CRAFTING AN INTERNATIONAL LEGAL FRAMEWORK FOR RENEWABLE ENERGY ON THE HIGH SEAS

BY

TODD EMERSON HUTCHINS*

Ocean renewable energy (ORE) technologies, such as wind, waves, and biomass harvesting, have rapidly advanced and are proliferating around the world. This Article considers whether existing Law of the Sea sufficiently manages ORE development on the high seas and, if not, what type of regime would best effectuate a sustainable and just allocation of such resources. Part II introduces ORE systems, highlighting factors that will push ORE development further from shore out into the high seas beyond national jurisdiction. Part III considers whether the existing international legal framework for allocating ocean resources, principally the United Nations Convention on the Law of the Sea (LOSC), can adequately govern ORE development on the high seas. In finding existing treaties and mechanisms are insufficient, this Part forewarns that disorderly development will likely lead to overexploitation and unjust resource allocations, potentially sparking geopolitical tensions and ecological disaster. Part IV explores alternative ocean resource management regimes, such as expanded exclusive zones for renewable energy administered by individual nations, regional organizations, and a global administrative authority. Parts V and VI conclude that a hybrid approach, which combines the most advantageous elements of each alternative, is necessary and exhort the United Nations to either call for a new convention or adopt a high seas ORE implementing agreement as an annex to the existing LOSC.

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*Lieutenant Commander, Judge Advocate General's Corps (JAGC), United States Navy. J.D., University of California, Berkeley; LL.M., The George Washington University. The author wishes to thank Professor Sean D. Murphy for inspiration and support. The views expressed are the author's and do not necessarily reflect those of the U.S. Navy, Dept. of Defense, or U.S. Government.

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I. INTRODUCTION

Modern civilization relies on electricity to power everything from cities and cars to computers and commerce, yet the fossil fuels currently relied upon are insufficient to meet growing demands, unsustainable, and environmentally dangerous.[1] The oceans offer alternative potential energy sources. New technological advances herald an ocean renewable energy (ORE) "renaissance" due to the advent of floating wind turbines, wave energy devices, and efficient marine biomass conversion processes.[2]

[1] UNITED NATIONS ENVIRONMENT PROGRAM ET AL., 2019 REPORT: THE PRODUCTION GAP 8 (2019); *see also* Archana Dayalu, *Why We Need Sustainable Energy*, HARV. U.: SCI. NEWS (Dec. 15, 2012), https://perma.cc/ZCA3-4EJD (highlighting the dangers associated with reliance on fossil fuel as the world's primary energy source; namely, the inability of a finite resource to meet growing societal needs, the unsustainable nature of the degrading impacts of fossil fuel extraction and toxic emissions, and the general environmental cost of climate change).

[2] *See* Joshua Philipp, *Boston Joins the Clean Energy Renaissance with Wind Facility*, EPOCH TIMES, https://perma.cc/HB5L-K7ME (last updated Aug. 12, 2012) (giving an example of Boston entering the offshore wind energy generation market, made possible by new

With increasing demand, promising technologies, and a number of factors pushing projects further from shore, ORE development on the high seas beyond national jurisdiction is not a matter of *if*, but rather *when* and *how*. If left unregulated, disorderly development will result in inequitable resource allocation and environmental damage. Regulatory, financial, and energy plans for ORE resources must be coordinated to prevent irreparable harm to marine ecosystems and geopolitical disputes.[3]

The United Nations Convention on the Law of the Sea (LOSC) allocates ocean resources, such as fish stocks and undersea oil, among states; however, its drafters never contemplated vast ORE farms on the "high seas"[4]—the open ocean beyond areas where the coastal state exercises jurisdiction over natural resources on the surface and in the water column.[5] The LOSC's silence regarding high seas OREs starkly contrasts with its detailed provisions for resource allocation in other maritime zones, including, for example, absolute coastal state resource control in the territorial sea;[6] coastal state sovereign rights to living and nonliving resources outside the territorial sea up to 200 nautical miles (nm) from the baselines in the Exclusive Economic Zone (EEZ);[7] coastal state sovereign rights to the resources of the continental shelf, which may legally extend up to 350 nm or more from the baseline depending on ocean floor topography;[8] and shared international communal rights to mineral resources on the deep seabed, which is the seafloor beyond the continental shelf,[9] managed by the LOSC-created International Seabed Authority for the benefit of all mankind.[10] Silence on ORE in the LOSC means that default rules for the high seas resources allocation apply, thus the LOSC permits all states equal and extensive "freedoms of the high seas" in those areas beyond national jurisdiction.[11] Consequently, the current Law of the Sea framework permits all states to develop high seas OREs but

technologies); *Ocean Energy Technology Continues to Develop*, THINK ENERGY, https://perma.cc/CMF4-NJCL (last visited Mar. 2, 2021).

[3] *See, e.g.*, HARRY SCHEIBER, ECONOMIC USES OF THE OCEANS AND THE IMPACTS ON MARINE ENVIRONMENTS: PAST TRENDS AND CHALLENGES AHEAD 3 (2011). *See also* Megan Higgins, *Is Marine Renewable Energy a Viable Industry in the United States? Lessons Learned from the 7th Marine Law Symposium*, 14 ROGER WILLIAMS U.L. REV. 562, 565, 572–75 (2009) (examining the complex regulatory interplay between state and federal agencies intended to ameliorate ecological and jurisdictional externalities brought by off-shore energy development).

[4] United Nations Convention on the Law of the Sea arts. 86–115, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter LOSC].

[5] *Id.* arts. 86–89.

[6] The territorial sea generally stretches 12 nautical miles seaward from the coastline. *Id.* art. 3.

[7] *Id.* arts. 56–57.

[8] *Id.* arts. 76–77.

[9] *See id.* art. 1(1) ("'Area' means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.").

[10] *Id.* arts. 136–37, 140.

[11] *See id.* art. 87 (recognizing, *inter alia*, unenumerated rights).

provides no guidelines on how such resource development should be allocated, managed, and operated.

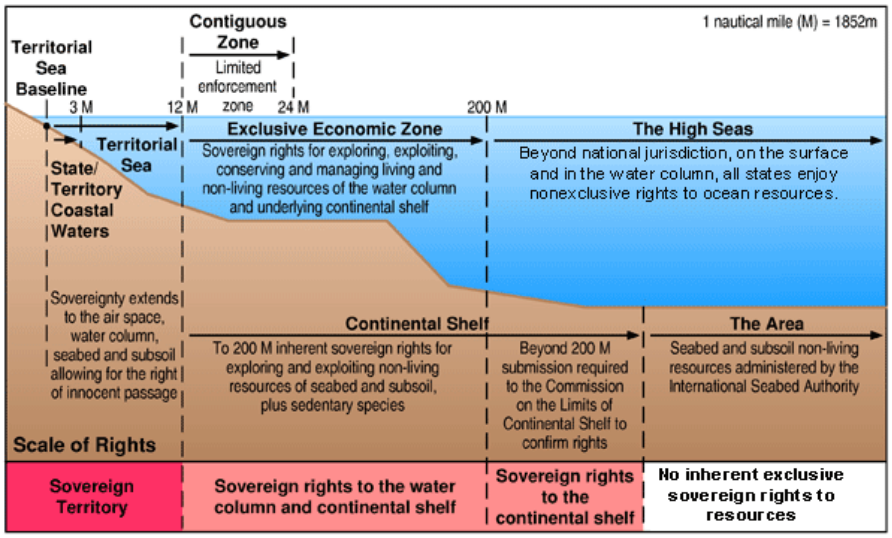

Figure 1: Maritime zones and rights under the 1982 United Nations Convention on the Law of the Sea (UNCLOS).[12]

This constitutes a substantial gap in the LOSC's framework. Top scientists and policymakers have called for a framework for high seas ORE management, but alarmingly, to date, there is scant legal scholarship on the topic.[13] No scholars have considered an international legal framework to manage ORE development on the high seas. Yet, the discussion must occur before it is too late. Without clear delimitation of rights and responsibilities, uncertainty may stymie development or, alternatively, result in marine environment destruction due to free-for-all exploitation.[14] The time has come for the United Nations Secretary

[12] Philip Symonds, Mark Alcock & Colin French, *Setting Australia's Limits*, AUSGEO NEWS, Mar. 2009, at 3, 4.

[13] *See* JOHN REID, REPORT OF WORKING GROUP ON MARINE GEOTHERMAL ENERGY 1 (2008), https://perma.cc/95RH-F37U (noting that before ORE can be harnessed, legal, political, and environmental issues must be solved). *See also* David Leary & Miguel Esteban, *Climate Change and Renewable Energy from the Ocean and Tides: Calming the Sea of Regulatory Uncertainty*, 24 INT'L J. MARINE & COASTAL L. 617, 619 (2009) (observing that regulatory uncertainty impedes development); Robin Whitlock, *Ownership of Offshore Wind Farms in the High Seas Needs to be Defined Says Chatham Partners Report*, RENEWABLE ENERGY MAG. (Dec. 3, 2019), https://perma.cc/T5BJ-3R8U (highlighting a recent report indicating that although "[d]eveloping technology means offshore wind projects can be built further from shore . . . if such technology were to allow the construction of wind farms in the high seas, the current legal framework would not have the scope to cover such development").

[14] *See* REID, *supra* note 13, at 7–8 (discussing the environmental consequences resulting from uncertain jurisdictional issues).

General to initiate a process for establishing a new international implementing agreement to allocate and manage high seas OREs.

II. OCEAN RENEWABLE ENERGY RENAISSANCE AND THE PUSH TO THE HIGH SEAS

Due to significant investment in ORE research and development, the technology has shifted from the "fringe" to mainstream, creating a robust offshore energy industry.[15] Today, OREs are being commercially developed and deployed around the globe.[16] With the rapid increase of electrical output from OREs,[17] experts anticipate ocean wind, wave energy, and biomass will become important sources of energy in the near future.[18]

A. Wind Power

Since the early 2000s, global wind power capacity increased dramatically and now satisfies over 5% of humanity's energy demand.[19] In Denmark, wind constitutes over 40% of the energy supply, while in Germany, Ireland, Portugal, Spain, Sweden, and Uruguay, wind represents over 10% of the power share.[20] Although offshore wind projects in 2019 produced just ".3% of global power generation . . . its potential is vast" and energy output is expected to surge.[21] In Europe and Australia, ocean wind farms have proliferated as higher offshore winds allow turbines to spin on average 10–20% faster than those on land.[22] As of 2020, the global offshore wind market has grown nearly 30% each year for the last decade, 150 new projects are in development, and by 2040,

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[15] Erik Jacques, *Brave New Waterworld*, CNBC (Mar. 2011), https://perma.cc/4NMY-Z5HN.

[16] *See* OCEAN ENERGY SYSTEMS, 2020 ANNUAL REPORT 10–13 (2021), https://perma.cc/WRS4-9D2G. *See also* Jahangir Khan & Gouri S. Bhuyan, Int'l Energy Agency [IEA], *Ocean Energy: Global Technology Development Status*, at 44–54, IEA-OES Doc. T0104 (Mar. 2009), https://perma.cc/W284-7SW4 (showing the various ocean wave technologies developed by various countries).

