Recovering Cables From Sustainability Policy:

Will Policy Hinder the Recovery and Recycling of Subsea Telecommunications Cables?

Abstract

In this research paper, we analyze the ways that the recovery and recycling of subsea telecommunications cables is at times hindered by policy and regulation that is paradoxically aimed at enhancing sustainability. As we describe in our paper, subsea telecommunications cable recovery and recycling is a sustainable industry practice. It ultimately reduces the global demand for raw materials, many of which have finite supplies and whose extraction, processing, and manufacturing can be carbon intensive. Additionally, abandoned out-of-service cables clutter the seabed, making the laying of new cables and maintenance of existing ones in the same area more difficult, potentially increasing the risk of damage to other cables and generation of additional carbon emissions in repair operations.

Our paper focuses on three primary policy areas in which recovery and recycling practices could be hindered by policy that was originally intended to enhance sustainability. First, we look at import and export regulations that could increase the shipping distance and greenhouse gas emissions generated by recovered cables. Then we look at regulations relating to environmental impact assessments (EIAs), which could increase the complexity of recovery operations and reduce margins. Lastly, we turn to marine biodiversity protections such as area-based management tools (ABMTs), in which recovery operations can have unclear status.

These important policies, developed by international and regional organizations as well as national governments, are often focused on marine sustainability and environmental

protection. Yet we identify that they could inadvertently undermine some efforts to advance sustainability via recovery and recycling within the subsea industry.

Cable Recovery and Recycling: Increasing the Sustainability of Subsea Cable Industry

Subsea telecommunications cables are the backbone of the internet. They are responsible for transmitting 99% of global internet traffic and are central to transoceanic digital connectivity. Although they are less carbon intensive than other components of internet infrastructure, there are nonetheless places across the lifecycle of a cable where sustainability benefits could be achieved, particularly in the recycling of cables deemed to be out-of-service (OOS).[1] From 1850 to 2019 there had been about three million kilometers of subsea telecommunications cable deployed with approximately 66% of this being OOS and left unrecovered on the seafloor.[2] This leaves a significant opportunity to reduce the extraction and processing of additional raw materials in the global manufacturing of a range of products, especially as cables contain multiple valuable recyclable materials including copper and steel.[3]

According to the companies that recover and recycle cables, along with preliminary research studies by the Sustainable Subsea Networks research project, recovery and recycling is a carbon net negative practice, reducing the emissions of the industry as a whole.[4] For example – according to Arnold Louw, Alwyn du Plessis, Bernard Logan, and Michael Logan of Mertech Marine – if only half of the 1,049,337 kilometers of coaxial and fiber-optic cables that had been installed before the year 2000 were recovered and recycled, 18,756,898 MT of CO2 would be

---

[1] Douglas Burnett, David Freestone and Tara Davenport, "Submarine Cables in the Sargasso Sea: Legal and Environmental Issues in Areas Beyond National Jurisdiction", Workshop Report, 2015. Available at: https://cil.nus.edu.sg/publication/submarine-cables-sargasso-sea-legal-environmental-issues-areas-beyond-national-jurisdiction/

[2] Simon Appleby and Stephen Dawe, "Submarine Cable Recovery and Recovery", 2019 Suboptic Conference Paper, New Orleans: 7.

[3] Eckhard Bruckschen and Alwyn du Plessis, "Recovering And Recycling Redundant Submarine Telecommunication Cables", InterGlobix Magazine, 18 November, 2022. Available at: https://www.interglobixmagazine.com/recovering-and-recycling-redundant-submarine-telecommunication-cables/

[4] Nicole Starosielski et al., "Report on Best Practices in Subsea Telecommunications", *Sustainable Subsea Networks*, 2023: 62. Available at: https://suboptic.org/page/sustainable-subsea-networks-report

saved from not mining or manufacturing raw materials from scratch. This is equivalent to about 35.75 MT of CO2 emissions per kilometer of cable that is recycled. Additionally, nearly 100 percent of the cable can be recycled into other goods.[5] Aside from integrating with the circular economy, recovering abandoned cables can have additional sustainability and commercial benefits for the industry, including de-cluttering the seabed, making the laying of new cables and maintenance of existing ones in the same area less difficult and potentially decreasing the risk of damage to other cables. This could, in turn, potentially lead to the reduction of more carbon emissions in maintenance and repair, although there have not yet been peer-reviewed studies on this topic.

There is growing momentum in the subsea cable industry to enhance environmental sustainability, with the recovery and recycling of OOS cables, a practice that is increasingly gaining popularity, being one immediate sustainability opportunity. One of the primary indicators of the growing interest in recovery and recycling efforts was the publication of the recent Report on the Management of Decommissioned and Out-of-Service Cables (ICPC Recommendation) by the International Cable Protection Committee (ICPC) detailing best practices for recovering and recycling cables. While recovery and recycling has been in place for many years, this represents the formalization of the practice in the industry. The ICPC's Recommendation, while not explicitly about environmental sustainability, does highlight the significance of understanding "present and possible future effects on the marine environment"[6] as well as the "potential socio-economic benefits of recovering the cable."[7] Ideally, these best practices would help shape

[5] Arnold Louw, Alwyn du Plessis, Bernard Logan, and Michael Logan, "The Benefits of Recycling the Right Way" 2016 SubOptic Conference paper, Dubai: 5.
[6] ICPC Recommendation para 3.2.2
[7] ICPC Recommendation para 3.2.7

international laws and norms, national regulations, and industry practices for cable recovery and recycling operations.

