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# Sustaining India's Blue Economy: Legal Challenges in Regulating Deep Sea Mining and Protecting Marine Biodiversity Through Environmental Law

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#### ABSTRACT :

India's pursuit of a sustainable blue economy has brought deep sea mining (DSM) to the leading edge of countrywide improvement strategy. Marine resources and strategic hobbies within the Central Indian Ocean Basin, DSM is considered as a key avenue to stable crucial minerals critical for smooth strength and technological advancement. However, this paper highlights that the expansion of DSM brings serious ecological threats to fragile deep-sea ecosystems and exposes crucial gaps in India's modern environmental regulatory framework. While India has policies assisting ocean exploration, there may be a lack of unique legal mechanisms to evaluate environmental affects and implement marine biodiversity safety in its Exclusive Economic Zone and beyond. This paper analyzes India's legal preparedness through the lens of environmental concepts along with precaution, polluter can pay, and sustainable improvement, and compares country wide efforts with global responsibilities below UNCLOS, the ISA, and the Convention on Biological Diversity. The paper concludes with the aid of advocating for a complete Marine Environment Protection Act, stepped forward institutional coordination, and alignment with worldwide norms to make certain that deep-sea mining progresses without compromising ecological integrity.

Keywords: Blue Economy, Deep Sea Mining, Environmental Law, Marine Biodiversity, ISA, Sustainable Development, UNCLOS.

# Introduction

The oceans, covering more than 70% of the Earth's floor, oceans are not most effective the lifeblood of planetary ecosystems but additionally essential drivers of world economic development.<sup>3</sup> In recent years, the notion of the blue economic system has emerged as a comprehensive and sustainable method by using ocean resources balancing an economic development with environmental stewardship.<sup>4</sup> For India, endowed with an expansive coastline, a big Exclusive Economic Zone (EEZ), and a deep maritime historic past, the blue economy represents an in depth strategic and developmental frontier.<sup>5</sup> Yet, as India intensifies efforts to capitalize on its marine capability, in particular through responsibilities including deep sea mining (DSM), new felony and environmental stressful situations have surfaced. DSM gives access to precious minerals critical for technological development, but it also poses severe risks to fragile and in large part unexplored marine ecosystems.<sup>6</sup> This duality underscores the urgency for a robust legal framework that ensures ecological integrity.<sup>7</sup> This paper explores the intersection of India's blue economy aspirations and marine environmental safety, focusing especially on the legal complexities surrounding deep sea mining. It argues that a sustainable blue economic system is contingent upon the development and enforcement of complete environmental legal guidelines that shield marine biodiversity even as allowing accountable useful resource usage.<sup>8</sup>

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<sup>&</sup>lt;sup>3</sup> U.N. Dep't of Econ. & Soc. Affs., The Ocean and the Sustainable Development Goals Under the 2030 Agenda for Sustainable Development (2017), <https://sdgs.un.org/topics/oceans-and-seas> accessed on April 11,2025.

<sup>&</sup>lt;sup>4</sup> World Bank, What is the Blue Economy?, THE WORLD BANK (June 6, 2017), <https://www.worldbank.org/en/news/infographic/2017/06/06/blue-economy.> accessed on April 11,2025

<sup>&</sup>lt;sup>5</sup> Gov't of India, Ministry of Earth Sciences, Draft Blue Economy Policy Framework (Feb. 2021), see also UNCLOS, Dec. 10, 1982, 1833 U.N.T.S. 3, arts. 55–75. accessed on April 11,2025.

<sup>&</sup>lt;sup>6</sup> KATHERINE E. DAVIS, Deep Sea Mining: Law, Policy, and the Threshold of Sustainability, 52 ENVTL. L. 115, 118–20 (2022); Int'l Union for Conservation of Nature (IUCN), Deep-Sea Mining Threatens Marine Biodiversity, IUCN (2021),< https://www.iucn.org/resources/issues-briefs/deep-sea-mining.> accessed on April 11,2025.

<sup>&</sup>lt;sup>7</sup> SURYA PRAKASH, Legal and Environmental Dimensions of Deep-Sea Mining in India, 14 INDIAN J. INT'L L. 37, 45–48 (2020). accessed on April 12,2025.