[17] Anmar Frangoul, *In the UK, Scientists Are Using Drones to Pick the Best Spots for Tidal Power Installations*, CNBC NEWS (Mar. 3, 2021), https://perma.cc/5CEA-CSA9 (discussing the ways better siting and implementation technologies have lowered the costs and risk of ORE projects, thereby increasing the number of projects in the coming years).

[18] Jacques, *supra* note 15.

[19] *Wind Power Capacity Reaches 546 GW, 60 GW Added in 2017*, WORLD WIND ENERGY ASS'N (Feb. 12, 2018), https://perma.cc/GJA7-P4XP.

[20] *Id.*

[21] INT'L ENERGY AGENCY, OFFSHORE WIND OUTLOOK 2019: WORLD ENERGY OUTLOOK SPECIAL REPORT (Nov. 2019), https://perma.cc/9GAH-B6JB [hereinafter OFFSHORE WIND OUTLOOK 2019] (quoting International Energy Association Executive Director, Dr. Fatih Birol); INTERNATIONAL RENEWABLE ENERGY AGENCY, FOSTERING A BLUE ECONOMY: OFFSHORE RENEWABLE ENERGY 18 fig.8 (2020), https://perma.cc/EA66-RU7P.

[22] ROGER H. CHARLIER & CHARLES W. FINKL, OCEAN ENERGY: TIDE AND TIDAL POWER 5–6 (2009).

"offshore wind power capacity is set to increase by at least 15-fold worldwide by 2040, becoming a $1 trillion business" and will "match[ ] capital spending on gas- and coal-fired capacity over the same period."[23] The European Commission has committed €800 billion (roughly $971 billion) to increase offshore wind production by twenty-five times current capacity by 2050.[24] In the United States, thirty offshore wind projects are in development.[25] The U.S. Department of Energy explains that, as these projects proliferate, they also tend to move further offshore due to more consistently strong winds.[26] Other factors pushing deployment of OREs into the high seas include the availability of ocean space beyond local jurisdiction,[27] reduced permitting costs,[28] lower taxation,[29] the invention of floating, self-aligning turbines (permitting placement in very deep waters and maximizing efficiencies),[30] investments in undersea power transmission cables,[31] and lack of interference with coastal vantages, nearshore fishing, or recreational boating.[32] Environmental concerns may also drive wind farms further out into the high seas. In nearshore waters, spinning wind turbines inadvertently kill a large number of coastal migratory birds in spinning blades; similar concerns, however, do not

[23] OFFSHORE WIND OUTLOOK 2019, *supra* note 21, at 11, 13.

[24] Anmar Frangoul, *Europe is Planning a 25-fold Increase in Offshore Wind Capacity by 2050*, CNBC (Nov. 19, 2020), https://perma.cc/G74K-LVYQ.

[25] *Top 10 Things You Didn't Know About Offshore Wind Energy*, OFF. ENERGY EFFICIENCY & RENEWABLE ENERGY (Oct. 8, 2020), https://perma.cc/N4N9-DRP6.

[26] Gary Norton & Brian Pitts, *4 Emerging Trends in U.S. Offshore Wind Technologies*, U.S. DEP'T ENERGY (Aug. 9, 2017), https://perma.cc/6TTN-86PP.

[27] *See* WALT MUSIAL ET AL., NAT'L RENEWABLE ENERGY LAB., 2016 OFFSHORE WIND ENERGY RESOURCE ASSESSMENT FOR THE UNITED STATES 38 (2016), https://perma.cc/4M5L-VQ2N (finding that "88.3% of the technical offshore wind resource potential area . . . in the United States is in federal waters [further from shore] and approximately 11.7% of the total technical resource area is in state waters").

[28] *See* U.S. DEP'T ENERGY & U.S. DEP'T INTERIOR, NATIONAL OFFSHORE WIND STRATEGY: FACILITATING THE DEVELOPMENT OF THE OFFSHORE WIND INDUSTRY IN THE UNITED STATES 55 (2016), https://perma.cc/D99V-D8BR (describing the various initiatives to improve the federal leasing permit process and, presumably, lowering of associated costs and fees).

[29] *See* STOEL RIVES LLP, THE LAW OF WIND: A GUIDE TO BUSINESS AND LEGAL ISSUES, ch. 10, at 5–6 (8th ed. 2018), https://perma.cc/CK3X-RWJ9 (noting that in addition to federal taxes, state tax issues must be evaluated carefully).

[30] *See, e.g.*, Sarah McFarlane, *Floating Wind Turbines Buoy Hopes of Expanding Renewable Energy*, WALL ST. J. (Feb. 6, 2021), https://perma.cc/3HE8-2K7H (discussing how floating wind farms such as Hywind Scotland will enable turbines to capture stronger winds in much deeper waters); Adrijana Buljan, *Germans Developing Self-Aligning Floating Wind Turbine*, OFFSHORE WIND (Nov. 23, 2020), https://perma.cc/4TDP-G3CQ (describing the potential cost-effectiveness and easy installation of self-aligning floating wind turbines).

[31] Patrick J. Kiger, *New Energy Projects Boost the Use of Undersea Power Cables*, NAT'L GEOGRAPHIC (Aug. 18, 2014), https://perma.cc/7FZF-BZMJ. *See also* Steve Hanley, *UK Energy Companies Plan Massive Undersea HVDC Cable from Scotland to Britain*, CLEANTECHNICA (Nov. 17, 2020), https://perma.cc/5Z3W-WFKH (describing plans for the Eastern Link that will be one of the longest undersea transmission cables once it is constructed).

[32] Norton & Pitts, *supra* note 26.

exist further at sea.[33] Multinational conglomerates are "moving quickly into the floating offshore wind space," indicating that "the technology is ready for widespread commercial deployment."[34] Individually, these turbines are growing larger as increased rotor diameter means greater power with longer, more aerodynamic blades.[35] Collectively, massive scale is also necessary for economic viability and to justify substantial initial investment. Consequently, proposed developments are sprawling, multi-turbine wind farms covering vast expanses of ocean space.[36] The largest, Hornsea One, consists of 174 seven-megawatt wind turbines that are 100 meters tall.[37] Located seventy five miles offshore in the North Sea, Hornsea One has spinning blades larger than the London Eye, spans 600 square miles (larger than the Maldives archipelago), and powers over one million homes.[38] Off the United States' eastern seaboard, mega-wind-projects will come online by 2025, including the 250-square mile Ocean Wind Project (three times larger than the District of Columbia).[39] For now, these projects are within the national jurisdiction of EEZs, but the need for greater scale and higher wind efficiencies will push future projects further offshore into the high seas.[40]

B. Wave Power

Wave power is another promising ORE, which captures the kinetic potential energy of ocean waves. According to the International Energy Association, wave energy alone may someday fulfill all human energy demands since it is more constantly reliable than other OREs.[41] Though not yet commercially viable, new technological breakthroughs suggest this may change quickly. The two most common wave energy technologies

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[33] *See* Kim Geiger, *First U.S. Offshore Wind Energy Project Faces Lawsuit*, L.A. TIMES (June 26, 2010), https://perma.cc/7D2Z-DVSC (referring to a lawsuit alleging Cape Wind's Environmental Impact Report failed to consider whales and sea birds).

[34] *World's Largest Floating Wind Turbine Begins Operation*, MARITIME EXECUTIVE (Jan. 5, 2020), https://perma.cc/Z88V-V7KP.

[35] Denis Loctier, *Why Do Offshore Wind Turbines Keep Getting Bigger?*, EURONEWS, https://perma.cc/9Z5T-AW5L (last updated Nov. 24, 2020).

[36] CHARLIER & FINKL, *supra* note 22, at 5.

[37] Hanna Ziady, *The World's Largest Offshore Wind Farm is Nearly Complete. It Can Power 1 Million Homes*, CNN, https://perma.cc/8QKW-M9N8 (last updated Oct. 11, 2019); Adnan Durakovic, *World's Largest Wind Farm Fully Up and Running*, OFFSHOREWIND.BIZ (Jan. 30, 2020) https://perma.cc/SS7M-3LWU.

[38] Ziady, *supra* note 37.

[39] Roger Drouin, *After an Uncertain Start, U.S. Offshore Wind is Powering Up*, YALE ENV'T 360 (Jan. 11, 2018), https://perma.cc/NAJ2-CRM6.

[40] *See* OFFSHORE WIND OUTLOOK 2019, *supra* note 21, at 75, 76.

[41] AEA ENERGY & ENV'T, REVIEW AND ANALYSIS OF OCEAN ENERGY SYSTEMS DEVELOPMENT AND SUPPORTING POLICIES 2 (June 28, 2006), https://perma.cc/D97G-NXF9 (current human consumption: 13 terrawatts/year; IEA estimates 8,000–80,000 tWh/year); Ewen Callaway, *Energy: To Catch a Wave*, NATURE (Nov. 7, 2007), https://perma.cc/4Z9M-UJTD; Alison Pearce Stevens, *Ocean Energy Could be the Wave of the Future*, SCI. NEWS STUDENTS (May 30, 2019), https://perma.cc/SZ7C-7CWM.

are attenuators and point absorbers.[42] Structurally, attenuators are long, semi-submerged floating devices that span up to 180 meters, have diameters of four meters, and are made of over 1,350 tons of steel.[43] Each attenuator consists of hinged articulated sections which push hydraulic rams, driving generators to produce electricity as waves pass.[44] In 2008, the first commercial system failed due to buoyancy tank leaks,[45] but engineers appear to have overcome such problems, prompting a wave of new projects. The European Marine Energy Centre (EMEC) installed an attenuator off Scotland, and fifty more are planned or are in development in United Kingdom, Portugal, Hawaii, and Oregon.[46] Estimates of the amount of power that might be produced by wave energy projects are staggering. Attenuator designers claim their projects can yield three times more power than a wind farm in the same amount of space and time.[47] The six wave energy projects planned off the coast of Scotland are expected to produce four times the energy as a nuclear power plant and the U.S. Department of Energy reports wave power may become the dominant source of energy for the U.S. West Coast.[48] Yet, critics of attenuators oppose deployment in nearshore areas, claiming they endanger navigation,[49] interfere with coastal fishing,[50] and diminish surfers' waves.[51] Such opposition will push the attenuators away from the shore.

Point absorber buoys, a variation of this technology, rise and fall with the ocean's waves at a single point, generating energy as the part floating

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42 *Wave Energy*, LIQUID GRID, https://perma.cc/ELT7-N6RD (last visited Mar. 5, 2021).

43 *Pelamis Wave Power*, EUR. MARINE ENERGY CTR., https://perma.cc/X68R-QSNF (last visited Mar. 5, 2021).

44 Yue Hong et al., *Review on Electrical Control Strategies for Wave Energy Converting Systems*, 31 RENEWABLE & SUSTAINABLE ENERGY REVS. 324, 332 (2014).