Recovery and recycling is still far from a straightforward process. Recovery companies have to navigate an array of different regional, national, and international regulations, which are currently in transition as various bodies determine whether to mandate the process. Notably, there is a significantly different economic and regulatory model for the recovery of deep-sea cable than shore-ends in territorial waters. This is because international waters do not require permits that stipulate the timing of recovery and these efforts often only require one operations team with one vessel. On the other hand, shore-end recovery often requires multiple units or subcontractors, and additional vessels, as well as equipment on land. These recovery operations can also require surveying, as well as additional research and assessments to ensure smooth operations and to satisfy the many stakeholders involved. Shore-end cable segments might be armored cables (protected from increased risk of damage from human activities such as fishing), which can be more difficult to recover given recovery techniques such as splitting. As a result of these technical and environmental conditions, deep-sea recovery has a different economic model since the value of the recycled cable much more clearly justifies the cost for the recovery and the recycling of the cable. The value of the shorter shore-end cables does not have the same economic benefit. Even with this increased momentum, our research below shows that the industry's relative invisibility has also contributed to policy and regulations – and often *environmental* policy and regulations – that could negatively affect the capacity to recover and recycle subsea cables. In particular, international, regional, and national policies aimed at environmental protection could come into direct conflict with these industry efforts.

In this paper, we survey several policies intended to protect the marine environment that could have direct impacts on the operations of the subsea cable industry, including on the efforts to recover and recycle OOS cables.[8] We describe below three areas in which this trend can be seen: in import and export regulations, in regulations that mandate environmental impact assessments (EIAs), and in regulations that generate marine biodiversity protections such as area-based management tools (ABMTs). Policies have been put forward by international organizations including the United Nations (UN) through instruments such as the 1982 United Nations Convention on the Law of the Sea (UNCLOS) and the 2023 *Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction* (BBNJ Agreement) and regional bodies such as the OSPAR Commission in the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR).

In each of the three areas we review below, regulations intended to advance sustainability and environmental awareness could come into conflict with a key mechanism for achieving sustainability in the subsea cable industry and more broadly in the internet and digital infrastructure: cable recovery and recycling. Since there are not significant margins on the process of recycling and recovery, and especially as we show above, on the shore-ends, this means that any added difficulty for the process could inhibit its commercial viability, and in turn, the opportunities for developing a sustainable market in the subsea cable industry.

[8] ICPC Recommendation #1, Management of Decommissioned and Out-of-Service Cables, Issue 14A, 12 June 2020 (ICPC Recommendation).

Import/Export Bans: Saying "No" to Recovered Cable

After subsea cables are recovered, but before they can be recycled, the cable must be imported into a country. Commonly, this requires an import permit. Over the past decade, the importation and exportation of "waste" has become increasingly regulated. For example, China was responsible for half of solid waste imports in 2016 (originally importing the waste for use as secondary material to facilitate their manufacturing sector), but starting in 2018, they banned the importation of all solid waste.[9] As a result, countries that used to ship their waste to China, had to find other ways to dispose of their waste. This ban, in the end, had multiple impacts on sustainability. Much of the waste ended up getting diverted to countries with higher incineration rates leading to higher total greenhouse gas emissions in the short term.[10] However, the ban seemed to improve sustainability in regards to fine particulate matter formation, freshwater ecotoxicity, human carcinogenic toxicity and water consumption.[11]

Following China's ban, wastes were sent to other countries in Southeast Asia (namely Malaysia, Vietnam, Thailand), but many of those countries did not have the capacity to take in all of the diverted waste.[12] In response, a handful of countries increased restrictions on the importation of waste. Malaysia, which became the the largest importer of plastic waste[13] after

---

[9] Martina Igini, "What Are the Consequences of China's Import Ban on Global Plastic Waste?", Earth.org, 7 April, 2022. Available at: https://earth.org/chinas-import-ban/ ; Regions in China that were importing waste saw a "a 4.4% greater decrease in the AQI, a 6.5% greater decrease in the PM2.5 concentration and a 5.6% greater decrease in the PM10 concentration" after the ban

[10] Zongguo Wen, Yiling Xie, Muhan Chen and Christian Doh Dinga, "China's Plastic Import Ban Increases Prospects of Environmental Impact Mitigation of Plastic Waste Trade Flow Worldwide" Nat Commun 12, 425, (2021). Available at: https://doi.org/10.1038/s41467-020-20741-9

[11] Ibid. Xinzheng Shi and Ming-ang Zhang, "Waste Import and Air Pollution: Evidence from China's Waste Import Ban", Journal of Environmental Economics and Management, Volume 120, (2023). Available at: https://www.sciencedirect.com/science/article/pii/S0095069623000554

