002) (describing the various life forms and life-history strategies that deep-sea organisms evolved to survive in deep-sea sediment and water); Gollner et al., *supra* note 35, at 78–79 (noting the long lives and slow-growing nature of organisms on seamounts); Wedding et al., *supra* note 33.

37. *See* Gollner et al., *supra* note 35, at 78 (describing the high biomass but specialized and endemic nature of the mega- and macrofauna that are dependent on the in situ primary production of chemosynthesizers that utilize active hydrothermal vents); Thaler & Amon, *supra* note 35, at 1–2.

38. *See* Thaler & Amon, *supra* note 35, at 2–3.

39. Lusty & Murton, *supra* note 28, at 302–03; Miller et al., *supra* note 16, at 2–6.

40. Miller et al., *supra* note 16, at 2–4.

41. *See* Gollner et al., *supra* note 35, at 78.

42. Moskvitch, *supra* note 23; Miller et al., *supra* note 16, at 2, 3, 10.

43. *See* Miller et al., *supra* note 16, at 4; Telmo Morato, Simon D. Hoyle, Valerie Allain & Simon J. Nicol, *Seamounts Are Hotspots of Pelagic Biodiversity in the Open Ocean*, 107 PROC. NAT'L ACAD. SCIS. U.S. 9707, 9709 (2010). *But see* Ashley A. Rowden, Thomas A. Schlacher, Alan

promote diverse and abundant life important for fisheries and provide sustenance for animals like whales and turtles.[44] These seamounts often consist of cobalt-rich manganese crusts and may contain other rare metals such as vanadium, molybdenum, platinum, and tellurium.[45]

Hydrothermal vents and other areas where geothermal energy interacts with seawater are unique ecosystems that occur along either geologically active or previously active ocean ridges.[46] Water adjacent to or within the seafloor in geologically active areas can reach temperatures as high as 400°C, even at depths of 1,000 to 4,000 meters.[47] This high-temperature seawater that is in contact with extreme geothermal temperatures becomes more buoyant and rises.[48] As the water rises, it accumulates high concentrations of sulfur and other metals on the seafloor.[49] If this seawater reaches the surface of the ocean floor, metal sulfides may rapidly precipitate and form "chimneys" or vents, but if the metal-rich waters never reach the seafloor, they may still precipitate just beneath the ocean floor.[50] These sulfur-rich metal deposits are referred to as "seafloor massive sulfide" deposits.[51] The high temperatures, high sulfur concentrations, and vent-structure habitats have resulted in discrete and entirely novel biological communities of worms, crabs, and mussels in and around hydrothermal vents.[52] Exploratory mining has indicated that these vents and other deposits also contain lucrative mineral deposits rich in iron, copper, lead, zinc, gold, molybdenum, platinum, and silver.[53]

Williams, Malcolm R. Clark, Robert Stewart, Franziska Althaus, David A. Bowden, Mireille Consalvey, Wayne Robinson & Joanne Dowdney, *A Test of the Seamount Oasis Hypothesis: Seamounts Support Higher Epibenthic Megafaunal Biomass than Adjacent Slopes*, 31 MARINE ECOLOGY 95, 101, 103–04 (finding significantly higher epibenthic megafaunal biomass associated with seamounts than on adjacent continental slopes, but arguing that biomass on seamounts in less productive regions must also be evaluated and compared to other pelagic habitats).

44. Miller et al., *supra* note 16, at 4.

45. *Id.* at 3; Moskvitch, *supra* note 23.

46. Miller et al., *supra* note 16, at 3.

47. *Id.*

48. R.E. Boschen, A.A. Rowden, M.R. Clark & J.P.A. Gardner, *Mining of Deep-Sea Seafloor Massive Sulfides: A Review of the Deposits, Their Benthic Communities, Impacts from Mining, Regulatory Frameworks and Management Strategies*, 84 OCEAN & COASTAL MGMT. 54, 55 (2013).

49. *Id.*

50. *Id.* at 55–56.

51. *Id.* at 54.

52. *See* Thaler & Amon, *supra* note 35, at 2; C. L. Van Dover, J. A. Ardron, E. Escobar, M. Gianni, K. M. Gjerde, A. Jaeckel, D. O. B. Jones, L. A. Levin, H. J. Niner, L. Pendleton, C. R. Smith, T. Thiele, P. J. Turner, L. Watling & P. P. E. Weaver, Correspondence, *Biodiversity Loss from Deep-Sea Mining*, 10 NATURE GEOSCIENCE 464, 464 (2017).

53. *See* Boschen et al., *supra* note 48, at 56; Moskvitch, *supra* note 23; Miller et al., *supra* note 16, at 3–4.

All three mineral sources on the deep seafloor present different technological challenges to, and unique potential ecological impacts from, mining operations.[54] All three are, however, rich, untapped sources of trace metals that are increasingly valuable in global economies that simultaneously rely more on computer and information technology and are transitioning from fossil fuel to renewable energy sources.[55]

C. The Emergence of Mining Technology

Despite long-term interest in searching the seafloor for minerals, no large-scale, commercial deep-sea mining has yet occurred in areas beyond national jurisdiction.[56] Operating in remote, deep, perpetually dark, frigid, and high-pressure environments is incredibly challenging.[57] In addition, each type of mineral deposit demands machinery and methods uniquely tailored to extract the specific resource the environment contains.[58] Remotely operated nodule harvesters need to vacuum or scrape polymetallic nodules off the ocean floor and send them up thousands of meters to vessels on the surface.[59] The surface support vessels must then isolate desirable minerals and transfer them to additional support vessels that transport the resources to shore.[60] Similarly, remotely operated machines must cut active and inactive hydrothermal vents and transport the vent to the surface in an enclosed riser system intact or grind them into a slurry that is then pumped to the surface for further processing.[61]

The steep and rugged cobalt-rich crusts of submerged seamounts may pose the most serious technological challenge for remote, autonomous mining vehicles.[62] The slope, grade, and ruggedness of a

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54. *See* Lisa A. Levin, Kathryn Mengerink, Kristina M. Gjerde, Ashley A. Rowden, Cindy Lee Van Dover, Malcolm R. Clark, Eva Ramirez-Llodra, Bronwen Currie, Craig R. Smith, Kirk N. Sato, Natalya Gallo, Andrew K. Sweetman, Hannah Lily, Claire W. Armstrong & Joseph Brider, *Defining "Serious Harm" to the Marine Environment in the Context of Deep-Seabed Mining*, 74 MARINE POL'Y 245, 250–54 (2016).

55. *See* HUND ET AL., *supra* note 25, at 73; Jones, *supra* note 4.

56. *See* Jonathan Watts, *Race to the Bottom: The Disastrous, Blindfolded Rush to Mine the Deep Sea*, GUARDIAN, https://www.theguardian.com/environment/2021/sep/27/race-to-the-bottom-the-disastrous-blindfolded-rush-to-mine-the-deep-sea [https://perma.cc/7XER-3SUA] (Mar. 17, 2022, 6:59 PM).

57. *See* Danley, *supra* note 21, at 231.

58. *See* Lusty & Murton, *supra* note 28; Baggaley, *supra* note 17; Miller et al., *supra* note 16, at 9.

59. Levin et al., *supra* note 54, at 250.

60. *Id.*

61. *Id.* at 251.

62. *Id.* at 253.

specific seamount, as well as the thickness of the crust deposit and its associated habitats, can vary widely.[63] Thus, a collection system on a submerged seamount must account for complex and rugged environments.[64] Ultimately, like mining nodules and vents, seamount mining would likely scrape or dig out ore from the crust before crushing the ore into a slurry and transporting the slurry to the surface in a riser pipe.[65]

All three of these techniques may have similar environmental impacts. Each will generate plumes that disperse sediment and potentially toxic compounds that have settled in the deep sea over thousands of years into the water column.[66] These sediments could remain suspended for years and spread far beyond the mining location.[67] Because each mining technique also requires moving mined materials with water through a riser pipe from the ocean floor to the surface, operators must discharge water from the riser pipe back into the ocean either at the surface, somewhere in the water column, or back close to the seafloor.[68] Wherever the return flow of the water from the riser pipe is discharged, the wastewater will release sediments, metals that leach into the water during processing, and unnaturally warm waters in the water column.[69] The discharge could impact marine life at the surface or at depths where communities are adapted to stable deep ocean waters.[70] Furthermore, the large, remotely operated machines and the numerous pumps needed to move ore up from the deep sea to the surface support vessels will generate noise, light, and vibrations that could have unforeseen consequences on marine life of all shapes, sizes, and behaviors.[71]

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63. *Id.* (the prevalence of sometimes abundant sponge and coral communities adds an additional challenge and impact to mining on seamounts).

64. *See id.* (similar challenges may exist at hydrothermal vents but are more likely to occur and cause problems at seamounts).

65. *Id.*

66. *See* Miller et al., *supra* note 16, at 15; *see also* Enrique Isla, Elisabet Pérez-Albaladejo & Cinta Porte, *Toxic Anthropogenic Signature in Antarctic Continental Shelf and Deep Sea Sediments*, SCI. REPS., June 14, 2018, at 1, 3.

67. Jeffrey C. Drazen, Craig R. Smith, Kristina M. Gjerde, Steven H. D. Haddock, Glenn S. Carter, C. Anela Choy, Malcolm R. Clark, Pierre Dutrieux, Erica Goetze, Chris Hauton, Mariko Hatta, J. Anthony Koslow, Astrid B. Leitner, Aude Pacini, Jessica N. Perelman, Thomas Peacock, Tracey T. Sutton, Les Watling & Hiroyuki Yamamoto, *Midwater Ecosystems Must Be Considered when Evaluating Environmental Risks of Deep-Sea Mining*, 117 PROC. NAT'L ACAD. SCIS. U.S. 17455, 17455–56 (2020).