45 Tim Smedley, *Has Wave Energy Finally Come of Age?*, STARTUP (Jun. 19, 2019), https://perma.cc/NG4J-ZDQP.

46 Jes Burns, *Oregon Wave Energy Testing Project Moves Forward*, OPB (Jun. 10, 2019) https://perma.cc/49NW-N7CD; International Water Power & Dam Construction, *How are Major Wave and Tidal Energy Projects Progressing around the Word?*, NS ENERGY (Oct. 26, 2020), https://perma.cc/H7JF-YQ3N. Callaway, *supra* note 41.

47 CHARLIER & FINKL, *supra* note 22, at 12.

48 Jacques, *supra* note 15; LEVI KILCHER ET AL., NAT'L RENEWABLE ENERGY RES. LAB., MARINE ENERGY IN THE UNITED STATES: AN OVERVIEW OF OPPORTUNITIES, at viii (Feb. 2021) https://perma.cc/W2KE-RRAE (figure ES-1 noting wave energy could be 64% of the West Coast's regional electricity generation).

49 The Royal Yacht Club demanded authorities prohibit nearshore installations. *See, e.g.*, *Wave Hub Adds Floating Wind to Pembrokeshire Wave Project*, ROYAL YACHT CLUB (Feb. 23, 2018), https://perma.cc/SCB4-4RMV.

50 Callaway, *supra* note 41.

51 Christina Williams, *Report: Stalled Energy Projects Cost Oregon 21,000 Jobs*, SUSTAINABLE BUS. OR., https://perma.cc/55PB-H76K (last updated May 8, 2011) (explaining that a permit for an offshore wave energy project opposed by the Ocean Surfrider Foundation was withdrawn only a year after it was granted). *Cf. Renewable Ocean Energy*, BEACHAPEDIA, https://perma.cc/2V83-Y9NS (last visited Mar. 6, 2021) (stating that although little information is known about the impact of wave energy converters on wave characteristics, "[a]n isolated impact, such as reduced wave height for recreational surfers, could possible result").

on the surface is pulled away from the base, which is anchored to the sea floor. These can be deployed in phenomenal depths—a PowerBuoy was moored in 3,300 feet of water seventy-five miles off the coast of New Jersey.[52] Massive multi-buoy farms are planned off the coasts of Australia and Oregon.[53] Since wave strength is greatest in open oceans, these OREs eventually will be drawn further out into the high seas.[54]

C. Biomass Conversion

Another promising ORE technology, biomass conversion, transfers the stored metabolic energy of plants into carbon-neutral fuels.[55] In the United States, biomass conversion already produces more energy than all the nation's hydroelectric dams combined.[56] However, land-based biomass farms require considerable land, which is costly and could otherwise be used for agricultural food production.[57] At sea, marine organisms (e.g., algae and kelp) grow quickly and abundantly, transforming naturally occurring ocean nutrients into harvestable biomass.[58] The photosynthetic efficacy of kelp and algae is four times greater than terrestrial biofuels, meaning it does a much better job of

[52] *Ocean Power Technologies Launches PowerBuoy for US Navy*, ELECTRICNET (Oct. 16, 2008), https://perma.cc/TF8B-MHCE. *See also* Marine Energy, *Wave Energy Developer Wins US Navy Deal*, OFFSHORE ENERGY (Feb. 14, 2019), https://perma.cc/H4A6-P9PN (discussing a recent contract the Navy awarded to Ocean Power Technologies to "begin the development of a buoy mooring system which incorporates fiber optics for the transmission of subsea sensor data to airplanes, ships, and satellites").

[53] *Remote Tasmanian Island to be Powered by 'Blowhole' Energy that Harnesses Waves*, GUARDIAN (Feb. 1, 2021), https://perma.cc/2HKH-E3G5; Michelle Klampe, *Wave Energy: Oregon Gets First Permit for Testing Facility*, CHRONICLE (Mar. 4, 2021), https://perma.cc/EH5S-MY96 ("The ocean test site will be located about seven miles offshore [and] accommodate up to 20 wave energy devices.").

[54] Michael Kanellos, *FAQ: Energy on the High Seas*, CNET (Aug. 15, 2007), https://perma.cc/XRY3-Y8WW ("Waves begin to dissipate energy when the water gets less than 200 meters deep. At 20 meters in depth, a wave might have only one third of the energy it had in deep water.").

[55] James Barber, *Biological Solar Energy*, 365 PHIL. TRANSACTIONS ROYAL SOC'Y A: MATHEMATICAL, PHYSICAL, AND ENGINEERING SCI. 1007, 1010–11, 1018 (2007) (discussing artificial photosynthesis as an alternative means of energy, explaining that "[b]iomass is the end product of photosynthesis . . . . Many organizations consider 'biomass power' as an increasingly attractive option to partially replace fossil fuels").

[56] *Id.* at 1011 (noting that biomass provides a mean annual production rate of 0.1 terawatts of power, which accounts for roughly 3% of the United States' energy needs).

[57] Ethanol biomass fuels in Brazil and, to a lesser extent in the United States, have proven commercially viable. However, to replace fossil fuels, biomass would need to generate 20 terawatts of power requiring three times the amount of arable land under cultivation today. *Id.* at 1011–12.

[58] *See* Annie Sneed, *Could Our Energy Come from Giant Seaweed Farms in the Ocean?*, SCI. AM. (Mar. 16, 2020), https://perma.cc/U62A-LHUT (reporting that the United States government is funding various projects focused on exploring renewable energy sources generated from the ocean, explaining: "Once harvested, seaweed, also known as macroalgae, could potentially be turned into various forms of energy, such as biogas and ethanol, through different chemical processes.").

converting the sun's energy into a renewable fuel than plants ashore, offering a potential competitive advantage.[59] Likewise, ocean biomass requires no arable land, fresh water, fertilizer, or pesticides, and still grows two to three feet per day.[60] Economically, marine biomass energy conversion could become as cost-effective as coal or nuclear power.[61] Consequently, ocean biomass farming may soon capture incredible amounts of solar energy. Scandinavia and Japan already adopted nationwide energy plans that rely heavily on kelp to generate power.[62] In the United States, researchers plan "platform[s] hundreds of meters across and hundreds of meters deep full of kelp plants."[63] However, to provide enough biomass-driven electricity for the entire U.S. population, an ocean area about ten times larger than Utah would be required, representing significant coverage of the ocean surface.[64] Powerful interests, including billionaire Peter Thiel, are rushing to develop "profitable aquaculture farms" on the high seas because "[a]ll land on Earth has been claimed, [making] the ocean[s] . . . humanity's next frontier."[65] Like other OREs, biomass appears destined for expansive farms in international waters.

III. THE EXISTING FRAMEWORK FOR HIGH SEAS RESOURCES

A. Balancing High Sea Freedoms with Resource Rights

The Law of the Sea has always been concerned with resource allocation. Early jurists opined that ocean resources could not be

[59] Huihui Chen et al., *Macroalgae for Biofuels Production: Progress and Perspectives*, 47 RENEWABLE & SUSTAINABLE ENERGY REVS. 427, 427 (2015).

[60] Ari Shapiro & Monika Evstatieva, *Scientists Hope to Farm the Biofuel of the Future in the Pacific Ocean*, NAT'L PUB. RADIO (Aug. 22, 2017), https://perma.cc/3JLS-WM4L.

[61] Alistair G.L. Borthwick, *Marine Renewable Energy Seascape*, 2 ENGINEERING 69, 77 tbl.2 (2016) https://perma.cc/S78H-VP3F (showing levelized costs of electricity in the U.K. (in £/MW hour) as 50–120 for biomass, 80–105 for nuclear, 100–155 for coal with carbon capture, and 150–210 for offshore wind); U.S. DEP'T ENERGY, POWERING THE BLUE ECONOMY: EXPLORING OPPORTUNITIES FOR MARINE RENEWABLE ENERGY IN MARITIME MARKETS 51 (2019), https://perma.cc/KXN9-8B46 ("Current projected costs for marine algae are several times higher than terrestrial biomass, but improvements in yields, scale, and operations could see algae become cost competitive with terrestrial crops."). *See also* U.S. ENERGY INFO. ADMIN., LEVELIZED COSTS OF NEW GENERATION RESOURCES IN THE *ANNUAL ENERGY OUTLOOK 2021*, at 22 tbl.22 (2021), https://perma.cc/6EGS-MGKV.

[62] Shinya Yokoyama et al., *Energy Production from Marine Biomass: Fuel Cell Power Generation Driven by Methane Produced from Seaweed*, 28 WORLD ACAD. SCI. ENGINEERING & TECH. 320, 321 (2007).

[63] Shapiro & Evstatieva, *supra* note 60.

[64] Evan Ackerman, *Robotic Kelp Farms Promise an Ocean Full of Carbon-Neutral, Low-Cost Energy*, IEEE SPECTRUM (Mar. 15, 2017), https://perma.cc/BW5G-JEXE (30 times Utah is 2,550,000 square miles).

[65] *Seasteading*, SEASTEADING INST., https://perma.cc/B663-KLSH (last visited Mar. 6, 2021).

exclusively appropriated by any sovereign.[66] The ancient Roman legal scholar Marcianus declared all the fish in the seas as "*communis omnium naturali jure*" (common to all by operation of natural law).[67] Yet with the birth of nation-states came jurisdictional claims over trade routes, fishing grounds, and taxation of passing vessels.[68] Grotius' 1609 treatise *Mare Liberum* (Freedom of the Seas) countered that the oceans were open for all states to use, but for none to abuse.[69] Still, coastal nations asserted jurisdiction over the sea that they could effectively control. In 1793, then-Secretary of State Thomas Jefferson claimed exclusive United States-control of ocean resources up to three nautical miles from the shore.[70] In 1911, Russia expanded its "sovereign" territorial sea to six nautical miles, along with six more for exclusive fishing rights.[71] Other nations extended their claims, primarily to assert control over nearshore fish stocks.[72] Following World War II, the idea that states had a right to the resources beyond national jurisdiction was often reiterated.[73] Nevertheless, state practice was inconsistent.[74] In 1945, U.S. President Harry Truman declared exclusive rights over coastal fisheries and continental shelf resources, unilaterally establishing fish "conservation zones" far beyond the traditional three nautical mile territorial sea limit.[75] "As human

66 Peter Prows, *Tough Love: The Dramatic Birth and Looming Demise of UNCLOS Property Law (and What Is to Be Done About It)*, 42 TEX. INT'L L.J. 241, 250 (2006) (explaining that Grotius, working off Marcianus' views, believed ocean resources could not be held under an exclusive, private property right).

67 *Id.* at 249. Percy Thomas Fenn, Jr., *Justinian and the Freedom of the Sea*, 19 AM. J. INT'L L. 716, 716 (1925).

68 Arvid Pardo, *The Law of the Sea: Its Past and Its Future*, 63 OR. L. REV. 7, 12 (1984).

69 *See* Prows, *supra* note 66, at 250 (explaining Grotius' treatise). *See also* William Wertenbaker, *The Law of the Sea—II*, NEW YORKER (Aug. 1, 1983), https://perma.cc/V8AE-J6QA [hereinafter Wertenbaker II] (discussing modern nations signing the Law of the Sea treaty to protect the ocean's resources during the Third United Nations Conference).