[12] Trang Tran, Hiromasa Goto, and Takuma Matsuda, "The Impact of China's Tightening Environmental Regulations on International Waste Trade and Logistics", Sustainability, (2021). Available at: https://doi.org/10.3390/su13020987

[13] Enru Wang, Changhong Miao and Xioafei Chen, "Circular Economy and the Changing Geography of International Trade in Plastic Waste", International journal of environmental research and public health, (2022). Available at: https://doi.org/10.3390/ijerph192215020

China's ban, began taxing its importation.[14] Vietnam stopped issuing plastic import permits after being overloaded with requests, and then proceeded to make their permitting process substantially more restrictive[15] before announcing they would completely ban the importation of plastic waste by 2025.[16] In a similar vein, Thailand implemented a short-term ban on the import of plastic waste and e-waste[17], and has now begun implementing a three stage plan, to completely ban the importation of plastic waste by 2025.[18]

Shortly after China's ban, there also were multiple revisions to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (the Basel Convention) — a multilateral agreement governing the transboundary movements of hazardous waste for recovery or disposal. First, there was an amendment to the Basel Convention which prohibited members from exporting hazardous waste, with hazardous waste including most electronic waste.[19] Second, there were amendments that changed practices governing the trade of plastic waste such that members could no longer export mixed, unrecyclable, and contaminated plastic waste to non-members.[20]

---

[14] Cole Rosengren, and Katie Pyzyk, "Malaysia to End Plastic Imports within Three Years", Wastedive, 1 November, 2018. Available at: https://www.wastedive.com/news/malaysia-tighter-restrictions-scrap-plastic-imports/533288/

[15] Kaustubh Thapa et al, "Towards a Just Circular Economy Transition: the Case of European Plastic Waste Trade to Vietnam for Recycling" Circ.Econ.Sust, (2024). Available at: https://doi.org/10.1007/s43615-023-00330-w

[16] Dat Nguyen, "Vietnam to End Plastic Scrap Imports From 2025", E.Vnexpress, 26 March, 2019. Available at: https://e.vnexpress.net/news/business/economy/vietnam-to-end-plastic-scrap-imports-from-2025-3900351.html

[17] So Sasaki, "The Effects on Thailand of China's Import Restrictions on Waste: Measures and Challenges Related to the International Recycling of Waste Plastic and E-waste" Journal of material cycles and waste management, 23(1), (2021): 77–83. Available at: https://doi.org/10.1007/s10163-020-01113-3

[18] Martina Igini, "Thailand Announces Ban on Plastic Waste Imports by 2025" Earth.org, 22 February, 2023. Available at: https://earth.org/thailand-ban-plastic-imports/

[19] International Pollutants Elimination Network, "The Entry Into Force Of The Basel Ban Amendment A Guide to Implications and Next Steps", 2020. Available at: https://ipen.org/sites/default/files/documents/ban-basel-fact-sheet-v2_1-en.pdf

[20] Emily Benson and Sarah Mortensen, "The Basel Convention: From Hazardous Waste to Plastic Pollution", Center for Strategic and International Studies, 7 October, 2021. Available at https://www.csis.org/analysis/basel-convention-hazardous-waste-plastic-pollution

As a result, the process of obtaining import permits for subsea cables could be a complex process, varying from country to country, and could even hinder a cable company from importing a recovered cable to a country with a recycling facility. In addition, recovery companies might ship their cables to be recycled in countries with no or less restrictive import bans on waste, which may not be the country closest to where the cable was recovered. This could easily increase carbon emissions and could potentially negate the environmental benefits from recycling. For cable recyclers, they are potentially an obstacle to operations.

Just as the permitting process for imports differs across countries, so do the specific types of materials that fall under the classification of waste. China includes iron and steel alongside twenty-two other materials in their solid waste ban.[21] The United States' definition of solid waste under the Resource Conservation and Recovery Act is broad including "any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations."[22] While this definition may seem all encompassing, under the Act, there are many cases in which recycled materials are excluded from the definition of solid waste.[23]

Brazil's national policy on solid waste has a similarly broad definition including "any material, substance, object or good disposed resulting from human activities in society, whose final destination proposes to proceed or whether it is obliged to proceed in solid or semisolid states, as well as gases and liquids within containers, whose peculiarities make impossible its

[21] Martina Igini, "What Are the Consequences of China's Import Ban on Global Plastic Waste?", Earth.org, 7 April, 2022. Available at: https://earth.org/chinas-import-ban/
[22] Resource Conservation and Recovery Act 1984, 42 U.S. Code § 6903
[23] 40 C.F.R. § 261.4a; some of the notable exceptions include recycled scrap metal and recycled circuit boards.

launch in the network of public sewers or water bodies, or require technical solutions or economically unviable solutions in the face of best available technology."[24] While one of the goals of the policy is to encourage the use of recycled materials,[25] there are no exceptions for recycled materials in its solid waste regulations. This has clear consequences for cable recycling as differing and changing classifications of solid waste could make it more difficult for recyclers to determine whether materials fall under solid waste regulations or outside of them.