<sup>&</sup>lt;sup>8</sup> Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79; see also Kunming-Montreal Global Biodiversity Framework, Conference of the Parties to the CBD, Dec. 2022, accessed on April 11,2025.

# India's Blue Economy and Growing Interest in Deep Sea Mining

The term 'blue economy' refers to the sustainable use of ocean resources which promotes the use of the marine resources without harming the marine biodiversity to gain economic benefits.<sup>9</sup> In the Indian system of the blue economy that the factors include the economic improvement, ecological balance which strengthens its recognition of the oceans. India's adoption of this idea along with the United Nations' Sustainable Development Goal 14, which requires the conservation and sustainable use of the oceans, seas, and marine assets.<sup>10</sup> This coverage contains the economic activities with shielding ocean environments, which ultimately prioritizes sustainability and livelihood protection. In 2021, India launched the Deep Ocean Mission (DOM), a key part of its blue economic system plan which is led by the Ministry of Earth Sciences, this mission involves many establishments and experts. It explores the deep ocean for precious assets which include polymetallic nodules, hydrothermal sulfides, and cobalt-rich ferromanganese crusts. India possesses a big Exclusive Economic Zone (EEZ) of over 2.3 million square kilometers and a shoreline spanning about 7,500 kilometers, making it one of the essential maritime nations within the Indo-Pacific region. Recognizing this strategic gain, the Indian government has prioritized the improvement of the blue economy through a coordinated coverage framework. The Draft Blue Economy Policy Framework, released through the Ministry of Earth Sciences in February 2021, identifies six center pillars: marine fisheries, deep sea mining and ocean energy, tourism, maritime delivery, talent development, and governance. The Deep Ocean Mission additionally includes additives on ocean climate trade advisories, deep-sea biodiversity conservation, and the improvement of human assets in marine technology.<sup>11</sup>

## Deep Sea Mining: Opportunities and Ecological Risks

Deep sea mining as a promising frontier has emerged for in search of raw materials such as critical materials that are necessary for the green energy transition. The seabed, specifically in areas inclusive of the Central Indian Ocean Basin (CIOB), harbors extensive deposits of polymetallic nodules which contains hight amount of manganese, cobalt, nickel, and copper metals that are necessary for production of batteries of e-vehicles, wind turbines, and solar panels.<sup>12</sup>As terrestrial mineral reserves dwindle and the demand for these strategic metals intensifies, Deep sea mining is considered as one of the alternative to achieve the clean energy goals.<sup>13</sup> For India, these sources are not most effective for energy security however additionally for lowering import dependence and accomplishing self-reliance in strategic sectors. International Seabed Authority granted exclusive rights to explore a 75,000 square kilometer area to India in the CIOB for polymetallic nodules. The exploration contract, signed in 2002 and renewed thereafter, mandates India to conduct geological, environmental, and technological studies in the designated region. The nodal agency of these kind of activities such as deep-sea bed mining and those activities for the development of the mining technology and assessment of environmental baselines under the responsibility of National Institute of Ocean Technology.<sup>14</sup> Subsequently this acts as a significant initiative that induces the establishment of the Deep Ocean Mission in India which aims to harness the blue economy in a sustainable manner.<sup>15</sup> Despite its potential, deep sea mining presents profound ecological risks. The most irreversible impact is the disruption of benthic ecosystems the deep-sea floor habitats that guide numerous specialised and endemic organisms.<sup>16</sup> Those habitats will recover in extremely slow manner as it broadened over millennia. Consequently, the disturbance such as mechanical disturbance by means of any mining equipment in the seafloor can completely modify the natural structure of the seafloor and spoil the marine organisms and species that has to be fully discovered or studied and those disturbance may also lead to species extinction.<sup>17</sup> Whereas another critical issue is the formation of sediment plumes while extracting which releases into the water column. These plumes can travel widespread distances and disrupting food webs in the mesopelagic and bathypelagic zones of the sea.<sup>18</sup> Plumes may also deliver heavy metals and other contaminants, posing long-time period toxicological risks to marine biodiversity.

## Indian Legal Framework: Shortcomings and Environmental Law Gaps

<sup>9</sup> Ibid.