68. *Id.* at 17456; Miller et al., *supra* note 16, at 15.

69. Miller et al., *supra* note 16, at 15–16.

70. *See id.* at 16.

71. *See id.*

Similarly, each mining technique poses unique potential risks to life on the ocean floor and within the water column.[72] The large machines that mining companies have designed to collect polymetallic nodules in the upper fifteen to forty centimeters of soft sediments on the abyssal plain (4,000 to 6,000 meters deep) will compress soft sediments within which animals burrow, remove rock substrates on which animals attach, and generate massive sediment plumes that could suspend and spread sediments into the water column for miles.[73] The sediment in this plume will eventually settle and may bury unmined areas of the abyssal plain in sediment that, absent human intervention, would take millennia to accumulate.[74] Some research suggests that only a few millimeters of sediment would naturally accumulate on the abyssal plain every 1,000 years, and that animal communities living on the ocean floor may take decades or centuries to recover from less than one centimeter of sediment deposition.[75] The combination of all this activity will introduce disruptions on the ocean floor that may take centuries or even millennia to fully recover from due to low temperatures and the low availability of food.[76]

Mining hydrothermal vents and seamounts pose risks to unique, endemic habitats. The collection of hydrothermal vents will remove critical structures for vent-associated species.[77] Reformation of active hydrothermal vents may occur over decadal time scales, but little information exists that describes the recovery of inactive vents.[78] The removal of cobalt-rich crusts will destroy what can be diverse and abundant sessile sponge and coral communities that thrive on seamount slopes.[79] Because seamounts can serve as critical connections between nutrient-rich, deep-sea water and light at the ocean surface, plankton may bloom around seamounts and support large and diverse fish communities.[80] Therefore, mining on seamount slopes has the

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72. *See* Miller et al., *supra* note 16, at 12–14.

73. Levin et al., *supra* note 54, at 250; Andrea Koschinsky, Luise Heinrich, Klaus Boehnke, J Christopher Cohrs, Till Markus, Maor Shani, Pradeep Singh, Karen Smith Stegen & Welf Werner, *Deep-Sea Mining: Interdisciplinary Research on Potential Environmental, Legal, Economic, and Societal Implications*, 14 INTEGRATED ENV'T ASSESSMENT & MGMT. 672, 676–78 (2018).

74. Levin et al., *supra* note 54, at 250; Gollner et al., *supra* note 35, at 82–83.

75. *See* Gollner et al., *supra* note 35, at 82–83; Ramirez-Llodra et al., *supra* note 20; Miller et al., *supra* note 16, at 15.

76. Koschinsky et al., *supra* note 73, at 676–77; Levin et al., *supra* note 54, at 250.

77. Levin et al., *supra* note 54, at 251; Gollner et al., *supra* note 35. *See generally* Thaler & Amon, *supra* note 35.

78. Levin et al., *supra* note 54, at 251–52.

79. *Id.* at 253; Miller et al., *supra* note 16, at 4–5.

80. Levin et al., *supra* note 54, at 254; Miller et al., *supra* note 16, at 4–5.

potential to disrupt both the habitat on the seamount itself and the planktonic communities that thrive in the limited areas of the open ocean where deep water is pushed to the surface.[81]

D. Regulation of the Seafloor

Prior to the twentieth century, the high seas were considered unclaimed and beyond the jurisdiction of any single nation.[82] Technological advancements after World War II, however, made the living and nonliving resources of the open ocean more accessible.[83] The prospect of deep-sea mining appeared not only more feasible, but also commercially viable for nations with both the technology and capital to attempt mining, such as the United States and the Soviet Union.[84] Because the development and remote operation of underwater technologies required significant resources and investment, poorer nations feared that wealthier nations would rapidly exploit or assert sovereignty over the lucrative resources of the deep sea in areas traditionally open to the international community.[85] As a result, a coalition of the international community—particularly countries with limited capital—wanted to establish international legal frameworks that would regulate the waters and fisheries of the open ocean and the deep seafloor.[86]

Sufficient interest emerged in the international community to convene three United Nations Conferences on the Law of the Sea in order to establish a legal framework for regulating the oceans.[87] After years of deliberation, negotiation, and several subsequent amendments, the United Nations Convention on the Law of the Sea (UNCLOS) emerged in 1982 to clearly define the scope of coastal national sovereignty and govern the oceans.[88] This framework set international rules and regulations that govern the deep seafloor for the common

81. Levin et al., *supra* note 54, at 254.

82. Randy W. Tong, *It's Time to Get Off the Bench: The U.S. Needs to Ratify the Law of the Sea Treaty Before It's Too Late*, 48 U. PAC. L. REV. 317, 320–21 (2017).

83. *Id.* at 321.

84. Danley, *supra* note 21, at 239.

85. *Id.*

86. *Id.*; Tong, *supra* note 82, at 321–22.

87. *See* Tong, *supra* note 82, at 321; James D. Brousseau, *Frozen in Time: A Fresh Look at the Law of the Sea and Why the United States Continues to Fight Against It*, 42 S. U. L. REV. 143, 150 (2014).

88. Danley, *supra* note 21, at 239–40; David Hartley, *Guarding the Final Frontier: The Future Regulations of the International Seabed Authority*, 26 TEMP. INT'L & COMPAR. L.J. 335, 339 (2012).

heritage of humankind and the benefit of the broader international community.[89]

Within the agreement, nations maintain complete jurisdiction over the seafloor within their territorial seas that extend twelve nautical miles from the mean low water line of the shore (the "baseline").[90] In addition, coastal nations may maintain Exclusive Economic Zones (EEZs) within 200 nautical miles of their baseline.[91] Inside their EEZ, nations maintain sovereignty over the living and nonliving natural resources in the water and seabed, as well as the economic exploration and exploitation of the zone for energy production from wind or currents.[92] Nations may retain jurisdiction over nonliving resources on their continental shelves beyond 200 nautical miles if the continental margin extends beyond that distance, but are limited to no more than 350 nautical miles from their baseline or 100 nautical miles from where the seafloor dips more than 2,500 meters beneath the surface.[93] The convention labels all remaining seafloor outside national jurisdiction as the "Area."[94]

Within the Area, UNCLOS empowers the International Seabed Authority (ISA) to organize and control activities on the seafloor.[95] The ISA is an autonomous organization consisting of an Assembly, Council, and Secretariat.[96] The major representative body of the ISA is the Assembly which includes a representative of each nation that ratified UNCLOS.[97] The Assembly elects the Secretariat and the Council and ultimately approves the rules and regulations that the Council proposes.[98] The Council consists of thirty-six elected members and develops the ISA's policies, rules, and regulations that govern prospecting, exploration, and exploitation in the Area before presenting them to the Assembly.[99] Lastly, the Secretariat conducts the day-to-day

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89. Tong, *supra* note 82, at 321–22.

90. United Nations Convention on the Law of the Sea arts. 2–3, 5, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS].

91. *Id.* arts. 55–58.

92. *Id.* art. 56.

93. *Id.* arts. 76–77.

94. *Id.* arts. 1, 137.

95. *Id.* arts. 156–57.

96. *Id.* art. 158.

97. *Id.* arts. 156, 159; *see The Assembly*, INT'L SEABED AUTH., https://www.isa.org.jm/authority/assembly [https://perma.cc/NW35-KALP] (last visited Feb. 21, 2021).

98. UNCLOS, *supra* note 90, art. 160. The Secretary-General of the ISA heads the Secretariat. *Id.* art. 166.

99. *Id.* art. 162. *See generally The Council*, INT'L SEABED AUTH., https://www.isa.org.jm/authority/council/members [https://perma.cc/LC4N-FVM9] (last visited Feb. 18, 2022).

administration of the authority.[100] The ISA must regulate the Area for the benefit of humankind and must therefore equitably share the financial and economic benefits derived from the Area.[101] Each party-nation to UNCLOS must ensure that agents and nationals conform to UNCLOS and ISA requirements during all activity within the Area.[102]

In 2017, the UN General Assembly adopted Resolution 72/249, instituting an annual intergovernmental conference from 2018 through 2020 to discuss a new legally binding instrument within UNCLOS that will ensure the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction.[103] The conference was specifically instructed to address: (1) environmental impact assessment requirements; (2) area-based management tools, including marine protected areas; (3) capacity-building and transferring of marine technology to help developing countries contribute to and benefit from the agreement; and (4) access to and benefit sharing of marine genetic resources in the ocean beyond national jurisdiction.[104] To date, the conference has convened for three sessions but has yet to agree on the implementation of a new agreement or the relationship of a new agreement with existing governance frameworks.[105] The UN General Assembly voted to indefinitely postpone the fourth conference scheduled to occur at the outset of the COVID-19 pandemic.[106] A new agreement that outlines environmental assessment or area

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100. UNCLOS, *supra* note 90, art. 166. *See generally The Secretariat*, INT'L SEABED AUTH., https://www.isa.org.jm/index.php/secretariat [https://perma.cc/Z5D4-GLDX] (last visited Feb. 18, 2022).

101. UNCLOS, *supra* note 90, arts. 136, 140, 160.

102. *Id.* art. 139.

103. G.A. Res. 72/249 (Dec. 24, 2017); *see* E.M. De Santo, Á. Ásgeirsdóttir, A. Barros-Platiau, F. Biermann, J. Dryzek, L.R. Gonçalves, R.E. Kim, E. Mendenhall, R. Mitchell, E. Nyman, M. Scobie, K. Sun, R. Tiller, D.G. Webster & O. Young, *Protection Biodiversity in Areas Beyond National Jurisdiction: An Earth System Governance Perspective*, 2 EARTH SYS. GOVERNANCE 100029, 1–2 (2019) (discussing the process leading to, and potential areas of concern within, negotiations on an agreement to conserve and sustainably use marine biodiversity in areas beyond national jurisdiction).