As another example, in 2006 the European Union (EU) introduced Directive 2006/12/EC for waste management, including recovery and recycling. In 2019, the Waste Electrical and Electronic Equipment (WEEE) Directive was enacted to regulate the disposal and recycling of electronic waste in the EU and the European Economic Area, but subsea telecommunications cables were not explicitly classified under this directive.[26] Subsea cables are also missing from Regulation (EC) No 1013/2006 on Shipments of Waste and the European Commission (EC) Regulation No 1418/2007 of 29 November 2007.[27] This omission means that cables recovered from international waters can be shipped without restrictions, though individual jurisdictions may impose their own recovery requirements. These omissions generate ambiguity in classification. For example, if subsea cables are interpreted as IT and telecommunications equipment waste – which are regulated in the WEEE Directive – then Member States could be compelled to comply with the Directive's framework for the collection and recycling of these cables. Member States would also be required to design products in such a way as to facilitate

[24] Law No. 12.305 on the National Policy on Solid Waste Management, Article 3, Section 16 (2010). Available at: https://www.wiego.org/sites/default/files/resources/files/Pereira-Brazilian-Waste-Policy.pdf
[25] Law No. 12.305 on the National Policy on Solid Waste Management, Article 7, Section 6 (2010). Available at: https://www.wiego.org/sites/default/files/resources/files/Pereira-Brazilian-Waste-Policy.pdf
[26] Annex Ⅰ, Ⅱ, Ⅲ, Ⅳ of the EU WEEE Directive
[27] European Commission (EC) Regulation No 1418/2007 of 29 November 2007 concerning the export and recovery of certain waste listed in Annex III or IIIA to Regulation (EC) No. 1013/2006 of the European Parliament and of the Council to certain countries to which the Organisation for Economic Co-operation and Development (OECD) Decision on the control of transboundary movements of wastes does not apply to subsea telecommunications cables

recycling[28] as well as achieve waste collection, recovery, and recycling targets. This could affect the manufacturing of subsea telecommunications cables. Making this even more complicated, Article 8 of the WEEE Directive establishes that producers share responsibility for the collection and recycling of electrical equipment, but subsea cables often involve multiple producers. The specific implementation of this clause can vary across EU member states, and if this was applied to the subsea cable, there could be additional considerations in identifying and enforcing responsibility for all producers involved, especially for older cables or those with complex ownership structures.

In short, if the status of subsea cables remains ambiguous in any policy, this can produce uncertainty among cable recoverers, especially in a landscape with shifting restrictions and classifications. This could necessitate that cable recyclers find new countries to bring their materials into or invest more resources into getting through the permitting process, both of which may decrease the profit margins of a recycling operation, making it unviable.

Regulating Cable Recovery in the Marine Environment

While import and export bans are regulations, at times intended to enhance sustainability, suffer from a lack of precision about the classification or specificity of subsea cables, another domain of regulation has emerged which specifically targets the recovery of subsea cables but does not always recognize the cable industry's specific attributes. For example, the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), is the instrument that creates biodiversity standards and regulations for most of Europe. In 2012, OSPAR Commission released a document entitled "Guidelines on Best Environmental Practice

[28] Article 4 of WEED Directive

(BEP) in Cable Laying and Operation."[29] It was produced without consulting the subsea cable industry.[30] The guidelines call for proposals to install, operate, and remove cables to submit an Environmental Impact Assessment (EIA).[31] The guidelines also require ecological compensation measures—essentially asking cable layers and operators to pay the government for any unavoidable environmental damage from producing and managing the cable.[32] The guidelines warn of environmental risks ranging from species displacement, pollution during the construction process, and underwater noise.[33]

Members of the subsea cable industry objected to the guidelines imposed by the OSPAR commission on both legal and scientific grounds. In terms of its legality, the removal component of the EIA requirement falls out of the bounds of UNCLOS and does not conform with common practices in the subsea industry.[34] Additionally, the ecological compensation measures do not conform with UNCLOS's call for freedom to lay and maintain undersea cables.[35] Both of these requirements, the need for EIA and ecological compensation measures, are inconsistent with UNCLOS as they restrict the freedom of states to lay cables on the high seas.[36] On a scientific level, there are also significant objections from the subsea cable industry surrounding the guidelines for noise pollution findings. Since cables are only laid and recovered once, and the duration of those activities is relatively short, the likelihood of a substantial noise impact is low.[37]

---

[29] Agreement 2012-2, OSPAR 12/22/1, Annex 14. (BEP) Available at: https://www.gc.noaa.gov/documents/2017/12-02e_agreement_cables_guidelines.pdf
[30] Douglas R. Burnett, "Chapter 11 OSPAR and Coastal State Encroachment on High Seas Submarine Cable Freedoms", In *Sustainable Ocean Resource Governance*, (Leiden, The Netherlands: Brill | Nijhoff, 2018): 242. Available at: https://doi.org/10.1163/9789004360273_012
[31] BEP Section 5.1
[32] BEP Section 4
[33] BEP Section 3
[34] Douglas R. Burnett, "Chapter 11 OSPAR and Coastal State Encroachment on High Seas Submarine Cable Freedoms", In *Sustainable Ocean Resource Governance*, (Leiden, The Netherlands: Brill | Nijhoff, 2018): 247. Available at: https://doi.org/10.1163/9789004360273_012
[35] Ibid. 248
[36] Ibid. 249
[37] Ibid. 246

The guidelines admit that "there are no clear indications that noise impacts related to the installation (or removal) and operation of subsea cables pose a high risk for harming marine fauna."[38] This is a case where clarity in policy and regulation was not effective in facilitating recovery and recycling.