<sup>&</sup>lt;sup>10</sup> G.A. Res. 70/1, U.N. Doc. A/RES/70/1, Transforming our World: The 2030 Agenda for Sustainable Development, Goal 14 (Oct. 21, 2015), accessed on April 11,2025.

<sup>&</sup>lt;sup>11</sup> Ministry of Earth Sciences, Deep Ocean Mission Components, https://moes.gov.in/programmes/deep-ocean-mission, accessed on April 11,2025.

<sup>&</sup>lt;sup>12</sup> RAHUL SHARMA, Deep-Sea Mining: Economic, Technical, Technological, and Environmental Considerations for Sustainable Development, 8 MARINE TECHNOLOGY SOC'Y J. 52, 53–54 (2021). accessed on April 13,2025.

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<sup>&</sup>lt;sup>14</sup> National Institute of Ocean Technology (NIOT), Deep Sea Mining Technologies and Exploration, <a href="https://www.niot.res.in/research/DeepSeaMining">https://www.niot.res.in/research/DeepSeaMining</a>, accessed on April 13,2025.

<sup>&</sup>lt;sup>15</sup> Ministry of Earth Sciences, Deep Ocean Mission, https://moes.gov.in/programmes/deep-ocean-mission accessed on April 13,2025.

<sup>&</sup>lt;sup>16</sup> LISA A. LEVIN, Climate Change Considerations Are Fundamental to Management of Deep-Sea Resource Extraction, 4 NATURE ECOLOGY & EVOLUTION 458, 460–61 (2020). accessed on April 14,2025

<sup>&</sup>lt;sup>17</sup> Kristina M. Gjerde et al., Protecting the Deep Sea: The Case for a Precautionary Pause in Deep-Seabed Mining, 122 MARINE POL'Y 104293 (2020). accessed on April 14,2025

<sup>&</sup>lt;sup>18</sup> Daniel O.B. Jones et al., Biological Responses to Sediment Plumes from Deep-Sea Mining Activities, 29 ENVTL. RES. LETT. 034001, 5–6 (2017). accessed on April 14,2025

#### Indian Legal Framework

India's environmental laws are not well-suited to manage the complex area of deep-sea mining. Although there are several environmental regulations, they are scattered and not designed to solve issues related to resource extraction from deep ocean areas.

- i. The Environment (Protection) Act, 1986 (EPA) is India's principal environmental regulation and gives the significant government with vast powers to modify and protect the environment.<sup>19</sup> While it empowers authorities to establish guidelines and requirements throughout sectors, it lacks provisions which can be tailor-made to the unique risks and medical uncertainties related to DSM. The Environmental Protection Agency (EPA) does not differentiate the land and sea areas which led to issues such as the damage to the seabed, sediment clouds, and lack of biodiversity in deep-sea areas.
- ii. The Coastal Regulation Zone (CRZ) Notification has the relation with the EPA which offers protection to marine ecosystem. However, it covers zones up to 12 nautical miles from the shore. It does not protect India's Exclusive Economic Zone (EEZ), that is where maximum deep-sea mining will take place. As a result, the CRZ leaves a big gap in legal protection for deeper ocean areas.<sup>20</sup>
- iii. The Offshore Areas Mineral (Development and Regulation) Act, 2002 was introduced to guide the exploration and development of mineral sources in offshore regions.<sup>21</sup> Although the Act mentions environmental duty, its predominant attention is on granting mining rights and economic regulation. It does no longer require environmental effect checks (EIAs) specifically for marine mining or involve public consultations.<sup>22</sup>

#### Shortcomings and Environmental Law Gaps

India faces major challenges in marine environmental governance. First, there is no specific rule for evaluating environmental risks of deep-sea mining. There are several issues with assessing the risks of offshore mineral extraction. The EIA suggestions, which have not been updated on the grounds that 2006, do not cover offshore mineral extraction, leading to confusion among stakeholders.<sup>23</sup> Legal requirements to protect marine biodiversity and encompass Marine Protected Areas (MPAs) in mining plans are vulnerable. This makes it difficult to restore ocean ecosystems or installation areas wherein mining is banned in sensitive regions.<sup>24</sup> Lastly, there is no centralized organization with authority to handle and supervise activities in the deep sea operations. While the Ministry of Earth Sciences and the National Centre for Polar and Ocean Research are worried in ocean studies, they cannot implement marine environmental legal guidelines in the deep sea. This loss of regulation should harm India's blue economic system. This lack of regulation creates a gap that could negatively impact India's blue economy. Without strong legal and structural changes, DSM might proceed with little control, potentially causing lasting harm to marine life and ocean resources.<sup>25</sup>