104. De Santo et al., *supra* note 103; *Background*, UNITED NATIONS: INT'L CONF. ON MARINE BIODIVERSITY OF AREA BEYOND NAT'L JURISDICTION, https://www.un.org/bbnj/content/background [https://perma.cc/UBM5-2VKE] (last visited Feb. 18, 2022).

105. *See* Efthymios Papastavridis, *The Negotiations for a New Implementing Agreement Under the UN Convention on the Law of the Sea Concerning Marine Biodiversity*, 69 INT'L & COMPAR. L.Q. 585, 591–93, 599–603, 607–09 (2020).

106. G.A. Dec. 74/543, U.N. Doc. A/74/49 (Vol. III), at 163–64 (Mar. 11, 2020) (delaying the fourth session of the Conference until "the earliest possible available date to be decided by the [General] Assembly"); G.A. Dec. A/75/570, U.N. Doc. A/75/49 (Vol. III) (June 9, 2021) (delaying the fourth session until 2022 at the earliest).

management requirements in the ocean outside national jurisdiction could impose environmental requirements on deep-sea mining operations, but substantial uncertainty surrounds whether and what future agreement may emerge.[107]

E. Holdouts

As of September 2021, 167 countries have ratified UNCLOS.[108] In response to holdouts, the party-nations renegotiated the original 1982 UNCLOS treaty in 1994 to eliminate controversial mandatory technology transfer provisions, limit mining regulatory authority, and restrict seabed mining royalties.[109] Although these amendments prompted the United States to sign the treaty in 1994, the Senate failed to ratify the treaty despite the United States' heavy involvement in its development.[110] The Senate again declined to ratify the treaty in 2007 after President Bush expressed his support, and once again in 2012 after the Senate Foreign Relations Committee heard testimony from the Secretary of State and several military officials, who recommended Senate ratification.[111] The Senate's arguments against ratifying the treaty appeared to stem from concerns that US companies may be subjected to the whims of foreign interests and the international bureaucracy of the ISA.[112] As a result, the United States remains a significant holdout from UNCLOS and ISA regulations, despite widespread international support for the agreement.[113]

II. REGULATING MINING OF THE DEEP SEAFLOOR

A. Regulation Within Territorial Seas and Exclusive Economic Zones

Article 57 of UNCLOS establishes that nations may claim an EEZ of up to 200 nautical miles from their territorial sea baseline in which they maintain sovereignty over both the living and nonliving resources of the seafloor.[114] Individual coastal nations thus may regulate the development of deep-sea mining within this zone.[115]

107. *See* Papastavridis, *supra* note 105, at 593, 609–10.

108. *About ISA*, INT'L SEABED AUTH., https://www.isa.org.jm/about-isa [https://perma.cc/7WBR-XC3J] (last visited Dec. 22, 2021).

109. Tong, *supra* note 82, at 323–24.

110. *Id.* at 324.

111. *Id.* at 325.

112. *Id.* at 323.

113. *Id.* at 326.

114. UNCLOS, *supra* note 90, arts. 56–57.

115. *Id.* art. 56; Danley, *supra* note 21, at 240–41.

Namibia, for example, has already extracted 1.4 million carats of diamonds within its coastal waters.[116] Japan authorized zinc mining within its territorial waters at depths of 1,600 meters in 2017 and claimed the operation would ultimately yield amounts equivalent to Japan's total annual zinc consumption.[117] For Japan, a country that is a net importer of resources, the capacity to mine resources on the seabed within its territorial waters could transform its access to mineral resources and shift the nation from a net importing to a net exporting nation.[118] Other nations like South Korea, Saudi Arabia, and Papa New Guinea are also evaluating mining within their territorial and EEZ waters.[119]

In the United States, mining within territorial and EEZ waters would likely be governed under the Outer Continental Shelf Lands Act (OCSLA), which extends federal jurisdiction over all submerged lands on the continental shelf beyond state jurisdictions—approximately three miles from the coastline—to international waters.[120] The Secretary of the Interior is authorized to lease areas of the outer continental shelf for mining minerals other than oil, gas, or sulfur through a competitive bidding process and must follow existing federal law to minimize the environmental impact of the mining.[121]

Because only around 46 percent of the global ocean is within 200 nautical miles of a coastline, much of the ocean floor, laden with potentially lucrative mineral deposits, is outside any nation's jurisdiction.[122] Even within that 46 percent of the ocean, nations may have varying interests or abilities to regulate deep-sea mining within

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116. Hylton, *supra* note 19.

117. R. Carver, J. Childs, P. Steinberg, L. Mabon, H. Matsuda, R. Squire, B. McLellan & M. Esteban, *A Critical Social Perspective on Deep Sea Mining: Lessons from the Emergent Industry in Japan*, 193 OCEAN & COASTAL MGMT. 105242, 1 (2020).

118. *Id.*

119. Hylton, *supra* note 19; Danley, *supra* note 21, at 255.

120. Outer Continental Shelf Lands Act, 43 U.S.C. §§ 1331(a), 1333(a); 30 C.F.R. §§ 581.2, 581.11 (2020); *see Non-Energy Marine Minerals Legal Framework*, BUREAU OF OCEAN ENERGY MGMT., https://www.boem.gov/marine-minerals/non-energy-marine-minerals-legal-framework [https://perma.cc/PD4W-Q8L4] (last visited Jan. 14, 2021) (providing an overview of the Bureau of Ocean Energy Management's legal authority to lease hard rock mining on the outer continental shelf); *Outer Continental Shelf*, BUREAU OF OCEAN ENERGY MGMT., https://www.boem.gov/oil-gas-energy/leasing/outer-continental-shelf [https://perma.cc/E69M-HZRZ] (last visited Jan. 14, 2021) (providing a succinct definition of the outer continental shelf).

121. 43 U.S.C. §§ 1331(b), 1337(k); *see Environmental Oversight*, BUREAU OF OCEAN ENERGY MGMT., https://www.boem.gov/marine-minerals/environmental-oversight [https://perma.cc/P9N6-FBQF] (last visited Jan. 14, 2021) (describing how BOEM complies with federal environmental laws, regulations, and executive orders, and requires monitoring of impacts after mining activities).

122. *See About ISA*, *supra* note 108.

their territorial or EEZ waters, especially in areas where nations dispute boundaries with other nations.[123]

B. ISA Regulation of the Area

The UNCLOS charges the ISA to regulate the exploration and exploitation of mineral resources within the Area for all nations under the agreement.[124] Under the treaty, all countries or organizations sponsored by another country must obtain an "exploration contract" with the ISA before exploring an area for mining, as well as a separate "exploitation contract" to commence commercial mining.[125] These contracts require operations to follow ISA regulations and ensure that the economic benefits of mining accrue to the "benefit of mankind as a whole."[126] To date, the ISA Assembly has developed exploration regulations for mineral deposits in all three habitats of interest and approved thirty exploration contracts.[127]

In preparation for its first exploitation contracts, the ISA Assembly is now drafting exploitation regulations that could come into effect in 2022.[128] These regulations and contracts may prohibit mining within the Area where substantial evidence suggests that mining poses a risk of "serious harm" to deep-sea environments.[129] The regulations are likely to implement a precautionary approach to mining and aim for an adaptive management strategy to minimize the potential for harm and address harms as they emerge.[130] Nations that sponsor mining

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123. *See* Carver et al., *supra* note 117, at 5 (highlighting the many social factors that drive the territorial claims of the seabed and interest in deep-sea mining); Clive Schofield, *Securing the Resources of the Deep: Dividing and Governing the Extended Continental Shelf*, 33 BERKELEY J. INT'L L. 274, 291 (2015) (describing development and problems associated with delineating outer continental shelf boundaries and the potential for overlapping jurisdictional claims).

124. UNCLOS, *supra* note 90, Annex III, art. 3.

125. *Exploration Contracts*, INT'L SEABED AUTH., https://www.isa.org.jm/index.php/exploration-contracts [https://perma.cc/H3UU-LJXD] (last visited Jan. 12, 2020); *The Mining Code*, INT'L SEABED AUTH., https://www.isa.org.jm/index.php/mining-code [https://perma.cc/H92E-3W6M] (last visited Jan. 12, 2020); Michael W. Lodge & Philomène A. Verlaan, *Deep-Sea Mining: International Regulatory Challenges and Responses*, 14 ELEMENTS 331, 333 (2018).

126. UNCLOS, *supra* note 90, arts. 136, 140, 150; Lodge & Verlaan, *supra* note 125.

127. *See Exploration Contracts*, *supra* note 125; Koschinsky et al., *supra* note 73, at 681; Hylton, *supra* note 19.

128. *See Draft Exploitation Regulations*, INT'L SEABED AUTH., https://www.isa.org.jm/mining-code/ongoing-development-regulations-exploitation-mineral-resources-area [https://perma.cc/9XH8-386T] (last visited Sept. 5, 2020); Levin et al., *supra* note 54, at 246; Hylton, *supra* note 19.

129. UNCLOS, *supra* note 90, arts. 160, 162; *see Draft Exploitation Regulations*, *supra* note 128; Levin et al., *supra* note 54, at 246; Hylton, *supra* note 19.