While emergent national and regional regulations are beginning to specifically target cable recovery – with more or less clarity, and more or less input from the industry – cables remain ambiguous in other marine policies. Another regulation that could shape the potential for recovery is the Biodiversity Beyond National Jurisdiction (BBNJ Agreement), which focuses on the conservation and sustainable use of marine biological diversity of the ABNJ. The BBNJ Agreement, including but not limited to, implements and addresses shortcomings of relevant provisions from UNCLOS, promotes international cooperation and coordination, creates and manages ABMTs like MPAs, EIAs, and facilitates capacity building and the transfer of marine technology.[39] EIAs and MPAs have historically been key policy instruments for protecting biodiversity, and are now getting new traction in the BBNJ Agreement. The recovery of telecommunications cables is not considered in the agreement, which could create – like the import and export bans – uncertainty in the status of this activity.

Reducing Impact on the Marine Environment: The Environmental Impact Assessment

One of the central policy mechanisms through which sustainability efforts could have unintended consequences on cable recovery and recycling is the set of requirements for Environmental Impact Assessments (EIAs). EIAs are assessments that determine the

[38] BEP Section 3.3

[39] ''United Nations Convention on the Law of the Sea Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction": Overview. Available at: https://www.un.org/depts/los/bbnj.htm

environmental impact of development projects. They are widely used by various institutions and form a common feature of environmental policy across sectors. States often use EIAs to protect their oceans. It is increasingly mandatory to conduct an EIA if an activity is likely to have a significant environmental impact.[40] One of the main intentions behind EIAs is the Precautionary Principle, which recommends that an activity should not be done in the absence of scientific evidence that an activity has less or no environmental impacts. While this intent is altruistic, in practice, for the EIAs and ABMTs like marine protected areas (MPAs), it could hinder the recovery of subsea telecommunications cables as illustrated in the examples below.[41]

In the United Nations Convention on the Law of the Sea, a key regulatory framework governing marine environments, Article 206 states that an EIA might be appropriate when stakeholders "have reasonable grounds for believing that planned activities under their jurisdiction or control may cause substantial pollution of or significant and harmful changes to the marine environment, they shall, as far as practicable, assess the potential effects of such activities on the marine environment." However, there remains uncertainty about UNCLOS's role in the requirement for an EIA.[42] UNCLOS fails to identify what information is required in an EIA, the procedure for requesting an EIA, and how and who conducts this EIA.[43] The rights of coastal States under UNCLOS may be interpreted to suggest that a State could require an EIA in order to lay, maintain, or recover cables within its territorial sea and, usually, the State tasks

---

[40] Astrid Epiney, "Environmental Impact Assessment", *Max Planck Encyclopedia of Public International Law*, 2009: 587–589. Available at: https://opil.ouplaw.com/display/10.1093/law:epil/9780199231690/law-9780199231690-e1581?prd=EPIL

[41] Peter Gluckman "'The Place of Science in Environmental Policy and Law", The Salmon Lecture to the Resource Management Law Association, Wellington, New Zealand, (2015): 5–6, available at: https://static1.squarespace.com/static/650b8bab23e9e609fd42e851/t/652dd801f4bc4b6dfbf5cedf/1697503235495/salmon_lecture_final2015.pdf.

[42] Danielly Salgado do Nascimento, "The Obligation to Conduct Environmental Impact Assessment in Areas Beyond National Jurisdiction: Proposals for a New Legal Regime", *The Arctic University of Norway*, (2018): 1. Available at: https://munin.uit.no/bitstream/handle/10037/14250/thesis.pdf?isAllowed=y&sequence=2

[43] Pulp Mills on the River Uruguay (Argentina v Uruguay): supra note 81 at para 205.

cable owners (who may be a private company and not the State) with overseeing and conducting the EIA.[44] In the EEZ and continental shelf, the coastal State does not have the right authority to mandate an EIA for cable operations. There is an argument, however, that there is no practical application for environmental measures concerning subsea cables due to their minimal impacts on the seabed.[45]

EIAs and the Precautionary Principle that it upholds may be exacerbated if a jurisdiction has never decommissioned and/or recovered a subsea telecommunications cable. The lack of a precedent for this activity could lead to countries basing their regulations on more environmentally damaging and invasive activities such as the decommissioning of oil and gas operations that occur for prolonged periods of time. Countries might also develop their cable recovery regulations based on their knowledge of operations relating to installing subsea cables – an activity which is not equivalent to cable recovery, which is even less invasive. Neither of these activities provide a valid precedent or sufficient awareness for creating recovery regulations.[46] This is a case where the lack of clarity about whether EIAs could potentially be mandated for recovery operations could eventually disincentivize these practices.