#### Environmental Law Principles as Legal Anchors for DSM

Environmental law relies on strong principles that can help regulate Deep Sea Mining (DSM). One crucial idea is following the precautionary principle, which has been extensive in Indian law for the reason that Vellore Citizens Welfare Forum v. Union of India case.<sup>26</sup> This principle implies to take preventive actions to keep away from harm, although the risks are uncertain. Another important principle is the polluter pays principle. This was supported in the case Indian Council for Enviro-Legal Action v. Union of India.<sup>27</sup> It holds that those who cause environmental damage must bear the full cost of their actions. For DSM, this means creating strict rules for accountability, requiring financial assurances for repairing damage, and establishing compensation methods for any harm caused. Sustainable development is another critical concept, discussed in the State of Himachal Pradesh v. Ganesh Wood Products case<sup>28</sup>. It emphasizes the stability in the environmental safety with robust development economically. However, equally significant is ecosystem-primarily based management (EBM), which, even though not formally a part of Indian regulation, it also considers how species, habitats, and their ecological roles are interconnected. This approach is well-suited for managing marine resources. Incorporating these principles into a future Deep Sea Mining Act would ensure that mining activities are carried out in an environmentally sound and legally justified.

<sup>&</sup>lt;sup>19</sup> The Environment (Protection) Act, 1986

<sup>&</sup>lt;sup>20</sup> Coastal Regulation Zone Notification, 2019, Ministry of Environment, Forest and Climate Change, https://crz.elaw.in/crz2019.html.

<sup>&</sup>lt;sup>21</sup>The Offshore Areas Mineral (Development and Regulation) Act, 2002, <https://www.indiacode.nic.in/bitstream/123456789/2040/6/a2003-17.pdf.> <sup>22</sup> *Ibid.* 

<sup>&</sup>lt;sup>23</sup> Environmental Impact Assessment Notification, 2006, Ministry of Environment, Forest and Climate Change, India, < https://www.moef.gov.in/wp-content/uploads/2022/07/EIA\_Notification\_2006.pdf.>

<sup>&</sup>lt;sup>24</sup> EKLAVYA TIWARY & DR. PUSHP BAJAJ, Decoding Marine Protected Areas in India – Part I: Understanding the Legal and Policy Frameworks, *Maritime India* (May 29, 2021), accessed on April 13,2025

<sup>&</sup>lt;sup>25</sup>National Centre for Polar and Ocean Research, Research Programmes, <a href="https://ncpor.res.in/programs">https://ncpor.res.in/programs</a> accessed on April 15,2025

<sup>&</sup>lt;sup>26</sup> Vellore Citizens' Welfare Forum v. Union of India, (1996) 5 SCC 647

<sup>&</sup>lt;sup>27</sup> Indian Council for Enviro-Legal Action v. Union of India, (1996) 3 SCC 212

<sup>&</sup>lt;sup>28</sup> State of Himachal Pradesh v. Ganesh Wood Products, (1995) 6 SCC 363

# International Legal Framework for DSM Regulation

# United Nations Convention on the Law of the Sea (UNCLOS)

The United Nations Convention on the Law of the Sea has ratified in India in 1995 and have been following these guidelines of the United Nations Convention on the Law of the Sea. UNCLOS is crucial for operations on the deep seabed, referred where in the Part XI of the convention dealt with the term "Area" which lies beyond the state jurisdiction. Whereas, Article 136 of UNCLOS declares the seabed and its resources as the Common Heritage of Mankind. This means no nation can claim it for itself, and benefits from mining there should be shared fairly, especially with developing nations.<sup>29</sup> The International Seabed Authority (ISA) oversees these activities to ensure they benefit everyone and follow specific regulations.<sup>30</sup> Entities, such as India's National Institute of Ocean Technology, must obtain permits, share exploration data, and adhere to environmental standards established by the ISA. UNCLOS also mandates countries to protect the marine environment. Articles 192 to 194 emphasize preventing, reducing and controlling pollution which require environmental impact assessments for the activities that might harm the ocean and the marine ecosystem.<sup>31</sup> The Convention adopts a precautionary approach, this approach aims to prevent irreversible damage.