130. *See* Levin et al., *supra* note 54, at 246.

companies are responsible for ensuring an "adequate means" of due diligence to assist the ISA to control the mining companies' activities within the Area and to apply the precautionary principle in proportion to the environmental risk.[131] Once in place, regulations will also provide minimal environmental regulations for deep-sea mining within the EEZs of nations that have ratified the agreement.[132]

In addition, an ongoing intergovernmental conference is currently negotiating potential amendments to UNCLOS to ensure the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction.[133] The UN General Assembly charged the intergovernmental conference to develop: (1) frameworks for environmental impact assessments; (2) area-based management tools (including tools for marine-protected areas); and (3) the capacity and transfer of marine technology to help developing countries contribute to and benefit from UNCLOS.[134] If enough nations ratify environmental impact assessment or area-based management commitments as a result of the intergovernmental conference, either of these commitments could also alter deep-sea mining regulatory requirements.[135] To date, the intergovernmental conference has not reached a consensus or drafted an agreement, and nations would still need to ratify such agreement before it would have any operational effect.[136] The difficulties associated with building a consensus to adopt and ratify any proposals from the intergovernmental conference will likely require negotiators to balance the potential environmental benefits of the agreement with the associated costs, which could ultimately limit its effectiveness.[137]

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131. Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, Case No. 17, Advisory Opinion of Feb. 1, 2011, 11 ITLOS Rep. 100, 110, 125–35; *see* UNCLOS, *supra* note 90, art. 139.

132. UNCLOS, *supra* note 90, arts. 208–09 (requiring coastal states to adopt laws or regulations to: (1) prevent pollution of the marine environment in connection with seabed activities and for those measures to be no less effective than international rules and standards, and (2) prevent pollution from vessels flying the flag of their State within the area); Lodge & Verlaan, *supra* note 125, at 334.

133. G.A. Res. 72/249, *supra* note 103, ¶¶ 1–2; De Santo et al., *supra* note 103, at 1. *But see* G.A. Dec. 74/543, *supra* note 106 (delaying the fourth session of the Intergovernmental Conference from 2020 until the COVID-19 pandemic will allow the session to be safely conducted).

134. G.A. Res. 72/249, *supra* note 103, ¶ 2.

135. *Background*, *supra* note 104.

136. *See* De Santo et al., *supra* note 103, at 2.

137. *See id.*; Glen Wright, Julien Rochette, Kristina M. Gjerde & Lisa A. Levin, Comment, *Protect the Neglected Half of Our Blue Planet*, 554 NATURE 163, 164 (noting that previous agreements had committed to protect marine biodiversity that have not borne out and that political consensus among member nations may trump scientific evidence).

1. Holdout Nations' Regulations in the Area

Nations like the United States, who never ratified UNCLOS, may still develop laws to govern their companies mining in the Area.[138] US companies that mine the deep sea in the Area must adhere to the Deep Seabed Hard Minerals Resource Act (DSHMRA).[139] Congress passed DSHMRA in 1980 to temporarily regulate deep-sea mining pending the United States' ratification of UNCLOS.[140] The environmental requirements of deep-sea mining within holdout nations' laws are entirely at their discretion, and the relationship between these laws and ISA regulations within the Area is unclear.[141] For example, the declaration of purpose in DSHMRA explicitly states that the "exploration for and commercial recovery of hard mineral resources of the deep seabed are freedoms of the high seas," subject merely to a duty of reasonable regard to the interests of other states and general principles of international law.[142] This purpose is seemingly in conflict with UNCLOS and the ISA; both emerged to provide a regulatory framework over the previous, unregulated freedoms of nations on the high seas.[143] As a result, US companies with claims to mineral rights in the Area face a substantial risk that ISA contracts could overlap with their claims and jeopardize recognition of their property rights.[144] In addition, because the United States and other holdout nations have no representatives within the ISA Assembly, they have limited influence on the development of ISA's deep-sea mining regulations.[145]

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138. *See supra* Section I.E.; Ronald Reagan, Statement on United States Participation in the Third United Nations Conference on the Law of the Sea (Jan. 29, 1982), https://www.reaganlibrary.gov/research/speeches/12982b [https://perma.cc/M95W-7DBL]; *see also Member States*, INT'L SEABED AUTH., https://www.isa.org.jm/member-states [https://perma.cc/P5LF-5VTP] (last visited Feb. 25, 2022).

139. *See* Deep Seabed Hard Minerals Resource Act, 30 U.S.C. § 1401(b)(3).

140. Tong, *supra* note 82, at 323.

141. *See About ISA*, *supra* note 108 (describing the member states and jurisdiction of the ISA); Ted R. Bromund, James Jay Carafano & Brett D. Schaefer, *7 Reasons U.S. Should Not Ratify UN Convention on the Law of the Sea*, THE HERITAGE FOUND. (June 4, 2018), https://www.heritage.org/global-politics/commentary/7-reasons-us-should-not-ratify-un-convention-the-law-the-sea [https://perma.cc/J2LG-4S8R] (arguing the freedom the United States maintains outside of UNCLOS is in the Nation's best interest as a sovereign because UNCLOS membership would simultaneously not confer any new benefits that the United States does not already enjoy and would expose US mining to regulations of an "unelected and unaccountable bureaucracy").

142. *See* 30 U.S.C. § 1401(a)(12); Tong, *supra* note 82, at 323–24.

143. *See* Tong, *supra* note 82; *see also* Brousseau, *supra* note 87.

144. Tong, *supra* note 82, at 323, 325; Danley, *supra* note 21, at 258–60.

145. Tong, *supra* note 82, at 335–38.

2. Potential Drawbacks of ISA Regulation

Uncertainties around both the composition and functioning of deep-sea ecosystems, as well as the operations of large-scale commercial deep-sea mining, could reduce the initial efficacy of ISA regulations. Relative to terrestrial and coastal ecosystems, the composition and key processes of deep seafloor ecosystems within the Area are poorly understood.[146] This lack of knowledge makes establishing clear environmental and ecosystem baselines difficult.[147] Because no previous large-scale mining in deep-sea environments can serve as a basis for ISA regulations and much of the deep sea itself is unexplored, the environmental impact of mining in these environments is difficult to predict.[148] Preliminary evidence suggests the dredging of seamounts;[149] the scrapping, compressing, and dispersing of soft sediments on the abyssal plain;[150] and the cutting of hydrothermal vents, can dramatically alter the community composition and structure of these environments for decades.[151] Similarly, the restoration of impacted deep-sea environments is largely unprecedented and uncertain.[152]

The combination of uncertain environmental impacts from deep-sea mining in remote, difficult-to-monitor environments, and the relative autonomy of the ISA, has raised concerns that once mining has begun, alterations to exploitation regulations that further minimize impacts may take substantial time and effort.[153] Without clear environmental standards and procedures that set forth how parties can monitor and establish that mining activities are causing "serious

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146. *Id.* at 329; *see* Niner et al., *supra* note 19, at 4–8 (describing a hierarchy of mitigation principles to protect poorly documented and understood biodiversity in the deep sea from mining).

147. Niner et al., *supra* note 19, at 4–8.

148. *Id.* at 8; Miller et al., *supra* note 16, at 19; Levin et al., *supra* note 54, at 248.

149. Miller et al., *supra* note 16, at 14; Koschinsky et al., *supra* note 73, at 677.

150. Miller et al., *supra* note 16, at 12; Levin et al., *supra* note 54, at 250–51.

151. *See* Boschen et al., *supra* note 48, at 59–60; Miller et al., *supra* note 16, at 12–15; *see also* Erik Simon-Lledó, Brian J. Bett, Veerle A. I. Huvenne, Kevin Köser, Timm Schoening, Jens Greinert & Daniel O. B. Jones, *Biological Effects 26 Years After Simulated Deep-Sea Mining*, SCI. REPS., May 29, 2019, at 1 (noting the uncertainty of ecological impacts on deep-sea mining and the limited recovery of an experimentally disturbed area twenty-six years after the sediments were disturbed). *But see* Gollner et al., *supra* note 35, at 83–86 (discussing the rapid, but highly variable, recovery of hydrothermal vents disturbed by volcanic eruptions and distinguishing rapidly spreading vents from slower-spreading and inactive vents).

152. *See* Koschinsky et al., *supra* note 73, at 677; Boschen et al., *supra* note 48, at 60.

153. *See* Koschinsky et al., *supra* note 73, at 682–85 (discussing the many uncertainties, such as the development of legal regimes, state actions, and social licenses to operate, associated with the emergence of deep-sea mining).

harm," the ability and willingness of the ISA to halt operations or adjust regulations is uncertain.[154]

Scholars have also raised concerns about the lack of transparency in deep-sea mining decisions because some ISA meetings occur behind closed doors with limited third-party observation or participation, and no appeals system exists for ISA decisions.[155] Similarly, the availability and quality of the safety, environmental, and compliance data that the ISA provides are often unclear.[156] As a result, should ISA regulations prove to be environmentally insufficient, the ability and willingness of the ISA to rapidly respond to external pressures to increase environmental protections in its regulations is not obvious.[157]

Holdout nations could also pose challenges to ISA regulation.[158] The ISA Assembly is a large and diverse body with representatives from 167 nations and the European Union, but holdouts from the agreement could undermine the efficacy and enforcement of the regulations it produces.[159] For example, companies could utilize holdout nations to skirt ISA regulations.[160] The widespread recognition and adoption of UNCLOS and ISA regulations, however, bring companies working within member nations the security of internationally recognized mineral and property rights.[161] In addition, the prospect of securing

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154. *See* Levin et al., *supra* note 54, at 246–48.

155. Jeff A. Ardorn, Henry A. Ruhl & Daniel O.B. Jones, *Incorporating Transparency into the Governance of Deep-Seabed Mining in the Area Beyond National Jurisdiction*, 89 MARINE POL'Y 58, 65 (2018); *see also* Jonathan Watts, *Deep-Sea 'Gold Rush': Secretive Plans to Carve Up the Seabed Decried*, GUARDIAN, https://www.theguardian.com/environment/2020/dec/09/secretive-gold-rush-for-deep-sea-mining-dominated-by-handful-of-firms [https://perma.cc/97J4-TK8M] (Oct. 29, 2021, 7:36 AM).

156. *See* Ardorn et al., *supra* note 155.