70 PHILIP C. JESSUP, THE LAW OF TERRITORIAL WATERS AND MARITIME JURISDICTION 6–7 (1927).

71 William Wertenbaker, *The Law of the Sea—I*, NEW YORKER (Jul. 25, 1983), https://perma.cc/88ZC-PLLB [hereinafter Wertenbaker I].

72 *See* R.R. CHURCHILL & A.V. LOWE, THE LAW OF THE SEA 78 (3d ed. 1999).

73 *See* Harry N. Scheiber, *The Biodiversity Convention and Access to Marine Genetic Materials in Ocean Law*, *in* ORDER FOR THE OCEANS AT THE TURN OF THE CENTURY 187, 190 (D. Vidas & W. Østreng eds., 1999) ("The freedom of the seas doctrine was a partially competitive ideal, embodying the notion of open access to resources that were beyond the jurisdiction and control of individual states . . . the idea of limiting access to resources unreasonably violates the rule of law was a concept often reiterated [in the Atlantic Charter and international institutions].").

74 *Id.*

75 Proclamation No. 2668, *Policy of the United States with Respect to Coastal Fisheries in Certain Areas of the High Seas*, 3 C.F.R. § 68 (1945) (implemented by Exec. Order No. 9634, Providing for the Establishment of Fishery Conservation Zones, 3 C.F.R. § 437 (1945)) (noting "[t]he character as high seas of the areas in which such conservation zones are established and the right to their free and unimpeded navigation are in no way thus affected"). Proclamation No. 2667, *Policy of the United States with Respect to the Natural Resources of the Subsoil and Sea Bed of the Continental Shelf*, 3 C.F.R. § 67 (1945) (implemented by Exec.

activities crept farther and deeper into the oceans, international conflicts began to grow . . . and positivist methods of international law failed to tame this 'creeping jurisdiction.'"[76] In the rush to control ocean resources, overfishing ensued.[77] Judicial recognition of a lack of rigid rules encouraged states to make even more expansive jurisdictional claims extending national jurisdiction by giving the "imprimatur of legality to the most strongly held, even outright provocative, positions."[78] The International Court of Justice (ICJ) even held the right to ocean resources could be acquired and lost by prescription in the *Fisheries Case*.[79] While recognizing that "[t]he delimitation of sea areas has always an international aspect" and "cannot be dependent merely upon the will of the coastal state," the ICJ nonetheless upheld Norway's unilateral claim to exclusive jurisdiction based on "historic" dominion and the lack of persistent objection by other nations.[80] In an effort to remedy the incongruous state of legal affairs and bring order to the international system of ocean resource allocation, the International Law Commission drafted conventions concerning the Territorial Sea and the Contiguous Zone (CTS), the Continental Shelf (CCS), the High Seas (CHS), and Fishing and Conservation of Living Resources on the High Seas (CFCLR).[81] The First United Nations Conference on the Law of the Sea, held in Geneva in 1958, adopted these conventions allocating resources rights in these zones but without agreeing upon a specific breadth for a territorial sea.[82] The CCS encouraged "creeping coastal jurisdiction" by granting exclusive economic rights on the shelf to the extent a coastal state was capable of the exploitation of the natural resources.[83]

Order No. 9633, Reserving and Placing Certain Resources of the Continental Shelf Under the Control and Jurisdiction of the Secretary of the Interior, 3 C.F.R. § 437 (1945)).

76 Prows, *supra* note 66, at 253.

77 Stephanie Holmes, Comment, *Breaking the Ice: Emerging Legal Issues in Arctic Sovereignty*, 9 CHI. J. INT'L L. 323, 329–30 (2008).

78 Prows, *supra* note 66, at 253.

79 Fisheries Case (U.K. v. Nor.), Judgment, 1951 I.C.J. 116 (Dec. 18).

80 *Id.* at 132, 138, 142, 143.

81 Tulio Treves, *Introductory Note*: *1958 Geneva Conventions on the Law of the Sea*, U.N. AUDIOVISUAL LIBRARY OF INT'L L., https://perma.cc/8UFP-6G3W (last visited Mar. 6, 2021).

82 *Id. See* Convention on the Territorial Sea & the Contiguous Zone, art. 24, Apr. 29, 1958, 15 U.S.T. 1606, 516 U.N.T.S. 205.

83 Convention on the Continental Shelf, arts. 1–2, Apr. 29, 1958, 15 U.S.T. 471, 499 U.N.T.S. 311. ("[C]ontinental shelf" refers (a) to the seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 metres *or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources*. The coastal State exercises over the continental shelf sovereign rights for the purpose of exploring it and *exploiting its natural resources*."); Erik J. Molenaar, *Multilateral Creeping Coastal State Jurisdiction and the BBNJ Negotiations*, 36 INT'L J. MARINE & COASTAL L. 5, 11 (2021) ("Once adjacency was generally accepted as a basis for authority at sea, coastal States started claiming new rights and new maritime zones further and further from shore at the expense of the high seas regime. This process of creeping coastal State jurisdiction . . . was eventually codified in the 1958 Continental Shelf Convention, 32 which also uses the notion of adjacency in the definition of the continental shelf in Article 1.").

Perversely, rights allocation on the continental shelf thus depended on "technological capabilities and economic [power]"[84] favoring technologically-advanced, wealthy nations.[85] Maltese Ambassador to the United Nations, Arvid Pardo, feared powerful nations would seize the world's seabed resources.[86] He called for ocean floor resources beyond national jurisdiction to be the "common heritage of mankind."[87] The United Nations General Assembly responded by convening the Third United Nations Conference on the Law of the Sea in 1973, which aimed to prevent national appropriation of ocean floor resources [88] and came to fruition in the LOSC in 1982.[89]

B. LOSC's Silence Regarding High Seas OREs

Currently, the legal framework for ocean resource development derives almost entirely from the LOSC.[90] Considered a "Constitution for the Oceans," the LOSC balances rights and duties among nations to use the ocean and benefit from its resources.[91] Observers claim the LOSC might have been more aptly titled "[the Convention] on the Uses and Ownership of the Ocean and Its Resources," because it allocates rights to food, oil, energy, minerals, preservation of the environment, and navigation.[92] The LOSC, ratified or acceded to by 168 state parties, with the prominent exception of the United States, is generally followed, even by non-party nations, such that most provisions can be considered customary international law.[93] The LOSC geospatially allocates

84 Prows, *supra* note 66, at 256.

85 *See id.*

86 *See generally Request for the Inclusion of a Supplementary Item in the Agenda of the Twenty-Second Session: Declaration and Treaty Concerning the Reservation Exclusively for Peaceful Purposes of the Sea-Bed and of the Ocean Floor, Underlying the Seas Beyond the Limits of Present National Jurisdiction, and Their Resources in the Interest of Mankind*, at ¶ 2, U.N. Doc. A/6695 (Aug. 17, 1967) [hereinafter Note Verbale to the Secretary General]; U.N. GAOR, 22nd Sess., 1515th mtg. at 1, U.N. Doc. A/6695 (Nov. 1, 1967) ("[R]apidly developing technology makes possible the exploration, occupation and exploitation of the world's sea-beds . . . this capability will lead, indeed is already leading, to appropriation for national use of these areas, with consequences for all our countries that may be incalculable.").

87 Note Verbale to the Secretary-General, *supra* note 86, at ¶ 5.

88 G.A. Res. 2749, ¶¶ 1, 7 (Dec. 17, 1970) (declaring seabed resources as "common heritage of mankind" exploitable "for the benefit mankind").

89 *The United Nations Convention on the Law of the Sea (A Historical Perspective)*, U.N. OCEANS & L. SEA, https://perma.cc/9P7W-5R9A (last visited Mar. 18, 2021).

90 Sixty other international agreements relate to ORE. Moira L. McConnell & Edgar Gold, *The Modern Law of the Sea: Framework for the Protection and Preservation of the Marine Environment?*, 23 CASE W. RES. J. INT'L L. REV. 83, 97 (1991).

91 *See generally* Tommy T.B. Koh, *A Constitution for the Oceans*, *in* THE LAW OF THE SEA–INTRODUCTORY MATERIAL ON THE CONVENTION AND THE CONFERENCE, at xxxiii (1983).

92 Wertenbaker I, *supra* note 71. *C.f.* SHIGERU ODA, FIFTY YEARS OF THE LAW OF THE SEA 686–87 (2003).

93 *See* J. Ashley Roach, *Today's Customary International Law of the Sea*, 45 OCEAN DEV. & INT'L L. 239, 239–40 (2014) (explaining the international effect of the Convention on the

jurisdictional resource rights to coastal states based on distance from the shore.[94] Up to twelve miles from the baselines, the LOSC recognizes a coastal state's sovereignty over "territorial waters," including all resources therein, but permits foreign vessels "innocent passage."[95] Thus, in the territorial sea, the coastal State alone has a sole and absolute right to exploit OREs. Outside the territorial sea and up to two hundred miles from the baselines, the LOSC allows "exclusive economic zones" (EEZ) where all ships can navigate freely, but only the coastal state may exercise

> sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the sea-bed and of the sea-bed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds.[96]

Consequently, in the territorial sea and EEZ, the coastal State alone has the right to exploit OREs. The absence of similar language regarding OREs on the high seas leaves a gaping hole in international ocean law.

1. The Right of All Nations to Develop ORE on the High Seas

On the high seas, which are found beyond the EEZs, freedoms are expansive. Building on Grotius' principle of *mare liberum*,[97] the LOSC proclaims that all nations have an equal and undivided right to make use of the high seas,[98] specifically recognizing freedoms of fishing, aircraft overflight, the laying of submarine cables, the constructing of installations, and scientific research.[99] Importantly, the LOSC recognizes these rights "*inter alia*," meaning there are other, unenumerated freedoms.[100] The only restrictions on high seas activities imposed by

Law of the Sea). *See also* Leslie M. MacRae, *Customary International Law and the United Nations' Law of the Sea Treaty*, 13 CAL. W. INT'L L.J. 181, 221 (1983) (detailing the United States' refusal to officially adopt the LOSC, but adherence to many provisions as customary international law); John King Gamble, Jr. & Maria Frankowska, *The 1982 Convention and Customary Law of the Sea: Observations, a Framework, and a Warnin*g, 21 SAN DIEGO L. REV. 491, 492 (1984); Hugo Caminos & Michael R. Molitor, *Progressive Development of International Law and the Package Deal*, 79 AM. J. INT'L L. 871, 872 (1985) (stating non-signatories often follow the provisions of the LOSC).

94 LOSC, *supra* note 4, art. 3; Philip Allott, *Power Sharing in the Law of the Sea*, 77 AM. J. INT'L L. 1, 15–16 (1983).

95 LOSC, *supra* note 4, arts. 2–3, 7–14, 17.

96 *Id.* arts. 56(1)(a) (emphasis added).