# International Seabed Authority (ISA)

The International Seabed Authority (ISA) turned into set up through the United Nations Convention on the Law of the Sea (UNCLOS). Its fundamental position is to oversee mineral resource activities.<sup>32</sup> The intention of the International Seabed Authority is to discover a top stability between growing sources and protective the environment. According to the ISA's regulations, corporations ought to carry out an Environmental Impact Assessment (EIA) before they begin exploring or mining. The EIA checks what impact those sports may have at the surroundings and suggests the way to reduce any negative affects. This information ought to be shared with the general public for transparency.<sup>33</sup> Moreover, agencies need to additionally create an Environmental Management Plan (EMP). This plan describes how they intend to deal with environmental dangers at some stage in mining and after the paintings is carried out. In 2020, the ISA implemented new tips to decorate environmental safety. These suggestions contain undertaking primary environmental studies and adopting flexible management processes. They additionally assist the advent of Areas of Particular Environmental Interest (APEIs) to guard biodiversity.

#### Convention on Biological Diversity (CBD)

India has been dedicated to the Convention on Biological Diversity (CBD) due to the fact that in 1994, displaying its determination to keeping and using marine biodiversity sustainably. The goals of the convention specified in Article 1 of the Convention on Biological Diversity which to protect biodiversity, use its elements sustainably, and ensure fair sharing of benefits from genetic resources, including marine biodiversity in national and international waters which includes Areas Beyond National Jurisdiction.<sup>34</sup> Further in 2022, the Kunming-Montreal Global Biodiversity Framework, agreed during the COP15 of the Biological Diversity Convention, which ultimately strengthened the commitments related to marine ecosystems. It emphasizes spatial planning and ecosystem restoration, including in ABNJ which stands as a global goal to protect 30% of the world's oceans by 2030.<sup>35</sup> India has advocated this framework, thereby committing to enhance the protection of marine biodiversity even in international waters impacted with the aid of activities which include deep-sea mining. In light of these commitments, India should harmonize its aid extraction strategies with its biodiversity duties. India must align its resource extraction methods with its biodiversity protection goals. Ignoring this could jeopardize global biodiversity targets and harm India's reputation in international environmental forums like the High Ambition Coalition for Nature and People.<sup>36</sup> The convergence of responsibilities beneath the CBD and UNCLOS suggests that marine biodiversity safety need to become fundamental part to India's DSM regulatory and operational rules.

# Bilateral and Multilateral Engagements with Neighbour Coastal Nations

India's place in the Indian Ocean makes collaboration with neighbour coastal countries crucial for effective marine resource management and safety. As marine ecosystems are interconnected, and environmental impacts pass countrywide borders, India has initiated several cooperative tasks. In 2021, India entered into a \$50 million agreement with the Maldives to reinforce the Maldivian Coast Guard and decorate safety infrastructure. This plan goals to improve protection of marine surroundings and make sure long-time period use of ocean assets within the place.<sup>37</sup> Furthering its willpower to local cooperation, India and Sri Lanka signed a Memorandum of Understanding in 2022 to establish a Maritime Rescue Coordination Center. This agreement,

<sup>29</sup> UNCLOS art. 136.

<sup>30</sup> UNCLOS arts. 137-140, 145.

<sup>31</sup> UNCLOS arts. 192-194.

<sup>&</sup>lt;sup>32</sup> MICHAEL W. LODGE, The Common Heritage of Mankind: Past, Present and Future, 70 *INT'L & COMP. L.Q.* 815, 819–821 (2021). accessed on April 15,2025

<sup>&</sup>lt;sup>33</sup> ISA, *Recommendations for the Guidance of Contractors for Environmental Protection*, ISBA/25/LTC/6/Rev.1 (Mar. 2019), <<u>https://isa.org.jm/document/isba25ltc6rev1.> accessed on April 15,2025</u>

<sup>&</sup>lt;sup>34</sup> Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79, arts. 1, 6–8.