157. Gollner et al., *supra* note 35, at 92–97 (describing the variability in community recovery and resilience across ecosystems of interest for mining and the gaps in knowledge that make predicting the impacts of mining difficult); Levin et al., *supra* note 54, at 247–49 (discussing the ISA's regulatory requirement to prevent "serious harm" to the marine environment and the difficulty of doing so without adequate data and an understanding of deep-sea environments).

158. *See* STEVEN GROVES, THE HERITAGE FOUND., THE U.S. CAN MINE THE DEEP SEABED WITHOUT JOINING THE U.N. CONVENTION ON THE LAW OF THE SEA 2–3 (2012), https://www.heritage.org/report/the-us-can-mine-the-deep-seabed-without-joining-the-un-convention-the-law-the-sea [https://perma.cc/75W4-4ALU]. *But see* Lodge & Verlaan, *supra* note 125, at 332 (arguing that provisions of UNCLOS are customary international law and may bind non-parties).

159. *See About ISA*, *supra* note 108.

160. *See* GROVES, *supra* note 158, at 14–15.

161. *See* Stewart M. Patrick, *(Almost) Everyone Agrees: The U.S. Should Ratify the Law of the Sea Treaty*, ATLANTIC (June 10, 2012), https://www.theatlantic.com/international/archive/2012/06/-almost-everyone-agrees-the-us-should-ratify-the-law-of-the-sea-treaty/258301/ [https://perma.cc/63KS-84M6].

mining rights provides strong incentives for mining companies that must expend enormous capital upfront to only work with nations that ratified UNCLOS and adhere to ISA regulations.[162]

C. Private Environmental Governance

Private environmental governance is an alternative, nongovernmental framework that addresses environmental problems through private contracts.[163] Supply chain contracts, loan agreements, and resource agreements can all influence environmental outcomes. Each can require disclosure of potential environmental harms, mitigation guarantees, third-party certification of operations to public or private standards, or other requirements intended to limit the environmental impact of a given activity.[164] These contract provisions can limit the exploitation of common-pool resources, reduce externalities, and more equitably distribute environmental amenities similar to, but entirely separate from, prescriptive national or international law.[165] Contracting parties and firms may include environmental provisions to create sustainably sourced products that cater to environmentally conscious markets, bolster public perception of the firm, or satisfy perceived social obligations to their communities.[166] Prior agreements with nonprofit groups, neighbors, or other private standard-setting organizations may also compel commercial parties to insert provisions that limit environmental impacts into their future contracts.[167] Private agreements have the potential to fill gaps within and extend existing regulatory regimes, or they can supply separate, independent standards and certification schemes for otherwise unregulated activities.

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162. *See id.*; Danley, *supra* note 21, at 256.

163. Michael P. Vandenbergh, *The New Wal-Mart Effect: The Role of Private Contracting in Global Governance*, 54 UCLA L. REV. 913, 914 (2007) [hereinafter *New Wal-Mart Effect*].

164. Michael P. Vandenbergh, *Private Environmental Governance*, 99 CORNELL L. REV. 129, 146, 160 (2013) [hereinafter *Private Environmental Governance*].

165. *Id.* at 146.

166. *See id.* at 137; Louis G. Leonard III, *Under the Radar: A Coherent System of Climate Governance, Driven by Business*, 50 ENV'T L. REP. 10546, 10552–55 (2020) (describing some of the primary drivers motivating firms to participate in environmental governance).

167. *See* Michael P. Vandenbergh, *The Private Life of Public Law*, 105 COLUM. L. REV. 2029, 2055 (2005) [hereinafter *Private Life of Public Law*] (describing the incorporation of environmental provisions in credit agreements as a result of prior commitments to nonprofit organizations).

1. Private Agreements to Fill Gaps and Extend Regulatory Regimes

Where public laws exist, private agreements can supplement or extend environmental regulation.[168] Private supply chain contracts can coerce suppliers to adjust their operations or find alternative sources to lower environmental impacts in production.[169] Globally dominant corporate buyers like Wal-Mart, who dominate large sections of the retail market and maintain extensive, global supply chains, may impose requirements on the environmental attributes of produced goods and the processes through which the goods are produced.[170] Large corporate buyers can force suppliers to adhere to specified regulatory regimes or impose even more demanding requirements on suppliers as terms of the corporation's purchase.[171] Because corporate buyers' market share can be large, contractual obligations will produce ripple effects down the supply chain and across national borders.[172] As a result, incorporating environmental provisions in supply chain contracts has the potential to mediate environmental impacts across jurisdictions and between importer and exporter countries that may have dramatically different environmental regulations.[173]

In addition to supply chain contracts, commercial transactions associated with loans, real estate, and other agreements may require contracting parties to adhere to stated environmental standards or impose stricter obligations.[174] For example, an analysis of loan agreements filed with the US Securities and Exchange Commission (SEC) in 2005 found environmental provisions in over 70 percent of the 1,500 credit agreements evaluated.[175] Lenders have even included provisions that allow them to monitor the borrower's activities over the course of the loan and enable the lender to enforce regulatory compliance.[176] In general, all of these provisions allow contracting parties to lower the potential for environmental harm from commercial activity. Any risk of subsequent liability or public outrage associated

168. *Private Environmental Governance*, *supra* note 164, at 186–88 (discussing spillover effects of environmental contractual provisions). *See generally* Michael P. Vandenbergh & Jim Rossi, *The Gap-Filling Role of Private Environmental Governance*, 38 VA. ENV'T L.J. 1 (2020) [hereinafter *Gap-Filling Role of Private Environmental Governance*].

169. *New Wal-Mart Effect*, *supra* note 163, at 959–61.

170. *Id.* at 916–17, 949–50.

171. *Private Environmental Governance*, *supra* note 164, at 156.

172. See *New Wal-Mart Effect*, *supra* note 163, at 919–20.

173. *See id.*

174. *See Private Life of Public Law*, *supra* note 167, at 2045–66 (describing the many forms of agreements in which parties may include environmental provisions).

175. *Id.* at 2051–52; *see Private Environmental Governance*, *supra* note 164, at 158.

176. *Private Life of Public Law*, *supra* note 167, at 2053.

with the environmental harms is thereby similarly reduced.[177] As a result, environmental provisions may be incorporated in a wide variety of commercial transactions when one or both parties feel that controlling environmental impacts will increase the profitability or lower the overall risk associated with the transaction.[178]

2. Private Certification Schemes and Standard Setting

Private certification schemes can also extend environmental regulation into areas with weaker or non-existent public environmental regulation to lessen the environmental impact of a given activity.[179] These certification regimes can act like private regulatory agencies that independently develop standards of conduct and then certify products or services that comply with those standards.[180] Critically, these certification schemes also label goods or services that adhere to their standards to provide a signal within the market that the labeled product is environmentally sustainable.[181] Labeling goods is central to private certification schemes because labels connect producers and servicers that adhere to the certification standards to the demand for sustainable goods and services in the market.[182] This market access may justify higher compliance costs that result from the certification scheme.[183] Organizations that develop and implement certification schemes might also then act as "standard-promoter[s]" that promote the quality and outcomes of products that adhere to their standards.[184]

Developing independent standards that producers will voluntarily adhere to and that will have meaningful consequences on environmental outcomes can be time-consuming, contentious, and expensive.[185] To balance competing interests in standard-setting,

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177. *See id.* at 2052–53; Michael P. Vandenbergh, *The Implications of Private Environmental Governance*, 99 CORNELL L. REV. ONLINE 117, 123–24 (2014) [hereinafter *Implications of Private Environmental Governance*].

178. *See Private Life of Public Law*, *supra* note 167, at 2045–66; *New Wal-Mart Effect*, *supra* note 163, at 946–50 (discussing the role of consumer and socially responsible investors on the social license to operate as well as the potential for environmental provisions to ensure stable supply chains and increase rivals' costs).

179. *See Implications of Private Environmental Governance*, *supra* note 177, at 133–34.

180. *Private Environmental Governance*, *supra* note 164, at 148.

181. *Id.*

182. Will Martin, *Marine Stewardship Council: A Case Study in Private Environmental Standard-Setting*, 44 ENV'T L. REP. 10097, 10097 (2014).

183. *See id.* at 10098 (describing the market demand and market rewards associated with complying with the independent certification scheme as incentives for fisheries to "up their game").

184. *Id.* at 10097.

185. *See Private Environmental Governance*, *supra* note 164, at 169 (listing the funding as a "substantial problem"); Martin, *supra* note 182, at 10098 (suggesting MSC governance is

certification-scheme designers should engage a wide spectrum of interested parties to build a broad consensus around the standards.[186] Designers should also develop their certification standards so that regulated parties can, and will, adhere to the standards during their commercial activity while simultaneously satisfying environmental and other interest groups' salient environmental concerns.[187] Successful certification schemes, like the Marine Stewardship Council (MSC), strive for an objective, independent, and data-driven process.[188] They function like public administrative institutions that provide procedural processes and transparency for interested parties during standard development and enforcement. This inclusion of all parties in decision-making instills a sense of fairness into the processes that may be attractive to regulated parties.[189]

This certification design may, however, require substantial resources to fund research, publication, and discussion of potential standards. Difficulties may also arise in the enforcement and marketing of a standard once it has been adopted.[190] For organizations to meaningfully develop, enforce, and revise standards with this design, they likely need long-term financial backing.[191] Such resources may only be available for markets in which demand for sustainable goods is high, strong public regulatory action is perceived to be imminent, or where a resource is clearly limited or vulnerable and thus critical for industry survival.[192] The development of certification schemes for commodities like grains and minerals can be difficult because

successful because the organization is a multi-stakeholder organization that develops and evolves standards in an inclusive, objective, scientific, transparent process and uses independent, third-party assessors to apply the standards in certifying fisheries).