EIAs have historically not been required in the Area Beyond National Jurisdiction (ABNJ) under UNCLOS. However, the Biodiversity Beyond National Jurisdiction (BBNJ) Agreement complicated this. Article 27 of the BBNJ Agreement newly establishes processes, thresholds, and other requirements for conducting and reporting assessments by Parties in areas

---

[44] Douglas R. Burnett, Robert Beckman, and Tara M. Davenport, *Submarine Cables: The Handbook of Law and Policy*, (Leiden, The Netherlands: Brill | Nijhoff, 24 Oct. 2013). Available at: https://doi.org/10.1163/9789004260337.

[45] Andrew Friedman, "Submarine Telecommunication Cables and a Biodiversity Agreement in ABNJ: Finding New Routes for Cooperation", *The International Journal of Marine and Coastal Law* 32, 1 (2017): 1-35. Available at https://doi.org/10.1163/15718085-12341425.

[46] Reja Khalid Mateen, Daniel Duckett, and Andrew Nunn, “Proactive Removal of Legacy Subsea Cables: Why An Owner Should recover?”, 2023 Suboptic Conference Paper, Bangkok.

beyond national jurisdiction. The goal of this Part and the Agreement is to identify, mitigate, and manage adverse impacts to the environment. The BBNJ Agreement supports Parties if they choose to create frameworks for EIAs within their national jurisdiction while also creating a framework to assess the environmental impacts of activities in the ABNJ.[47] Additionally, the BBNJ Agreement aims to strengthen the capacity of developing States Parties to prepare, conduct, and evaluate EIAs.[48]

Article 30 of the BBNJ Agreement establishes thresholds and factors for conducting EIAs. It mandates that an EIA be conducted by the Party with jurisdiction or control of the activity if a planned activity "may have more than a minor or transitory effect on the marine environment, or the effects of the activity are unknown or poorly understood." Considering the applicability of this provision to cable recovery, cables are chemically stable even if they have lain on the seabed for three decades and longer. Additionally, unlike other oceanic activities (such as commercial fishing, oil and gas exploitation, and deep sea mining) which happen frequently or happen for a long period, recovering a cable only happens once and for a short period, making its negative biodiversity impact relatively minimal.[49] This is especially true for cables that are not buried below the seabed.[50] Cable recovery work involves the use of cutting and holding grapnels like the flatfish cutting grapnel that has a blade approximately five centimeters thick, which penetrates only 75 centimeters into the seabed, and has a surface plate

[47] Article 21(c), BBNJ Agreement.
[48] Articles 28, 29(1), 29(2), BBNJ Agreement.
[49] International Cable Protection Committee, "Submarine Cables and BBNJ", (2016). Available at: https://repository.oceanbestpractices.org/bitstream/handle/11329/2115/Submarine-Cables-_-BBNJ-August-2016.pdf?sequence=1.
[50] International Cable Protection Committee, "Submarine Cables and BBNJ", (2016). Available at: https://repository.oceanbestpractices.org/bitstream/handle/11329/2115/Submarine-Cables-_-BBNJ-August-2016.pdf?sequence=1

that is about 50 centimeters wide.[51] Given the limited physical impact on the seabed, recovery operations may not have more than a minor or transitory effect on the marine environment. Therefore, due to the inert nature of cables in the water and the minimal impacts they have on their surrounding environment, there is a strong argument that cable recovery operations are below this threshold and thus do not require EIAs.

Additionally, a submarine cable route would be planned to avoid sensitive ecological areas for the reasons discussed above. In the unlikely event that a proposed route did pass through such an ecosystem and the cable had to be buried, it could be argued that only then there would be cause for an EIA.[52] Since it already takes extensive amounts of research and collaboration to choose a cable route and since environmentally vulnerable ecosystems make cable laying, maintenance, and recovery difficult, these locations are less likely to be chosen. Therefore, cables in the ABNJ may not need an EIA because their cable route planning process is already similar to an EIA.

Subsea cable legal expert Kent Bressie notes that UNCLOS and the BBNJ Agreement grant rights and responsibilities only to States, which raises difficulties for the cable industry who can neither enforce treaty provisions directly against states nor seek dispute settlement in the absence of state espousal of a claim. Additionally, subsea cable recovery is not explicitly mentioned in the BBNJ Agreement and there is still an absence of intergovernmental organizations overseeing subsea cables. This raises the issue that varying interpretations of the

---

[51] Simon Appleby and Stephen Dawe, “Submarine Cable Recovery and Recovery”, 2019 Suboptic Conference Paper, New Orleans: 4.

[52] Andrew Friedman, "Submarine Telecommunication Cables and a Biodiversity Agreement in ABNJ: Finding New Routes for Cooperation", *The International Journal of Marine and Coastal Law* 32, 1 (2017): 1-35. Available at https://doi.org/10.1163/15718085-12341425

treaty may still hinder cable recovery and recycling in the high seas,[53] an area where these operations have historically remained uninhibited by regulation up until the advent of this agreement.