<sup>&</sup>lt;sup>35</sup>CBD Secretariat, Kunming-Montreal Global Biodiversity Framework, Target 3 (2022)

<sup>&</sup>lt;sup>36</sup>High Ambition Coalition for Nature and People, *Members and Mission*,< https://www.hacfornatureandpeople.org/> accessed on April 15,2025

<sup>&</sup>lt;sup>37</sup> CLIVE SCHOFIELD & COALTER G. LATHROP, *Maritime Zones and Jurisdiction in the Indian Ocean Region*, in *Oceans and the Law of the Sea* 25 (United Nations, 2021). accessed on April 18,2025

derived from India's Security and Growth for All inside the Region initiative, underscores the importance of collaborative efforts in maritime protection and environmental protection. These bilateral engagements are complemented by using the use of the use of India's lively participation in close by agencies collectively with the Indian Ocean Rim Association and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation. Through those platforms, India collaborates with neighboring nations on troubles related to the blue economic system, marine spatial making plans, and functionality constructing for sustainable ocean useful resource usage.<sup>38</sup>

# Toward an Ocean-Conscious Legal Framework for DSM in India

India's environmental law currently lacks particular provisions for deep-sea ecosystems, necessitating the advent of a Marine Environment Protection Act. This Act ought to shield marine existence within India's Exclusive Economic Zone and areas past our countrywide jurisdiction. For all deep-sea mining initiatives, having Strategic Environmental Assessments is essential. This centralized authority would streamline regulatory oversight and regulate the marine resource extraction aligns with conservation objectives. Moreover, the formation medical advisory panels composed of marine ecologists and specialists would provide evidence-based totally steering for retaining marine biodiversity and for determination of Marine Protected Areas. Further, Strengthening Biodiversity Protection by increasing Marine Protected Areas to encompass deep-sea regions like hydrothermal vents and seamounts is vital for retaining biodiversity. These areas are frequently neglected in desire of coastal protections., leaving deep-sea habitats inclined. Integrating key marine areas inclusive of Ecologically or Biologically Significant Marine Areas in country wide making plans is crucial and vital in safeguarding the marine environments which can be critical for biodiversity.<sup>39</sup> Improving Global Cooperation India desires to be a key participant in International Seabed Authority discussions. This is important for organising strong environmental standards for deep-sea mining. By undertaking these discussions, India can push for sustainable practices and better environmental safeguards. Furthermore, India's guide toward the High Seas Treaty demonstrates its dedication to global marine safety and biodiversity conservation.<sup>40</sup>

# Conclusion

Balancing India's Blue Economy India is at a essential turning factor in developing a sustainable blue economy system. The ocean's mineral resources can guide the growing demand for renewable strength, but not at the cost of marine ecosystems. Deep-sea mining need to be controlled with warning in India. This includes prioritizing strong environmental protections and conducting thorough effect exams. Further, to ensure secure mining practices, India have to establish in specialized corporations which recognition at the robust implementation of the policies, carrying out ordinary research, and definitely tracking mining operation for regulating the deep-sea mining activities and the sustainable development to defend marine surroundings. Moreover, the regulatory frameworks should align with international agreements just like the United Nations Convention at the Law of the Sea (UNCLOS) and ISA policies. By growing a balanced approach, India can assist sustainable aid extraction while protective the marine surroundings. This approach will make a contribution to a sturdy blue economy, respecting the integrity of its marine biodiversity.

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<sup>&</sup>lt;sup>39</sup> Government of India (2023), Ministry of Environment, Forest and Climate Change, "India's Marine Conservation Initiatives," <a href="https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987749.>accessed on April 20,2025">https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987749.>accessed on April 20,2025</a>

<sup>&</sup>lt;sup>40</sup> United Nations, "Biodiversity Beyond National Jurisdiction (BBNJ) Agreement," *United Nations Treaty Collection* (2024), <a href="https://www.un.org/biodiversity-treaties/bbnj.> accessed on April 20,2025.">https://www.un.org/biodiversity-treaties/bbnj.> accessed on April 20,2025.</a>

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