186. *See* Martin, *supra* note 182, at 10099 (describing the multi-stakeholder design of the Marine Stewardship Council as one of the key design attributes of the scheme to prevent any one sector from dominating).

187. *See id.* at 10098 (describing the tension between industry groups viewing MSC standards as a set bar that may already be "[too] high" and environmental groups that often criticize MSC standards as "too low").

188. *See id.* at 10098–99 (suggesting MSC governance is successful because the organization is a multi-stakeholder organization that uses independent, third-party assessors to assess fishery stocks and develop standards in a guided but objective, scientific process resembling public administrative law).

189. *See id.* at 10099 (discussing the engagement of stakeholders and development of standards similar to public administrative law).

190. *See id.* at 10097 (highlighting the success of the MSC scheme as a result of not only investing resources to develop a standard with independent scientific evaluation, diverse input, substantial review, but also active promotion of the standard).

191. *Private Environmental Governance*, *supra* note 164, at 169.

192. *See id.* at 186–87 (describing the potential for private regimes and provisions to deter more efficient public regulation and the potential for private regimes to support or reduce costs of government actions); *New Wal-Mart Effect*, *supra* note 163, at 949–50.

consumers are not purchasing directly from producers, and the final good does not necessarily have an obvious connection to the commodity.[193]

3. Potential Drawbacks of Private Environmental Governance

Both bilateral environmental contract provisions and independent certification schemes have the potential to undermine public law initiatives. If private agreements generate the perception that an activity is effectively regulated, but alternative private or public law initiatives would be more effective or efficient, then the existing private governance scheme may have a negative spillover effect on the potential to develop a better public or private scheme.[194] Industry groups can deliberately include token environmental provisions in contracts or develop lax standards as industrial "greenwashing" to boost their public image and dampen public desire for more stringent public regulation of commercial activity.[195]

Likewise, environmental contractual provisions and private certification schemes may not provide the general public or regulatory agencies with information on their efficacy or may obscure the parties most responsible for environmental outcomes.[196] Enforcement of contract provisions may not require public adjudication of facts or even public notification of contractual disputes because the parties may informally contact one another or act through lawyers.[197] Even substantial legal disputes may be resolved in private dispute resolution proceedings rather than in public courts.[198] Contracting parties may also have to include environmental provisions in their agreements because one or both parties are bound by a prior agreement with a third party, who may not be obvious within the new agreement but can still seek enforcement of the provision.[199] As a result, not only could the general public and regulatory agencies have difficulty determining the efficacy and legitimacy of private certification schemes or contractual promises, but both could have difficulty determining the party

193. *See Private Environmental Governance*, *supra* note 164, at 152.

194. *Id.* at 186–88.

195. *Id.* at 175, 186–88; Eric L. Lane, *Greenwashing 2.0*, 28 COLUM. J. ENV'T L. 279, 280–81 (2013); *see also* Jennifer Jacquet, Daniel Pauly, David Ainley, Sidney Holt, Paul Dayton, & Jeremy Jackson, *Seafood Stewardship in Crisis*, 467 NATURE 28, 28–29 (2010) (arguing that market incentives caused drifts in the goals of the MSC certification scheme).

196. *Private Life of Public Law*, *supra* note 167, at 2069–71.

197. *Id.* at 2070–71.

198. *Id.*

199. *See id.* at 2055, 2070 (describing how indemnitors and insurers may influence firm behavior, but their influence may not be apparent to the public or regulatory authorities).

ultimately driving environmental decision-making within a given transaction or activity.[200]

Similarly, bilateral contracts may require certain procedures or certification systems be followed but not necessarily that the proscribed procedure or scheme is environmentally appropriate or adequate.[201] Private environmental governance can change firm behavior, and studies suggest positive outcomes on environmental impacts, particularly with private certification schemes, such as increases in the status of fisheries stocks managed under the MSC.[202] Few studies, however, have directly connected private efforts to limit environmental consequences to realized environmental impacts.[203] Like public regulation, private governance will require consistent evaluations to ensure that firms adjust their behavior and that a positive environmental outcome results from that behavior adjustment.[204]

III. PRIVATE ENVIRONMENTAL GOVERNANCE TO LIMIT THE HARMS OF MINING

The ISA is closer than ever to adopting exploitation regulations for the Area's first large-scale, commercial mining operations.[205] Because demand for rare-earth metals available in the deep sea is expected to rise, and autonomous vehicles capable of operating at extreme depths are already operational, preparation for the first mining operations will likely commence shortly after the ISA regulations are adopted.[206]

200. *Id.* at 2070–71.

201. *Implications of Private Environmental Governance*, *supra* note 177, at 128.

202. *See id.* at 131–33.

203. *Id.*

204. *See* Martin, *supra* note 182, at 10099 (highlighting the MSC's annual fishery surveillance audits and the reassessment of fishery stocks every five years to ensure fishery assessments are accurate and that standards are effective).

205. James Munson, *Global Seabed Mining Rules Could Be Delayed to 2021 Due to Virus*, BLOOMBERG L. (May 29, 2020, 9:28 AM), https://news.bloomberglaw.com/environment-and-energy/global-seabed-mining-rules-could-be-delayed-to-2021-due-to-virus [https://perma.cc/3G8U-2XQR].

206. ISA mining regulations will likely require preliminary environmental impact analyses that may delay the commercial operation, but these assessments will likely commence not long after ISA regulations are adopted or have already begun. *See* Daniel O.B. Jones, Jennifer M. Durden, Kevin Murphy, Kristina M. Gjerde, Aleksandra Gebicka, Ana Colaço, Telmo Morato, Daphne Cuvelier & David S.M. Billett, *Existing Environmental Management Approaches Relevant to Deep-Sea Mining*, 103 MARINE POL'Y 172, 176–77 (2019) [hereinafter *Existing Environmental Management Approaches*] (discussing the development of environmental impact assessments); Baggaley, *supra* note 17; Jones, *supra* note 5.

Given the vast capital and effort required to conduct deep-sea studies and the remote, deep environments where they occur, third-party observers and journalists may have difficulty monitoring mining practices.[207] Complete and detailed information on the consequences of deep-sea mining and the proper regulatory responses may take years to emerge after mining begins.[208] However, as studies and reports from mining operations accumulate, alternative regulatory options or subtle changes in practices that better protect deep-sea ecosystems could emerge.[209] Despite over twenty years of rigorous debate at the ISA and mining companies' preemptive efforts to minimize environmental harms from mining, some harms to the structure and function of deep-sea environments are almost certain to occur from the first commercial mining operations.[210] Subsequent alterations to mining practices may more effectively protect deep-sea ecosystems.[211]

Private environmental governance could complement a precautionary approach to deep-sea mining and ensure the adaptive management of mining operations to mitigate impacts regardless of where they occur in the oceans. Brand reputation is a significant driver of private initiatives to adopt socially and environmentally conscious policies.[212] Firms sensitive to reputational harms or social responsibility initiatives may not want to associate themselves with the environmental consequences of deep-sea mining. As a result, they may arrange their transactions to ensure the rare-earth metals, either extracted with their capital or used in their products, were mined under

207. Letter from Andrew Friedman, Assoc. Manager, Seabed Mining Project, The Pew Charitable Trs. (Jan. 28, 2021), https://www.pewtrusts.org/-/media/assets/2021/01/isa-stakeholder-strategy-comments-pew_jan-2021.pdf [https://perma.cc/LJ33-55RK].

208. Ramirez-Llodra et al., *supra* note 20, at 19; Levin et al., *supra* note 54, at 248–49.

209. *See Stakeholders Provide Expert Feedback on Proposed Rules*, THE PEW CHARITABLE TRS., https://www.pewtrusts.org/en/projects/seabed-mining-project/development-of-seabed-mining-regulations [https://perma.cc/C4S6-VHM8] (last visited Feb. 26, 2022) (highlighting the need for expert feedback on ISA rules); Andrew Friedman, *After Chaotic Year, Seabed Mining Oversight Body Must Strengthen Policies*, THE PEW CHARITABLE TRS. (Feb. 12, 2021), https://www.pewtrusts.org/en/research-and-analysis/articles/2021/02/11/after-chaotic-year-seabed-mining-oversight-body-must-strengthen-policies [https://perma.cc/E9VH-NX2S] (suggesting more regional conservation measures are needed and environmental impact assessment requirements may be insufficient).

210. *See supra* Section I.A–C.

211. *See* David Shukman, *Electric Car Future May Depend on Deep Sea Mining*, BBC NEWS (Nov. 13, 2019), https://www.bbc.com/news/science-environment-49759626 [https://perma.cc/LC8Z-4SYC] (describing adjustments to autonomous vehicles to limit harms to deep-sea environments).

212. *See Private Environmental Governance*, *supra* note 164, at 167; *Private Life of Public Law*, *supra* note 167, at 2059 (describing the incentives for environmental provisions in credit agreements).

the best available procedures. Alternatively, firms may elect to obtain rare-earth metals from more sustainable alternative sources.

A. Potential Roles for Private Environmental Governance

Private contractual arrangements could serve as important gap fillers to ISA or national regulations in order to ensure that mining practices account for potential harms associated with the alteration of the seafloor and water column.[213] Environmental provisions in supply chain contracts or credit agreements could demand that parties guarantee their operations' adherence to the latest emerging environmentally sustainable deep-sea mining practices.[214] Contractual provisions could force changes to mining operations more rapidly than ISA regulations that require ISA Council and Assembly consensus, which may be more difficult after parties have a vested interest in the existing regulations.[215] Such provisions could require borrowers to use, or suppliers only purchase from, operations using autonomous vehicles upgraded with the latest technology to ensure minimal environmental impact.[216] Gap-filling provisions could also ensure that environmental impact assessments: (1) are conducted over the spatial scales that data suggests are most appropriate for the given environment, (2) consider the cumulative effect of multiple mines and other environmental stresses, and (3) require long-term monitoring of the mined site.[217]

Similarly, environmental provisions could also guarantee that ISA regulations, more environmentally protective national regulations, or private certification schemes are extended throughout the market for rare-earth metals. These contractual provisions would ensure that specified regulations are implemented within the transaction regardless of the national or international waters from which the minerals are sourced.