97 HUGO GROTIUS, THE FREEDOM OF THE SEAS (James Brown Scott ed., Ralph Van Deman Magoffin trans., 1916) (1608) (translating to "the freedom of the seas"). *Id.* at 7 ("[An] unimpeachable axiom of the Law of Nations . . . [is that] [e]very nation is free to travel to every other nation, and trade with it.").

98 LOSC, *supra* note 4, art. 87.

99 *Id.*

100 *Id.*

LOSC are that they be exercised: 1) peacefully,[101] 2) with due regard for the interest of other states' high sea freedoms,[102] and 3) with due regard for the rights with respect to deep seabed mineral extraction.[103] Logically then, under the LOSC's unenumerated high seas freedoms, every nation has a right to develop OREs on the high seas. The LOSC's absence of language governing renewable energy on the high seas beyond national jurisdiction starkly contrasts with other parts of the Convention, namely the EEZ and territorial sea, which accord to the coastal State sole rights with respect to OREs.[104] This is understandable: In 1982, the LOSC's drafters were unaware of the potential for OREs on the high seas.[105] They did not contemplate expansive floating wind, biomass, and wave energy farms on the high seas. Rather, high seas resources were viewed as a commons and not subjected to exclusive national jurisdiction.

2. OREs as 'Installations' Under the LOSC

Legally classifying OREs is challenging due to their novelty. Since floating wind turbines, wave energy devices, and biomass farms are occasionally mobile, it may be tempting to treat them as ships. International law provides "no clear cut definition" of the words "ship," "vessel," or "installation,"[106] so the terms could possibly encompass floating ORE projects. Although the International Court of Justice considered whether floating oil rigs should be classified as ships under international law, the parties in the case settled before judgement on the matter was issued.[107] Scholars have similarly debated whether floating oil rigs constitute ships or installations, yet the International Maritime Organization and insurance companies pragmatically require those rigs to register as vessels while transiting, even though they will eventually become stationary and are then treated as installations.[108] By analogy,

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101 *Id.* art. 88.

102 *Id.* art. 87(2).

103 *See id.* arts. 1, 87 (noting the freedom of the high seas must be exercised with regard for other states' rights to exploit resources on the ocean floor).

104 *See id.* arts. 2, 55–56 (outlining a coastal State's sovereign rights over its territorial sea and sovereign right to exploit its exclusive economic zone for the production of energy from water, currents, or wind).

105 *See* Nicholas J. Lund, *Renewable Energy as a Catalyst for Changes to the High Seas Regime*, 15 OCEAN & COASTAL L.J. 95, 98–100 (2010) (explaining that wind and wave energy from the ocean is a very recent development).

106 HOSSEIN ESMAEILI, THE LEGAL REGIME OF OFFSHORE OIL RIGS IN INTERNATIONAL LAW 28, 44 (2001).

107 Case Concerning Passage through the Great Belt (Fin. v. Den.), Order, 1991 I.C.J. Rep. 86, ¶¶ 2, 6, 11, 21, 22 (Jul. 29) (discussing how Denmark claimed oil rigs were not ships and denied passage through its territorial waters); Passage through the Great Belt (Finland v. Denmark): Overview of the Case, INT'L COURT OF JUSTICE, https://perma.cc/R7WZ-DCE9 (last visited Mar. 7, 2021).

108 Hossein Esmaeili, *Legal Status of Offshore Oil Rigs in International Law*, 50 RHDI 107, 111 (1997). *See also* Convention on Civil Liability for Oil Pollution Damage Resulting from Exploration and Exploitation of Seabed Mineral Resources art. 1(2), Feb 1, 1977, 16

floating OREs might be considered ships or vessels while navigating but will ultimately be considered "installations" once permanently anchored or physically connected to a power grid.[109] Per the LOSC, on the high seas, all states have the "freedom to construct artificial islands and *other installations* . . . ."[110] High sea installations are subject *mutatis mutandis* "to the same provisions as [EEZ installations]," but the LOSC does not describe what "necessary modifications" are required to make Article 60 (describing EEZ installations) applicable to the high seas.[111] Some LOSC drafters had sought to clarify this meaning of *mutatis mutandis*, but unfortunately, they ultimately did not.[112] This has created confusion among legal scholars regarding which provisions related to installations in the EEZ also apply to high seas installations. The most logical interpretation would apply provisions governing onboard safety and navigation around installations but not incorporate provisions related to coastal state economic rights. Yet, some scholars, most notably Nicholas Lund and Kieran Dwyer, interpret *mutatis mutandis* in Article 60 to mean coastal states "have the exclusive right to construct [and exercise] an exclusive jurisdiction over [high seas ORE installations]," such that adjacent coastal states could prohibit other states from developing high seas OREs.[113] However, such arguments are problematic as they undermine the LOSC's regime of free and nonexclusive rights to the high seas resources. Lund neglects that the fundamental difference between the EEZ and high seas is resource allocation, when arguing coastal states should have exclusive control of expansive tracts of high seas for permanent ORE installations. Such a position also conflicts with Article 87(1)(d)'s non-exclusivity provision which enunciates that "all States" have the "freedom to construct . . . installations permitted under

I.L.M 1450 (defining oil rigs as "installations"); VI NEW DIRECTIONS IN THE LAW OF THE SEA 535–36 (Robin Churchill et al. eds., 1977).

109 LOSC does not define "installation." Common definitions include placement and reflect permanency. Cambridge Dictionary, *Installation*, https://perma.cc/N64L-7NS9 (last visited Mar. 7, 2021).

110 LOSC *supra* note 4, art. 87(1)(d) (emphasis added).

111 *Id.* arts. 80, 87(1)(d); *Mutatis Mutandis*, Black's Law Dictionary (7th ed. 1999) (defining mutatis mutandis as "[a]ll necessary changes having been made; with the necessary changes").

112 Indonesia had attempted to clarify the use of the term "*mutatis mutandis*," but the Committee Chairman, Ambassador Aguilar, refused, claiming that such specifications would make the articles too long. BARBARA KWIATKOWSKA & ETTY R. AGOES, ARCHIPELAGIC WATERS: AN ASSESSMENT OF NATIONAL LEGISLATION IN LAW OF THE SEA AT THE CROSSROADS: THE CONTINUING SEARCH FOR A UNIVERSALLY ACCEPTED REGIME 142 (Rudiger Wolfrum ed., 1991).

113 Kieran Dwyer, *UNCLOS: Securing the United States' Future in Offshore Wind Energy*, 18 MINN. J. INT'L L. 265, 279 (2009). Lund, *supra* note 105, at 108 ("Article 87(1)(d) [notes] all States have the 'freedom to construct . . . other installations . . . subject to Part VI . . . which provides that 'Article 60 applies mutatis mutandis' [so] the coastal State shall have the exclusive right to construct . . . installations and structures for the purposes provided for in article 56 and other economic purposes.' Article 60 gives the coastal State complete jurisdiction over their installations and structures . . . . Finally, Article 56 gives the coastal State the sovereign right to exploit natural resources in the EEZ.").

international law, subject to Part VI," and explicitly declares rights to exploit continental shelf resources do not "affect the legal status of the superjacent waters . . . or the air space above those waters."[114] Consequently, the current regime is most logically understood as permitting all states a nonexclusive right to develop high seas OREs.

C. Problems with the Status Quo

The existing legal framework provided by the LOSC is inadequate to regulate ORE development. Troublingly, the current framework leaves regulation to flag states who have a poor record of providing meaningful oversight.[115] This *laissez-faire* approach to high seas OREs might also increase international tensions by interfering with navigational freedoms, encouraging spatial discontinuity of economic rights, and failing to constrain extensions of coastal state jurisdiction into the high seas. Unchecked, the existing framework may lead to unfair and environmentally destructive outcomes.

1. Insufficient Flag State Regulation

Since the high seas lack a centralized authority to govern, legal order is "ensured primarily by the flag State."[116] Flag states, the nations where the installations are registered, would be responsible for regulation and oversight.[117] Under the LOSC, flag states exercise exclusive jurisdiction over administrative, technical, and social matters.[118] However, experience shows flag states often fail to provide adequate oversight with so-called "flags of convenience" offering low-cost registration, loose environmental and operational requirements, and weak enforcement.[119] Making flag states the primary governor for high seas ORE installations may result in more problems as flag states have a perverse incentive in the form of registration fees to encourage multiple developments with little oversight, potentially causing disorderly and excessive development without due regard for the rights of other nations or the environment.

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114 LOSC, *supra* note 4, arts. 78, 87, 135 (similarly, Article 135 refers to Area beyond the continental shelf).

115 NIVEDITA M. HOSANEE, A CRITICAL ANALYSIS OF FLAG STATE DUTIES AS LAID DOWN UNDER ARTICLE 94 OF THE 1982 UNITED NATIONS CONVENTION ON THE LAW OF THE SEA 40 (2009).

116 YOSHIFUMI TANAKA, THE INTERNATIONAL LAW OF THE SEA 153 (2012).

117 *See* United Nations Convention on the High Seas, art. V, Apr. 29, 1958, 13 U.S.T. 2312, 450 U.N.T.S. 11 (codifying CIL granting nationality/jurisdiction). *See also* LOSC, *supra* note 4, arts. 91–94.

118 Flag states must ensure safety at sea of ships including construction, seaworthiness, manning, training, and gear to prevent collisions. LOSC, *supra* note 4, arts. 92, 94.

119 2 BOLESLAW A. BOCZEK, INTERNATIONAL LAW: A DICTIONARY 280 (2005).

2. Threat to Navigational Freedoms

The freedom of the seas concept was intended for moving ships[120] and is certainly not *carte blanche* to deploy expansive, permanent ORE installations on the high seas. Vast anchored farms covering substantial tracts of ocean space for commercial purposes will occupy spaces currently free for navigation. From a safety of navigation standpoint, this will surely hamper vessels from freely traveling and restrict routing options. While under the LOSC, new installations would have to show "due regard for the interests of other states high sea freedoms,"[121] it remains unclear how to appropriately balance high seas ORE installation rights of one state against the navigational freedoms of other seagoing states. Would the creation of dedicated sea lanes across the oceans be sufficient or would such narrowing represent an impermissible constraint of freedom of navigation? There are no internationally agreed upon standards by which to gauge these questions. Large ORE installations on the high seas would be particularly alarming to navies as they would constrict area available for transit, making naval movements more predictable and thus the warships more easily targeted and attacked. Submarines would be particularly hindered by ORE anchors in the high seas. High seas ORE installations are something new with very different characteristics and dynamics than past installations; the current framework does not effectively balance OREs with navigational freedoms.

3. Lack of Environmental Safeguards

The current framework permits rapid deployment of substantial infrastructure into the high seas without full understanding of the consequences. This could wreak havoc on natural systems. Environmentalists claim wind farm anchors may confuse migrating whales, turbines kill seabirds, and underwater noise vibrations disorient marine life with sensitive sonar navigation.[122] With few ecological studies of ORE environmental impacts, much remains unknown.[123] Will biomass

120 *See* William R. Hawkins, *Reaffirming Freedom of the Seas*, FOUND. ECON. EDUC. (Mar. 1, 1982), https://perma.cc/R7GH-XAYN (stating that the freedom of the seas is "the right to navigate through the global expanse of the oceans as one sees fit").