Mandating EIAs for recovering subsea cables, if widely adopted, may be inefficient since these cables and cable operations have little to no environmental footprint while the process of gaining permits and assessing projects can take months to years.[54] The long timeline associated with EIAs may in fact hinder sustainability efforts like recovery and recycling, especially for less-economically viable recovery of shore ends. As is the case for the omission of recovery in the import-export regulation, the absence of these activities generates ambiguities that could complicate recovery efforts.

Reducing Impact on the Marine Environment: Area-Based Management Tools

Marine and biodiversity protection have been key features of environmental policy for decades and have only become more popular and urgent in light of the shifting conditions of oceanic ecologies brought about by climate change. One of the marine protection tools used by legislators that directly impacts cable recovery operations are ABMTs such as marine protected areas (MPAs). MPAs are areas designated by coastal states that have a set of special protections, typically with the purpose of preserving biodiversity or re-establishing ecosystem function. While the protections within an MPA vary from state to state, they often have protections that impact cable operations.[55]MPAs can be designated by individual nations within their territorial

[53] Kent Bressie, “Submarine Cables and the Need for Regulatory Certainty in Oceans Law and Regulation”, 2023 Presentation at Suboptic Presentation, Bangkok.
[54] Douglas R. Burnett and Lionel Carter. "International Submarine Cables and Biodiversity of Areas Beyond National Jurisdiction: The Cloud Beneath the Sea", *Brill Research Perspectives in the Law of the Sea* 1, 2 (2017): 50. Available at https://doi.org/10.1163/24519359-12340002
[55] Lionel Carter, Douglas Burnett, and Tara Davenport, "Chapter 7. The Relationship between Submarine Cables and the Marine Environment", In *Submarine Cables: The Handbook of Law and Policy*, (Leiden, The Netherlands: Brill | Nijhoff, 2014): 202. Available at: https://doi.org/10.1163/9789004260337_009

waters. Beyond territorial waters, MPAs can exist, but the framework to regulate these MPAs is unclear and adds additional confusion about how to engage them. In territorial waters and elsewhere, MPAs are likely to impact cable recovery efforts. Often this comes in the form of additional consultation and permit for the cable recoverer.[56]

An example can be seen with National Oceanic and Atmospheric Administration (NOAA), which manages MPAs[57] and has the authority to regulate whether and how proposed submarine cables may be installed in National Marine Sanctuaries (NMS), a type of MPA, in accordance with international agreements to which the United States is a party. Although the United States is not a party to UNCLOS or the 1994 Convention on Biological Diversity – which identified MPAs as an important strategy for protecting marine environments – they are considered "generally accepted principles of international law" that cannot be contravened.[58] According to NOAA, in order for a subsea cable to transit the coastal zone including a portion of a NMS several permits or approvals may be required as well as a federal or state environmental review.[59] An EIA must determine that the impacts to sanctuary resources, including those to cultural resources and cumulative impacts, from installation, maintenance, long-term operation, and removal are negligible. Cable operators must remove all or part of the cable at the end of its life, if it is determined appropriate by NOAA. Thus, every EIA and permit must analyze, in part, the impacts of removing the cable at the end of its useful life.[60]

---

[56] Lionel Carter, Douglas Burnett, and Tara Davenport, "Chapter 7. The Relationship between Submarine Cables and the Marine Environment", In *Submarine Cables: The Handbook of Law and Policy*, (Leiden, The Netherlands: Brill | Nijhoff, 2014): 206. Available at: https://doi.org/10.1163/9789004260337_009.
[57] 15 C.F.R. § 922
[58] 16 U.S.C. § 1435(a)
[59] Installing and Maintaining Commercial Submarine Cables in National Marine Sanctuaries, 65 FR 51264, (2000), Available at: https://www.federalregister.gov/documents/2000/08/23/00-21539/installing-and-maintaining-commercial-submarine-cables-in-national-marine-sanctuaries
[60] Installing and Maintaining Commercial Submarine Cables in National Marine Sanctuaries, 65 FR 51264, (2000): Appendix A, Section 3, Parts 2, 4, and 6. Available at:

There are many examples highlighting that MPAs and cable operations in areas within national jurisdiction are not mutually exclusive but can operate in harmony in the presence of communication between the legislators and the telecommunications industry.[61] Ideally, the efforts to protect our marine environments should not be at-odds with cable recovery and recycling efforts. Rather, cable recovery and recycling reduces overall carbon emissions of cable systems, which has positive short and long term consequences for the ocean and marine ecologies. Given this, it is clear that cable recovery should be a component of marine protection efforts and not understood as a conflict of interests or point of contention.

The adoption of the BBNJ Agreement has raised concerns about how it will impact cable operations in the high seas, especially with regards to ABMTs like MPAs in the ABNJ that could potentially cause route foreclosures for new cables and making repairs for existing cables more expensive due to delays.[62] These unnecessary route foreclosures and delays may impact recovery efforts as well. They can be mitigated through communication between policy makers and the subsea telecommunications industry. Additionally, there is extensive precedent where submarine cables and ABMTs have existed in harmony.[63]

The BBNJ Agreement has provisions for the creation and management of ABMTs such as MPAs for conservation and sustainable use of these protected areas.[64] This Agreement is

---

https://www.federalregister.gov/documents/2000/08/23/00-21539/installing-and-maintaining-commercial-submarine-cables-in-national-marine-sanctuaries

[61] National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, “Chumash Heritage National Marine Sanctuary Draft Environmental Impact Statement”, (2023): 15, 19, 23, 26, 33, 36, 39, 42, 46. Available at: https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/chumash/2023-proposed-chumash-heritage-nms-deis.pdf

[62] Kent Bressie, “Submarine Cables and the Need for Regulatory Certainty in Oceans Law and Regulation”, 2023 Presentation at Suboptic Presentation, Bangkok.