Other potential provisions within a supply or credit agreement could require suppliers or borrowers to more aggressively account for

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213. *See generally Gap-Filling Role of Private Environmental Governance*, *supra* note 168.

214. *Private Environmental Governance*, *supra* note 164, at 157, 161 (describing the commonality of environmental requirements in supply chain contracts and that resource agreements may impose obligations on a small number of large suppliers that are then expected to regulate many small enterprises).

215. *See* Olivia Heffernan, *Seabed Mining Is Coming – Bringing Mineral Riches and Fears of Epic Extinctions*, 571 NATURE 465, 466–68 (2019) (describing different viewpoints on whether the ISA will be able to rapidly adjust regulations because of information that emerges from monitoring of the first commercial deep-sea mines).

216. *See* Shukman, *supra* note 211.

217. *See generally* Aline Jaeckel, *Strategic Environmental Planning for Deep Seabed Mining in the Area*, MARINE POL'Y, Feb. 2020, at 1.

environmental impacts. Provisions could require mining operations to protect fixed areas of the seafloor at the mine site, facilitate recovery of mined areas, or actively restore the mined areas.[218] If public awareness and concern over the impacts of deep-sea mining grow, supply chain contracts from corporations with substantial market share and environmentally conscious shareholders or customers could even bar deep-sea minerals from the corporation's products.[219] Given the complex political dynamics associated with developing, implementing, and enforcing international regulations, private environmental governance could provide organizations with opportunities to respond to new information on the environmental consequences of deep-sea mining and the public's perception of these operations.[220]

218. *See* Nicola Jones, *A Growing Call for International Marine Reserves*, YALE ENV'T 360 (Sept. 29, 2016), https://e360.yale.edu/features/high_stakes_on_the_high_seas_international_marine_reserves [https://perma.cc/7KVW-GANG] (describing a push to establish protected areas in the ocean beyond national jurisdiction to ensure a thriving ocean in the face of increasing fishing pressures and the up-and-coming mining industry); *see also* C.L. Van Dover, J. Aronson, L. Pendleton, S. Smith, S. Arnaud-Haond, D. Moreno-Mateos, E. Barbier, D. Billett, K. Bowers, R. Danovaro, A. Edwards, S. Kellert, T. Morato, E. Pollard, A. Rogers & R. Warner, *Ecological Restoration in the Deep Sea: Desiderata*, 44 MARINE POL'Y 98 (2014) (calculating the high cost of deep-sea restoration and highlighting the potential to control restoration costs if they are considered *a priori* and once economies of scale and specialized tools emerge).

219. *See* Koschinsky et al., *supra* note 73, at 683–87 (discussing the social license deep-sea mining operations need to mine and difficulties obtaining broad public support while also describing different factors potentially influencing public support for operations); Stephen Nellis, *Apple Taps Recycled Rare Earth Elements for Iphone Parts*, REUTERS, https://www.reuters.com/article/us-apple-rareearths/apple-taps-recycled-rare-earth-elements-for-iphone-parts-idUSKBN1W31JG [https://perma.cc/GG37-NQ5J] (Sept. 18, 2019, 7:09 AM) (suggesting suppliers could find alternative sources of rare-earth metals for products if sufficient concern for the environmental consequences emerges).

220. *See* Koschinsky et al., *supra* note 73, at 682 (describing that "national regulations will take many years to emerge and discussions at the ISA will continue once economic, social, and environmental effects of deep-sea mining" become apparent); Niner et al., *supra* note 19, at 8 (concluding that, due to uncertainties of deep-sea ecosystems, net loss of biodiversity is almost certain to occur).

B. Who Might Include Environmental Provisions?

Because deep-sea minerals are necessary for the global transition from fossil fuel to renewably powered economies and transportation, the renewable energy and automobile industries can substantially influence their supply chains to limit the environmental consequences of deep-sea mining.[221] Many automobile retailers and manufacturers already consider environmental protection and fuel efficiency in their designs.[222] A majority of the top ten largest auto manufacturers also impose some form of an environmental standard on their suppliers.[223] These requirements generally force suppliers to comply with all environmental laws in their host countries or with third-party environmental certification standards, such as standards promulgated by the International Organization for Standardization.[224] Volvo and BMW already publicly support a moratorium on deep-seafloor mining until operations can clearly demonstrate they will effectively protect deep-sea ecosystems.[225] Under the right market conditions, other auto manufacturers could also require battery suppliers to ensure that the minerals used in their production processes come from sources that adhere to ISA regulations, even if sourced in nations that have not adopted UNCLOS or from non-Area waters. Similarly—should the ISA not improve or adjust its regulations in response to new information about deep-sea mining—automobile manufacturers could include provisions that require more stringent environmental provisions in their supply agreements.

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221. *See* Shukman, *supra* note 211 (highlighting the demand for cobalt that a thriving electric car industry will produce); Jones, *supra* note 4 (describing that a shortage of rare-earth metals may limit the transition to renewable energy sources).

222. Brett Berk, *Luxury Cars Go Sustainable from the Inside Out*, N.Y. TIMES (June 4, 2020), https://www.nytimes.com/2020/06/04/business/sustainable-materials-cars.html [https://perma.cc/8LLY-MMFN] (describing how auto manufacturers are considering new ways to make production environmentally sustainable); *Highlights of the Automotive Trends Report*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/automotive-trends/highlights-automotive-trends-report [https://perma.cc/L673-NJQK] (last visited Feb. 21, 2021) (explaining that most manufacturers lowered carbon dioxide emissions and increased fuel efficiency in automobiles over the last five years).

223. *New Wal-Mart Effect*, *supra* note 163, at 930.

224. *See id.* at 930–31.

225. Frank Jordans, *Automakers BMW, Volvo Back Moratorium on Deep Seabed Mining*, ASSOCIATED PRESS NEWS (Mar. 31, 2021), https://apnews.com/article/technology-oceans-environment-overfishing-europe-3359dff680e15606dc9d069e1992e0bf [https://perma.cc/7K66-4EEX].

Many countries, like India, Brazil, China, and Nigeria, will continue to experience rapid economic growth and generate additional rare-earth metal demand for electronic devices.[226] As a result, personal electronics manufacturers and retailers may be similarly situated to automakers to pressure suppliers for sustainable mineral sourcing in their products.[227] Many personal computer manufacturers and retailers already incorporate some sort of environmental mitigation requirement in their supply agreements.[228] These environmental requirements vary. Some provisions in supply chain contracts only require suppliers to adhere to domestic environmental laws, while other provisions require that suppliers adopt organizational environmental management systems that will consistently review, evaluate, and improve environmental performance in the supplier's operations.[229] Apple has transitioned to using recycled rare-earth metals for key components of its latest iPhone and has signaled that rare-earth metal recycling is critical for the industry.[230] Samsung EV and Google publicly support a moratorium on deep-sea mining until the operations clearly demonstrate minimal environmental harm.[231] If the environmental consequences of deep-sea mining are substantial and public, electronics manufacturers that are sensitive to environmental impacts or are appealing to an environmentally conscious consumer base could incorporate sustainable mining practices into supply agreements to ensure their products are produced as sustainably as possible.

Furthermore, given the vast capital required for deep-sea mining, institutional investors and banks could tie their financial support of such operations to sustainability requirements.[232] The Equator Principles, which require companies to meet eight Environmental and Social Performance Standards, are widely adopted

226. *See* Koschinsky et al., *supra* note 73, at 672 (highlighting the increased demand for metals in India, China, and other "transitioning countries"); HUND ET AL., *supra* note 25, at 38 (projecting that by 2050, most solar photovoltaic deployments are expected to take place in non-Organisation for Economic Co-operation and Development countries, but especially in China and India); Jeanne Whalen, *The Next China Trade Battle Could Be over Electric Cars*, WASH. POST (Jan. 17, 2020), https://www.washingtonpost.com/business/2020/01/16/next-china-trade-battle-could-be-over-electric-cars/ [https://perma.cc/N7EA-ASJY].

227. *New Wal-Mart Effect*, *supra* note 163, at 930–32.

228. *Id.* at 932.

229. *Id.* at 930; *Learn About Environmental Management Systems*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/ems/learn-about-environmental-management-systems#what-is-an-EMS [https://perma.cc/FG9E-WYC9] (Sept. 28, 2021).

230. Nellis, *supra* note 219.

231. Jordans, *supra* note 225.

232. *Existing Environmental Management Approaches*, *supra* note 206, at 174.

among project financing organizations.[233] Performance Standard 6 requires borrowers to minimize impacts to biodiversity in the project's area of influence.[234] The Equator Principles could thus force mining operators to consider the consequences of their activities on deep-sea biodiversity in light of developing scientific research and information before they receive funds to conduct further mining.[235] Institutional investors are also increasingly mindful of their investment's environmental effects and could thus reconsider their ventures if negative publicity surrounding the environmental consequences of deep-sea mining emerges.[236]

C. Potential Independent Certification Schemes

Third-party, private certification schemes attempt to align market preferences for sustainably sourced goods with firms that supply sustainably produced goods by using labels in marketplaces.[237] In theory, the economic advantage that firms derive from this connection to consumers should incentivize firms to adopt these environmental practices.[238] Establishing effective and independent certification schemes is, however, expensive to establish and requires extensive organization to develop, implement, monitor, enforce, and promote private standards.[239] Given this expense and the likely emergence of ISA regulations to govern mining in the Area, the justification for a third-party, independent regulatory regime may not

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233. *Id. See generally* THE EQUATOR PRINCIPLES ASS'N, EQUATOR PRINCIPLES: EP4 (2020), https://equator-principles.com/ep4/ [https://perma.cc/J7YG-SKZP]; INT'L FIN. CORP., PERFORMANCE STANDARD 6: BIODIVERSITY CONSERVATION AND SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES (2012), https://www.ifc.org/wps/wcm/connect/3baf2a6a-2bc5-4174-96c5-eec8085c455f/PS6_English_2012.pdf?MOD=AJPERES&CVID=jxNbLC0 [https://perma.cc/G7KC-WHMZ].