121 LOSC, *supra* note 4, art. 87(2).

122 Geiger, *supra* note 33. Fred Mogul, *Offshore Wind May Help the Planet – But Will it Hurt Whales?*, NAT'L PUB. RADIO (Dec. 5, 2019), https://perma.cc/JHV9-VWSZ.

123 *See* Meinhard Doelle & Gunnar Sander, *Next Generation Environmental Assessment in the Emerging High Seas Regime? An Evaluation of the State of the Negotiations*, 35 INT'L J. MARITIME & COASTAL L. 498, 498–99 (2020) (observing a "gap" between effective environmental assessments on the high seas beyond national jurisdiction "actual performance," thus calling for a cohesive international framework for 'Next Generation Environmental Assessment.'). *See, e.g.*, *New Jersey Offshore Wind Study Shows Minimal Environmental Impact*, MARINE LOG (June 22, 2010), https://perma.cc/GGG5-D84C; Helen Bailey et al., *Assessing Environmental Impacts of Offshore Wind Farms: Lessons Learned and Recommendations for the Future*, 10 AQUATIC BIOSYST. (2014), https://perma.cc/SK4D-BNVS ("still uncertainties about the effects [of offshore wind] on the environment.").

farms deplete ocean oxygen and nutrients? Will devices impede migrations? Will undersea cables interrupt the untouched habitats of the ocean floor? Ecologist fear overexploitation and environmental degradation of shared resources will result in "the tragedy of the commons."[124] Overfishing offers a forewarning corollary. Until the twentieth century, no one imagined the ocean could run out of fish, yet by the mid-century, large commercial factory-fishing ships had rapidly depleted fish stocks.[125] Overfishing decimated fish populations because "people have interpreted the 'freedom of the seas' to include an unlimited right to fish them."[126] Technological developments, such as trawler fishing, radar fish-finding, aerial-spotting, and refrigerated ships, exacerbated the problem.[127] Many fish stocks were completely wiped out, thus jeopardizing ecological stability and food supply in reliant communities.[128] By 2005, over 75% of fish stocks were over-exploited or depleted.[129] The LOSC, despite containing specific provisions on the conservation and management of living resources on the high seas, had little impact.[130] Per the LOSC, all states have the right to fish on the high seas but must cooperate with other states to manage resources "with due regard for the interests of other States."[131] The LOSC similarly mandates regional fisheries management organizations (RFMOs) and even provides instructions for determining the maximum allowable catch.[132] But these RFMOs have been largely ineffective at preventing fishery degradation due to fragmentation, inconsistency, lack of enforcement capacity, focus on specific species rather than ecosystems, and an unwillingness to consider broader environmental impacts of fisheries operations.[133] The fisheries example serves as a cautionary tale about overexploitation of common resources absent a strong framework for environmental

124 *See* Garrett Hardin, *The Tragedy of the Commons*, 163 SCI. 1243, 1243 (1968).

125 Wertenbaker I, *supra* note 71 (noting catch quantity increased four-fold as overfishing depleted fish stocks).

126 Garrett Hardin, *Tragedy of the Commons*, LIBR. ECON. & LIBERTY, https://perma.cc/3CN4-KE8F (last visited Mar. 7, 2021).

127 Scheiber, *supra* note 3.

128 *See, e.g.*, Arthur F. McEvoy & Harry N. Scheiber, *Scientists, Entrepreneurs, and the Policy Process: A Study of the Post-1945 California Sardine Depletion*, 44 J. ECON. HIST. 393, 393–94 (1984) (describing the collapse of the California sardine stock). *See also* John Radovich, *The Collapse of the California Sardine Fishery: What Have We Learned?*, 23 CAL. COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS REP., 1982, at 56, 57 (describing the collapse of the Pacific sardine fishery).

129 Food and Agric. Org. of the United Nations [FAO], *The State of the World Fisheries and Aquaculture 2006*, 32–33 (2007), https://perma.cc/89P2-2LJW.

130 *See* Lawrence Juda, *The 1995 United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks: A Critique*, 28 OCEAN DEV. & INT'L L. 147, 147–49 (1997) (describing the LOSC's inability to prevent overfishing of migratory species).

131 LOSC, *supra* note 4, arts. 87(2), 116–19.

132 *Id.* arts. 118–20.

133 Pedro Pintassilgo et al., *Stability and Success of Regional Fisheries Management Organizations*, 46 ENV'T & RESOURCE ECON. 377, 378 (2010); Montserrat Gorina-Ysern, *World Ocean Public Trust: High Seas Fisheries After Grotius – Towards a New Ocean Ethos?*, 34 GOLDEN GATE U. L.R. 645, 683–84 (2004).

protection. If ORE development begins without a comprehensive plan for safeguarding the environment, the pattern of ecological harm caused by rushing to capture resources could be repeated. The U.N. General Assembly recognized the inadequacy of existing rules to safeguard high seas environments and called for "an international legally binding instrument . . . on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction," but to date, no convention has been agreed upon.[134]

When consequences are potentially damaging, a precautionary approach is prudent. The Rio Declaration on Environment and Development includes precautionary environmental protection.[135] Principle 15 says "to protect the environment, the precautionary approach shall be widely applied by States," albeit "according to their capabilities."[136] Principle 17 calls for environmental impact reports to be undertaken if there are possible "significant adverse impact[s] on the environment" which may cause "serious or irreversible damage."[137] These principles are nonbinding, thus offering no legal effect.[138] However, some states and scholars argue the precautionary approach has become customary international law.[139] Yet, despite many states evidencing the practice of following the precautionary approach, the reluctance of other states and international tribunals to adopt the principle suggests a lack of *opinio juris* to accept the norm as a binding rule.[140] At sea, the LOSC mandates parties "protect and preserve the marine environment," but it does not generally incorporate the precautionary principle.[141] The International Seabed Authority (ISA), an institution created by the LOSC to manage mineral mining on the ocean floor beyond national jurisdiction,[142] does "apply a precautionary approach" "to ensure effective protection for the marine environment from harmful effects,"[143] but it

134 G.A. Res. 69/292, U.N. Doc. A/RES/69/292 (June 19, 2015). *Intergovernmental Conference on Marine Biodiversity of Areas Beyond National Jurisdiction*, UNITED NATIONS, https://perma.cc/9BNK-BY4N (last visited Mar. 7, 2021). As of December 2020, no convention has been agreed upon. *See generally* Chris Arsenault, *Countries Fall Short of U.N. Pledge to Protect 10% of the Ocean by 2020*, MONGABAY (Dec. 2, 2020), https://perma.cc/6Q3F-VQQZ (discussing the ineffectiveness of present marine protections and targets for future protections); Doelle & Sander, *supra* note 123.

135 United Nations Conference on Environment and Development, *Rio Declaration on Environment and Development*, U.N. Doc. A/CONF.151/26/Rev.1 (Vol. 1), annex 1 (Aug. 12, 1992).

136 *Id.* princ. 15.

137 *Id.* princ. 17.

138 United Nations, *Report of the United Nations Conference on Environment and Development*, U.N. Doc. A/CONF.151/26/Rev.1 (Vol. 1) (June 1992), https://perma.cc/F7B9-D355.

139 *See generally* Djibril Moudachirou & Hamid Mukhtar, *Precautionary Principle in International Environmental Law: Rule of Customary International Law*, 6 INT'L J. MGMT. SCI. 564 (2015).

140 *Id.* at 568–71.

141 LOSC, *supra* note 4, art. 192.

142 *Id.* arts. 1, 156–57.

143 Michael W. Lodge, *International Seabed Authority's Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area*, 20 J. ENERGY & NAT. RES. L. 270, 288

only applies to the seabed. The International Tribunal for Law of the Seas (ITLOS) mandate imposing the "precautionary approach" is limited only to deep seabed mining based on the authority the LOSC invested in the ISA to create regulations for that area of the seabed.[144] For ORE on the surface, no similar environmental protection exists to account for the many unknowns. The current regime has no requirement to take a precautionary approach and lacks the regulatory scope, breadth, and authority to prevent harm to the marine environment.

4. National Appropriation of High Seas Resources

An area of potential international dispute, likely to be exacerbated by ORE development, is the extent to which a coastal state can claim exclusive rights and extraterritorial jurisdiction over economic resources in different parts of the ocean. Under the LOSC, coastal states maintain control of resources on the surface and in the water column out to 200 nm from shore under EEZ rights.[145] On the seafloor, coastal states have been given exclusive rights to develop continental shelf resources out to 350 nm (or further depending on the ocean floor topography characteristics).[146] OREs on the surface and in the water column beyond the EEZ cannot be nationally appropriated. Yet, some nations have done just that. The United States, while not a party to the LOSC, asserts a right to manage the development of surface wind and ocean current energy projects on its "federally owned Outer Continental Shelf" (OCS).[147] The United States Congress amended the Outer Continental Shelf Lands

(2002). International Seabed Authority, *Considerations Relating to the Regulations for Prospecting and Exploration for Hydrothermal Polymetalic Sulphides and Cobalt-rich Ferromanganese Crusts in the Area*, reg. 33 ¶ 2, ISBA/7/C/2 (May 29, 2001).

144 Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, Case No. 17, Request for Advisory Opinion of Feb. 1, 2011, ITLOS Rep. 10, paras. 104, 127, 148, 161, 236 (Recognized states must comply with the "regulations and procedures of the [ISA], . . . and its obligation[s]"; "[t]he provisions of the aforementioned Regulations transform this non-binding statement of the precautionary approach in the Rio Declaration into a binding obligation"; "Thus, in light of the customary rule mentioned by the ICJ, it may be considered that environmental impact assessments should be included in the system of consultations and prior notifications set out in article 142 of the Convention with respect to 'resource deposits in the Area which lie across limits of national jurisdiction.'"; "the provisions of the Nodules Regulations and the Sulphides Regulations [of the ISA] that set out the obligation for the sponsoring State to apply a precautionary approach in ensuring effective protection of the marine environment"; "the obligation to apply a precautionary approach [to the area]").

145 LOSC, *supra* note 4, arts. 56–57.

146 *Id.* arts. 76–77.

147 *Harnessing American Resources to Create Jobs & Address Rising Gasoline Prices: Domestic Resources and Economic Impacts, Oversight Hearing Before the Comm. on Nat. Res. H. Rep.*, 112th Cong. 20, 25 (2011) (statement of Gene Whitney, Energy Research Manager, Congressional Research Service). Note that the United States generally acts in alignment with the LOSC's terms. ADAM VANN, WIND ENERGY: OFFSHORE PERMITTING, REPORT, CONGRESSIONAL RESEARCH SERVICE 1 (Aug. 11, 2010), https://perma.cc/BYH9-CTAG.

Act[148] with the Energy Policy Act of 2005[149] (EP Act) to regulate activities that "produce or support production, transportation, or transmission of energy sources *other than oil and gas*"[150] over the continental shelf, such as "development of wind, ocean wave, and ocean current resources on the OCS for the purpose[] of . . . generating electricity."[151] In 2010, U.S. Secretary of the Interior created the Bureau of Ocean Energy Management (BOEM), which has since leased multiple areas over the OCS to ORE developers.[152] Yet, this practice directly conflicts with Article 78 of the LOSC, which states that the "rights of the coastal State over the continental shelf do not affect the legal status of the superjacent waters."[153] Nevertheless, BOEM uses "attachment to the seabed" of anchors and power cables as a jurisdictional hook.[154] The United States' extension of national jurisdiction into ocean space of the high seas above the continental shelf frustrates the LOSC's freedom of the seas principles. If other nations were to follow suit in declaring jurisdiction over the OREs above their continental shelves, it would constitute a serious erosion of free access to high seas resources. Crafting a new treaty framework for OREs would discourage unilateral actions and unify state practice.

5. Spatial Discontinuity Created by ORE

High seas ORE exacerbates a spatial discontinuity in the law that could lead to conflicts. For instance, as described above, the United States' claims to control the surface ORE, based on the country's extended continental shelf, could conflict with other nations' high seas freedom to fish at the same location. This problem also arises with respect to a potential clash between high seas ORE and surface activities related to mining on the seabed. The LOSC states that "shipboard processing immediately above a mine site of minerals derived from that [Area] mine site" should be included in "activities in the Area."[155] Thus, a ship processing minerals on the surface above the Area would be governed by the International Seabed Authority, while a floating biomass farm in the same location would not. This potential for conflict raises interesting

148 Outer Continental Shelf Lands Act, 43 U.S.C. §§ 1331–1356b (2018).

149 Energy Policy Act of 2005, Pub. L. 109-58, 119 Stat. 594 (codified as amended in scattered sections of Titles 7, 10, 15, 16, 22, 26, 40, and 42 of the U.S.C.).

150 Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701–1787, 1337(p)(1)(C) (2018) (emphasis added).

151 OFFICE OF RENEWABLE ENERGY MGMT., GUIDELINES FOR ACTIVITIES REQUIRING AUTHORIZATION FOR RENEWABLE ENERGY DEVELOPMENT ON THE OUTER CONTINENTAL SHELF (2020).

152 *See, e.g.*, *Lease and Grant Information*, BUREAU OF OCEAN ENERGY MGMT., https://perma.cc/JRE9-VZRG (last visited Mar. 7, 2021).

153 LOSC, *supra* note 4, art. 78.

154 OFFICE OF RENEWABLE ENERGY MGMT., *supra* note 151 ("Any activities supporting . . . the development of wind, wave, and current resources—including resource assessment, research, and technology testing activities—that entail the temporary or permanent attachment of a structure or device to the seabed generally require a lease . . . .").

155 LOSC, *supra* note 4, art. 17(2)(f).

questions about the relationship between the activities on the surface and on the seabed. Would the mere presence of an anchor on the seabed give the continental shelf state, as the United States asserts, or the Deep Seabed Authority jurisdiction over an ORE project on the surface? What if the coastal nation has the right to develop the continental shelf but other states have the right to develop ORE on the surface? Both have rights under the LOSC, so which governing entity should yield when conflicts arise? What is the meaning of "due regard" in such situations? These questions highlight why the LOSC's provisions appear inadequate to regulate high seas ORE development.

6. Lack of Judicially Recognizable Standards for Resolving ORE Disputes

While the current LOSC framework provides dispute resolution mechanisms,[156] it lacks any guidance on how disputes related to OREs on the high seas should be resolved. When issues arise, existing institutions, such as the ICJ, ITLOS, and IMO, would be forced to manage potential disputes without clear guidance. Beyond the challenge for legal advisors and jurists trying to discern judicial standards, uncertainty regarding legal rights may deter investment in OREs at a time when the world needs to rapidly develop ORE resources to meet climate change greenhouse gas emission reduction targets. Investors in capital-intensive projects desire unambiguous and predictable legal regimes, so they can be assured their investments will be protected and rights recognized.

IV. POTENTIAL APPROACHES TO HIGH SEAS ORE MANAGEMENT

Without a legal intervention in the form of a new international framework, the current language of the LOSC will allow for the development of high seas OREs on a first-come-first-served basis.[157] On the ocean surface, ORE would be treated as installations and development would be regulated only by the flag state without any meaningful international organization mechanism.[158] Such a hodgepodge approach, almost inevitably, will result in interstate conflict as nations compete for the best locations. In the rush to seize high sea OREs, states will also likely fail to assess environmental impacts.[159] As the United Nations confronts the challenges and opportunities of ORE development, a new regime must be fashioned that is orderly, fair, and environmentally

156 LOSC, *supra* note 4, arts. 279–99 (detailing the procedures for dispute resolution under LOSC).

157 *See supra* notes 11–14 and accompanying text.

158 Paul Elsner & Suzette Suarez, *Renewable Energy from the High Seas: Geo-Spatial Modelling of Resource Potential and Legal Implications for Developing Offshore Wind Projects Beyond the National Jurisdiction of Coastal States*, 128 ENERGY POL'Y (2019), at 919, 924–26.

159 *See* discussion *supra* Part III.C.3.

sound. There are four distinct approaches to ORE allocation and managements: the *laissez faire* status quo, grants of national areas of exclusive control over high seas areas for ORE development (essentially an extended EEZ for energy), regional management organizations, and a global administrative entity.

A. Extending Coastal State Exclusive Economic Control

A new regime could grant exclusive economic control of high seas OREs to geographically proximate coastal states. This would recognize coastal states' interests in controlling high seas OREs, which will likely connect to the coastal state's power grid and link to transmission cables in its EEZ. Such an approach finds a corollary in the LOSC's extended continental shelf regime, which grants coastal states "exclusive" rights to natural resources on and in the seabed and subsoil, which can stretch out to 350 nautical miles or more from the baseline, depending on undersea topography.[160] This type of framework would efficiently allocate rights to the states most likely to derive the most benefit. It may also incentivize local investment in high seas OREs if coastal states felt a sense of nationalistic pride in "ownership." This approach efficiently allocates resources and would utilize the previously agreed upon formulas for determining the boundaries. However, this approach may ignite disputes as the exclusive allocation of ocean space, which would otherwise be considered high seas, diminishes the global commons available to all nations. The expansion of exclusive rights further into the high seas would conflict with Arvid Pardo's notion of high seas resources as common "heritage of mankind."[161] Such a plan may enjoy support from states, like the United States, that would be able to expand their economic reach, and ire from land-locked countries with no coasts, such as Mongolia, Malawi, and Bolivia and states that cannot contiguously expand their EEZs due to constraining geographic conditions such as opposing coasts, like Bangladesh, China, Germany, and Kenya. This option would also create the problem of determining how far across the high seas coastal states should be able to exert sovereign rights beyond the 200 nautical miles currently permitted for EEZs.

B. Non-Contiguous Exclusive ORE Development Zones

One alternative would be to grant states exclusive economic rights to high seas ORE in specified tracts of the ocean that are not necessarily contiguous with existing maritime jurisdictions. While such a system would be simple and easy to administer; it would be difficult to establish. Determining a method for allocating exclusive zones, separate from states' existing EEZs and continental shelf claims, would be fraught with

160 LOSC, *supra* note 4, arts. 76(1),(6), 77.

161 *See supra* notes 86–89 and accompanying text.

difficulty. What will be the bases for such allocations? Terrestrial size, population, physical proximity, site energy potential, current types of power, expected future usage, or economic need? What authority would exist to divide the oceans? Drafting committees, consensus, experts, ICJ, or ITLOS? Would the threat of non-participating states completely undermine such a regime? Such a process would likely generate more disputes than it would resolve. Getting nations to even agree on a structure for allocating resources would be diplomatically tedious. This national appropriation of oceans resources neglects the importance of communal decision-making and cooperation.

C. Regional Organizations

Another approach would rely on voluntary associations of regional states to manage OREs for mutual benefit based on ongoing diplomatic negotiations. Such associations would avoid the contentiousness of allocating permanent rights and provide flexibility to adjust relationships over time to account for changing technologies or climatic conditions. These organizations could also tailor ORE management based on regional concerns and contexts, rather than applying a blanket rule to the entire world, thus encouraging regional experimentation in organizational structures, instead of imposing a global standard. However, regional organizations are inherently exclusive and would not result in global equity. The ORE potential of one region, for instance the Antarctic Circle with powerful gusts, may be vastly greater than in places with less wind, waves, and biomass opportunity. Further, without a significant exclusionary mechanism, there would be nothing to prevent an outsider from harnessing renewable energy resources within the zone being managed by the regional organization. The free entry into the system by outsiders would undermine the regime. In the fisheries context, regional fishery management organizations struggle to control free riders.[162] However, regional states can often assert diplomatic or pragmatic pressures (such as preserving the future viability and sustainability of the fishing stock) to cause free-riders to eventually integrate into the responsible resource management organization.[163] Similar mechanisms for compelling cooperation would not necessarily exist with the transmission of power from high seas OREs projects, because the LOSC recognizes the rights of all nations to lay undersea cables (even through the EEZ of another country).[164] Consequently, regional organizations may

[162] Sarah Tory, *Catch Me If You Can: The Global Pursuit of a Fugitive Ship*, HAKAI MAG. (Mar. 3, 2020), https://perma.cc/L7ZP-QQ6V; Jon Van Dyke, *Allocating Fish Across Jurisdictions*, *in* SHARING THE FISH '06: ALLOCATION ISSUES IN FISHERIES MANAGEMENT 57, 90 (2006), https://perma.cc/LP73-5JKG (explaining that "free riding" undermines the viability of the RFMO and the challenge of RFMOs face compelling free riders to participate fairly).

[163] JAMES HOLLWAY, THE EVOLUTION OF GLOBAL FISHERIES GOVERNANCE 1960-2010, at 178 (2015).

[164] LOSC, *supra* note 4, art. 58.

not be able to control outsiders in ways necessary to effectively manage regional OREs. Regional plans would fail to create a uniform global framework and result in unequitable resource allocation among states.

D. Universal Internationalist Management Authority

A final method of managing the world's OREs would vest authority in a singular, global entity entrusted to allocate development rights, disperse revenues in an equitable fashion, and comprehensively protect marine environments. Such a plan would be consistent with the idea that the resources of the high seas belong to the global community to be shared.[165] The LOSC provides an example of this type of unitary authority, the ISA, to manage common resources such as rare metallic nodules on the sea floor.[166] In the 1960s and 1970s, investors spent a half a billion dollars identifying potential deposits and developing technology to mine the seafloor.[167] Developing nations viewed deep sea resources as "common heritage of mankind" to be shared by the international community,[168] resulting in the LOSC's establishment of ISA to control all deep-sea mining in international areas.[169] Per the LOSC, the "Authority shall provide for the equitable sharing of financial and other economic benefits . . . on a non-discriminatory basis."[170] The ISA has adopted regulations for prospecting polymetallic nodules and granted exclusive mining rights to designated tracts of the seabed to companies backed by governments.[171] Proceeds fund an endowment for marine scientific research and developing country educational scholarships.[172] In this way, the unified authority provides the broadest sharing of benefits but requires the most sophisticated and complex legal framework to implement.