234. *See generally* INT'L FIN. CORP., *supra* note 233.

235. *See* Jones, *supra* note 218.

236. *See* Paul Sullivan, *A Call for Investors to Put Their Money Toward a Green Future*, N.Y. TIMES (Jan. 24, 2020), https://www.nytimes.com/2020/01/24/business/green-investments-climate-change.html [https://perma.cc/2N63-8AUK] (describing Blackrock's, the world's largest asset manager, decision to set environmental sustainability as a core goal).

237. *See* Martin, *supra* note 182; *Private Environmental Governance*, *supra* note 164, at 148–49.

238. *See Private Environmental Governance*, *supra* note 164, at 141–43, 166 (discussing the incentives for users to overexploit common pool resources and that labelling products may address this issue by allowing users that appropriately use common pool resources to access lucrative market opportunities).

239. *See generally* Martin, *supra* note 182 (describing the multi-stakeholder organization that is involved in the development, implementation, review, and marketing of a successful private certification scheme, the Marine Stewardship Council).

exist for some time.[240] If sufficient consumer interest in sustainably sourced electronics or energy production emerges, however, a private certification scheme with labels to identify compliant products could become feasible.[241] Existing certification schemes like the MSC can serve as models for creating a "Deep Sea Floor Stewardship Council" that could provide independent mining standards and assemble and disseminate information to the public and the market about existing mining practices.[242]

D. Valuable Roles for NGOs

Regardless of the potential governance mechanism, nongovernmental organizations (NGOs) will likely have a critical role in developing and enforcing environmental standards for deep-sea mining. NGOs are not officially associated with or incorporated into the ISA but play a key role in monitoring and publicizing discussions, agreements, and initiatives in the ISA Assembly or Council.[243] NGOs will also likely be instrumental in evaluating and publicizing the environmental consequences of deep-sea mining to the general public.[244] In addition, firms could develop environmental performance agreements with NGOs that promise to meet or exceed regulatory requirements to prevent public opposition to an activity.[245] Thus, NGOs could have critical direct and indirect roles that ensure the environmental sustainability of deep-sea mining.

240. *See Private Environmental Governance*, *supra* note 164, at 148 (describing the development of the Forest Stewardship Council after a period of government inaction and failed international agreements).

241. *See* Aryn Baker, *This Mining Executive Is Fighting Her Own Industry to Protect the Environment*, TIME (Apr. 13, 2022, 12:34 PM), https://time.com/6166174/seabed-mining-environmental-impact/ [https://perma.cc/UPS3-H8S2] (discussing the potential for innovative new mining techniques and for a private independent standards body to produce a "BetterEV" standard for mining companies to demonstrate their environmental sustainability).

242. *See generally* Martin, *supra* note 182.

243. *See Observers*, INT'L SEABED AUTH., https://www.isa.org.jm/index.php/observers [https://perma.cc/Q2WX-Z825] (last visited Feb. 27, 2022).

244. *See* Miller et al., *supra* note 16, at 7, 19 (describing the involvement of NGOs during development of exploitation regulations and mentioning a potential role for nongovernmental observers during mining operations); Koschinsky et al., *supra* note 73, at 684, 686 (noting the role of NGOs in advocating and challenging perceived deficiencies in ISA procedures or substantive requirements).

245. *Private Life of Public Law*, *supra* note 167, at 2064–66.

E. Limitations of Private Deep Sea Governance

Market pressure for sustainable production of goods and services is a powerful incentive for firms to justify the incorporation of private environmental governance into their decisions and operations. Firms that incorporate environmental requirements into their business models, however, must be able to internalize the cost of those requirements unless the requirements increase efficiency to offset the cost, stave off further government regulation, or otherwise lower the transaction costs associated with the activity.[246] High consumer pressure for sustainably produced goods, competition from rivals with fewer resources, or corporate recognition that long-term stability relies on sustainable production may also justify investment in environmental protection provisions.[247] Parties are most likely to include environmental provisions in rare-earth metal transactions if the environmental consequences of deep-sea mining are publicized. Publicity could spark selective purchasing of recycled or sustainably mined products and can damage the reputation of companies that purchase or invest in deep-sea minerals and mining operations.[248]

Because deep-sea mining will occur in remote and inhospitable environments, monitoring the effectiveness of any regulations or standards or determining whether operations adhere to regulations and applicable contractual obligations will be costly and difficult.[249] State parties that sponsor mining operations and NGOs attached to the ISA will likely be critical for the discovery and publicity of deep-sea mining's environmental impacts, as well as any deviations

246. *See id.* at 2079–81; *Private Environmental Governance*, *supra* note 164, at 180.

247. *Private Environmental Governance*, *supra* note 164, at 180; Van Dover et al., *supra* note 218, at 100–02 (highlighting the difficulty of raising public pressure to restore deep-sea ecosystems that are far from the public's eye).

248. *See* Ardorn et al., *supra* note 155, at 58 (discussing the benefits of transparency); *e.g.*, Letter from Andrew Friedman, *supra* note 207 (demonstrating PEW's efforts to draw attention to ISA's decisions); *Deep Sea Mining Industry Confronted at Sea for First Time by Greenpeace*, GREENPEACE INT'L (Apr. 6, 2021), https://www.greenpeace.org/international/press-release/47077/deep-sea-mining-industry-confronted-sea-first-time-greenpeace/ [https://perma.cc/7FUM-W3AE] (highlighting Greenpeace's efforts to draw publicity toward the environmental harms of deep-sea mining).

249. *See* Niner et al., *supra* note 19, at 4 (highlighting the cost and difficulty of assessing biodiversity in remote environments that will be a key metric to establishing effective environmental baselines and evaluating the recovery of mined locations); Van Dover et al., *supra* note 218, at 103 (highlighting that 80 percent of estimated deep sea restoration costs are related to ship time and autonomous vehicles that are necessary as a result of the deep and remote environments).

from regulations or private requirements.[250] The effectiveness of NGOs in this capacity, however, may turn entirely on the ISA's cooperation and the meaningful incorporation of NGOs in their processes.[251] If deep-sea mining occurs outside regulatory frameworks or if the ISA does not develop and enforce a transparent regulatory scheme, the ability of NGOs, and other observers, to monitor and share information on mining practices may be limited.[252] As a result, the entire regulatory scheme, public and private, may rely on good faith observations and reports of a relatively small number of organizations capable of independently evaluating the practices and consequences of an industry operating in remote and extreme environments.

IV. CONCLUSION

Demand for rare-earth metals is likely to surge as economies around the world transition to renewable energy sources.[253] The deep sea has the potential to provide large amounts of high-quality rare-earth metals to supply this demand, but the inadequacy of information on deep-sea ecosystems means very little is known about the potential consequences of mining in these areas.[254] The ISA is the international regulatory body charged with regulating the exploitation of the deep seabed beyond national jurisdiction, but some countries—notably the United States—are not members of the ISA.[255] To date, the ISA is drafting, and will likely soon adopt, regulations for commercial exploitation of deep-sea ecosystems.[256] Although these regulations will likely strive for a precautionary approach that limits damage to the environment and adopts an adaptive management framework, the limited data and knowledge of these systems mean some environmental damage is inevitable.[257] Private environmental governance has the potential to reduce the harms of deep-sea mining as more information on mining in deep-sea ecosystems emerges. Contract provisions can ensure that corporations looking to sell their metals conduct rigorous

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250. *See Observers*, *supra* note 243 (describing the ability of nongovernmental organizations to observe, but not vote during, the public deliberations of the ISA Assembly and, upon invitation, the deliberations of the Council).

251. *Id.* (noting the ISA's discretion in the level of NGO participation); *see also* Ardorn et al., *supra* note 155 (noting limited public participation and the inability of observers to attend key committee meetings).

252. *See* Ardorn et al., *supra* note 155, at 62–63.

253. *See* Ives, *supra* note 7; HUND ET AL., *supra* note 25, at 13, 71–74, 93.

254. Hylton, *supra* note 19; Miller et al., *supra* note 16, at 1–2, 19.

255. Tong, *supra* note 82, at 323.

256. *See* Munson, *supra* note 205.

257. Miller et al., *supra* note 16, at 1–2, 19. *See generally* Niner et al., *supra* note 19.

environmental assessments before mining, adopt the latest mining technology, and monitor and report the impacts of their operations over the long term.[258] Because these provisions only require the consensus of the contracting parties, as opposed to the approval of a large regulatory body like the ISA, they could quickly expand or extend the ISA regulatory regime.[259] If large financial investors and leaders in the retail, technology, or automobile industry recognize the importance of sustainable rare-earth metal production and consumption, they may align their transactions in the commodities market to minimize their impact on the deep sea by forcing contracting parties to adhere to best environmental practices or—perhaps better—by finding alternative, recycled sources for their technology.[260]

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258. *See Private Environmental Governance*, *supra* note 164, at 157, 161; *Private Life of Public Law*, *supra* note 167, at 2051–52.

259. *See generally Gap-Filling Role of Private Environmental Governance*, *supra* note 168.

260. *See supra* Section III.B.

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