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165 *See id.* art. 136 ("The Area and its resources are the common heritage of mankind.").

166 Nii Odunton, Deputy to the Secretary-General, Int'l Seabed Auth., *International Seabed Area – Common Heritage of Mankind Exploration and Exploitation of Nonliving Resources* 1 (Sept. 26, 2002), https://perma.cc/YQ9Y-2D5W.

167 Private firms from the United States, Canada, the U.K., Germany, Belgium, the Netherlands, and Japan, as well as state-entities from the Soviet Union, India, and China worked to mine nodules. *Id.* at 2.

168 Lund, *supra* note 105, at 117–18.

169 *About ISA*, INT'L SEABED AUTHORITY, https://perma.cc/9P8G-FNS3 (last visited Feb. 16, 2021). *See* Odunton, *supra* note 166, at 1 (describing efforts by the International Seabed Authority to assure benefits to the international community from the International Seabed Area).

170 LOSC, *supra* note 4, arts. 136, 140.

171 Odunton, *supra* note 166, at 3–4.

172 *See Endowment Fund*, INT'L SEABED AUTHORITY, https://perma.cc/A9HT-62G8 (last visited Mar. 7, 2021) ("[The Fund] promotes and encourages the conduct of collaborative marine scientific research . . . through . . . supporting the participation of qualified scientists . . . from developing countries in marine scientific research programmes and activities").

Additionally, the ISA model remains unproven as seafloor mining is not commercially viable.[173] ISA officials concede the LOSC erred in creating a regulatory framework and costly bureaucracy in the absence of proven technology.[174] Moreover, nonparticipating states, such as the United States, may undermine the Authority's ability to maintain exclusive control of the resource.[175] This illustrates that, for such an endeavor to be feasible, virtually all nations would need to participate to prevent free-rider problems. Achieving global consensus might be difficult, especially in light of rising nationalistic sentiment in many countries that tends to disfavor international organizations. Additionally, a global authority is no guarantee of sufficient equitable sharing or environmental protection.[176] ICJ Judge Shigeru Oda consistently "deplored the lack . . . of equitable distribution" of ocean resources.[177] Environmentalists deride the ISA for declaring virtually all of the Area open to mining without ample ecological preserves.[178] Yet, despite these flaws, the ISA does offer a model of an international unitary authority with the capacity and global trusts to collectively manage ocean resources.

V. HOW THE UNITED NATIONS SHOULD IMPLEMENT A HYBRID APPROACH

The United Nations should take the lead. States committed to renewable energy sustainability should champion this initiative as a top priority.[179] The General Assembly should call for a new conference on the law of the sea to address OREs in a new treaty (just as when creating the LOSC),[180] but this process would take time and significant diplomatic effort. The framework for ORE development could also be added as a relevant and important annex to the forthcoming United Nations

173 Kathryn A. Miller et al., *An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps*, FRONTIERS (Jan. 10, 2018), https://perma.cc/GDH9-2HD8.

174 Odunton, *supra* note 166, at 4.

175 Jeff Smith, *Biden Must Keep Challenging China on Freedom of Navigation*, FOREIGN POL'Y (Feb. 16, 2021), https://perma.cc/J5WV-AP4V.

176 Erica Westly, *Deep-Sea Mining is Coming: Assessing the Potential Impacts*, YALE ENV'T 360 (Mar. 3, 2011), https://perma.cc/FZD5-R52F.

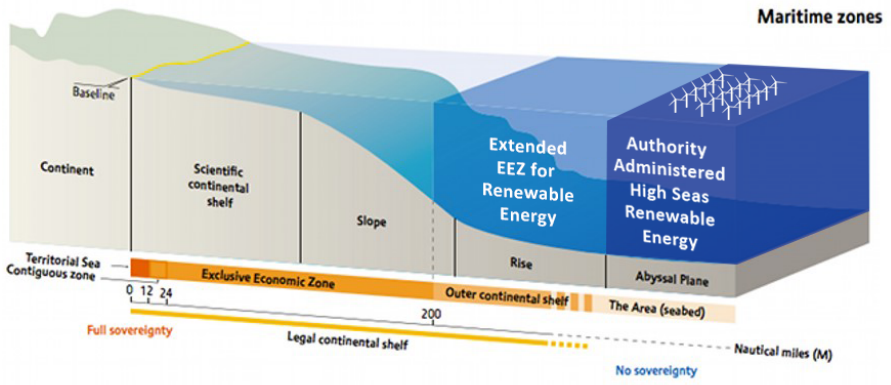
177 Shigeru Oda, *Some Recollections of the Development of the New Law of the Sea, and, in Particular, its Resource Aspect*, *in* IMPLEMENTATION OF THE LAW OF THE SEA CONVENTION THROUGH INTERNATIONAL INSTITUTIONS: PROCEEDINGS OF THE 23RD ANNUAL CONFERENCE OF THE LAW OF THE SEA INSTITUTE 555, 556 (Alfred H.A. Soons ed., 1990). *See also* Shigeru Oda, *Recollections of the 1952 International North Pacific Fisheries Convention: Decline of the "Principle of Abstention?"*, 6 SAN DIEGO INT'L L.J. 11, 11–17 (2004).

178 Westly, *supra* note 176.

179 China, Costa Rica, Denmark, Germany, Kenya, Morocco, Nicaragua, Scotland, Sweden, Uruguay, and the United States are global clean energy leaders per Climate Council, an international sustainable energy advocacy group. *11 Countries Leading the Charge on Renewable Energy*, CLIMATE COUNCIL (Jan. 13, 2019), https://perma.cc/4S46-LZR2.

180 Garry Taylor, *The Law of the Sea and "Creeping Jurisdiction" of Coastal States*, PULSE (July 21, 2015), https://perma.cc/4RCB-B25P.

Intergovernmental Conference on the Conservation and Sustainable Use of Marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ).[181] Alternatively, the General Assembly could call on the Secretary General to initiate state consultations and propose a new LOSC implementing agreement on OREs for ratification by states parties following the procedures successfully employed in 1994 to change aspects of the LOSC's deep seabed mining regime.[182] Legally, an implementing agreement would act as a specialized addendum to the LOSC, providing a convenient way for states parties to address OREs. Such an agreement should adopt a hybrid approach to ORE allocation and management by granting coastal states extended rights above their OCSs while collectively managing ORE above the deep seabed Area through a unitary global authority akin to the ISA. The rights to exclusively exploit OREs should align with the existing OCS and deep seabed regimes. Granting coastal states exclusive control of high seas OREs above their OCS prudently reflects their special interests and pragmatically takes into account that energy will most likely be transported to them as the nearest country. Allowing coastal states to concurrently manage ORE resources on the surface and those on the seafloor will avoid conflicts and ease coordination of development. Consistent with the LOSC, the ICJ, ITLOS, or arbitral panel could be given jurisdiction over high seas ORE disputes. By adopting such a new framework, states would provide guidelines to enable international judicial bodies to justly rule on disputes in a realm lacking prior state practice and customary existing law due to the novelty of OREs.[183]



181 The Intergovernmental Conference on the Conservation and Sustainable Use of Marine Biodiversity of Areas Beyond National Jurisdiction is being developed as a legally binding instrument that will create a management framework for marine protected areas, require environmental impact assessments for activities, and regulate the building and transfer of marine technology. *Intercessional Work of the Intergovernmental Conference on the Conservation and Sustainable Use of Marine Biodiversity of Areas Beyond National Jurisdiction*, INT'L INST. SUSTAINABLE DEV. (Sept. 14, 2020), https://perma.cc/V8TK-VNX7.

182 Jon M. Van Dyke, *U.S. Accession to the Law of the Sea Convention*, 22 OCEAN Y.B. 47, 56 (2008).

183 *See, e.g.*, LOSC, *supra* note 4, arts. 279–87 (detailing the procedure for dispute settlement).

Figure 2: Proposed maritime zones and rights, including the extended EEZ for OREs above coastal states' continental shelves and an ISA-managed OREs above the Area.[184]

OREs located above the ISA-managed deep seabed Area should be managed by a unitary global authority on behalf of states parties. The ISA could fulfill the unitary management role. From an efficiency standpoint, the authority would provide a "one-stop-shop" for management and licensing rights for developers, as well as a single point of contact for deconfliction for fishers and transporters, while providing clear channels of oversight and regulation. Pragmatically, this would enable uniform and universally consistent development of OREs. Simultaneously, it would preserve environmentally sensitive areas by adopting the precautionary principle, as it did for deep seabed mining.[185] The centralization of authority might lead to the development of more professional administrators and enable better mechanisms to ensure globally consistent navigational safety and operating procedures. The ISA, with its existing bureaucracy, structure, expertise in ocean resources, relationships, and operating procedures, appears well-suited to take on the additional role of managing high seas OREs above the deep seabed area. This allocation would avoid discontinuity between surface and seafloor activities while reflecting existing guidelines for determining the extent of the OCS with respect to the area. Revenues from high seas ORE managed by the unitary global authority would be distributed for the betterment of all peoples with profits directed to the U.N. Development Program, U.N. Children's Fund, World Health Organization, or humanitarian efforts. This would allow all nations to benefit from ORE development regardless of geographic location or technical and economic capacity.

VI. CONCLUSION

The United Nations Secretary General should initiate an international effort to develop a comprehensive new treaty to allocate and manage OREs on the high seas. Recent technological advances make OREs economically viable, and multiple factors will push them into the high seas. Under the current regime, all nations are free to exploit high seas resources and develop installations. The proliferation of vast high seas ORE farms will fundamentally change the way humanity utilizes ocean space by disrupting traditional navigational freedoms and potentially harming fragile ecosystems. Without intervention, the risk of interstate conflict and environmental damage are high. The United Nations has the opportunity now, before interests become entrenched, to

184 Adapted from U.N. ENV'T PROGRAMME, CONTINENTAL SHELF: THE LAST MARITIME ZONE 9 (Tina Schoolmeester & Elaine Baker eds., 2009), https://perma.cc/N7FN-KUJX.

185 *About ISA*, *supra* note 169.

proactively intervene by crafting a more equitable and prudent framework promoting cooperation for the "benefit of mankind as a whole."[186] Such a framework could be created through a new implementing agreement or as annex to the BBNJ, which is currently being negotiated. A hybrid approach would most prudently guide the development of OREs by permitting coastal states to exercise exclusive economic control over OREs above their internationally recognized continental shelves, while granting rights above the Area to the international community, under management of the ISA, with proceeds benefiting international charitable causes. This new system for managing high seas OREs would be efficient, fair, and environmentally sound.

[186] LOSC, *supra* note 4, arts. 136, 140.