[63] International Cable Protection Committee, “Submarine Cables and BBNJ”, (2016). Available at: https://repository.oceanbestpractices.org/bitstream/handle/11329/2115/Submarine-Cables-_-BBNJ-August-2016.pdf?sequence=1

[64] Article 17, BBNJ.

focused on protecting and sustainably using ecologically-vulnerable areas in the ABNJ and on developing the capacity of developing States Parties by establishing frameworks to develop, implement, monitor, manage, and enforce area-based management tools, including marine protected areas. Currently, cables in the ABNJ are not buried but instead layed on the flat seabed to avoid damaging potential biological "hot spots." Each cable has a diameter of only 17-22 millimeters with the collective footprint of all in-service cables being about 0.00002% of the ABNJ.[65] However, the recovery of cables has the potential to be hindered by ABMTs depending on how subsea telecommunications cables and their operations are classified. It is up to States to interpret and classify cables as critical infrastructure that is protected by the Agreement or as infrastructure that causes pollution that is prohibited in ABMTs.

Additionally, the BBNJ Agreement recognizes the needs of small and developing States to build and develop capacity. Capacity includes access to the internet and telecommunications cables due to the cables also being the means of commercial, educational and financial transactions.[66] In this context, subsea telecommunications cables are a critical infrastructure necessary for financial transactions and global communication and thus the laying, maintenance, recovery, and recycling of cables is essential for capacity-building. Capacity building is equally as important as managing ABMTs tools like marine protected areas. Therefore, cables are an inherent part of considerations in ABMTs and must not have any restrictions on the laying, maintaining, and recovery of them.[67]

---

[65] International Cable Protection Committee, "Submarine Cables and BBNJ", (2016). Available at: https://repository.oceanbestpractices.org/bitstream/handle/11329/2115/Submarine-Cables-_-BBNJ-August-2016.pdf?sequence=1

[66] According to Annex II of the BBNJ Agreement, capacity building includes the development and establishment of relevant infrastructure, including equipment, for information and data dissemination.

[67] Installing and Maintaining Commercial Submarine Cables in National Marine Sanctuaries, 65 FR 51264, (2000). Available at: https://www.federalregister.gov/documents/2000/08/23/00-21539/installing-and-maintaining-commercial-submarine-cables-in-national-marine-sanctuaries

The impacts of MPAs on cable recycling and recovery extend beyond the BBNJ Agreement. The subsea cable industry has been concerned about the OSPAR commission's creation of nine MPAs in the high seas.[68] Given that all of these MPAs are outside the territorial seas of the contracting Parties to OSPAR, some have concluded that there is no legal basis and are far outside the bounds of UNCLOS as there is no reason the OSPAR commission has jurisdiction to impose regulations in the high seas.[69] The MPAs were especially concerning for cable owners, as they were not consulted before the MPAs were created, and five territorial cables ran through them.[70] Without dialogue, it was unclear whether cable maintenance and recovery operations for cables within the bounds of the MPA would be impacted. It is believed that the lack of clarity still affects cable recovery activities. The inaccuracies in the BEP Guidelines and the lack of consultation in the creation of the high seas MPAs show the importance of government bodies consulting the subsea cable industry when creating policies that could impact their operations.

Conclusion: Sustainabilities in Conflict

While regulations may be motivated by altruistic intentions of protecting the environment, we have shown here that some of them only consider one aspect of environmental sustainability. At times, we show, investments in marine sustainability may generate regulations that could inhibit or prevent the recovery and recycling of subsea cables. We suggest, in closing, that a holistic approach to sustainability necessitates a consideration of different forms of sustainability across the environmental spectrum, from the consideration of marine life to the consideration of the reduction of carbon emissions. Moreover, sustainable futures must be

[68] Ibid. 242
[69] Ibid. 249
[70] Ibid. 242

crafted with three areas of concern in mind: social, economic, and environmental needs. In order for an initiative or legislation to be considered sustainable, we believe that policymakers must consult both with experts on environmental issues as well as with members of the telecommunications industry to ensure that the regulation considers its wide-ranging effects on the environment and industry practice.

Organizations and institutions that create policy or set regulatory norms should collaborate with industry bodies, like the ICPC, to expand the scope of sustainable policy to include subsea cables. The ICPC Recommendation is one example of the kind of work already being done within the industry that could be included in the development of international agreements and national regulations.

With regard to specific regulations, environmental policies like EIA requirements, ABMTs, and import and export bans could benefit from accounting for practices like recycling subsea cables, that enhance and strengthen the overall well being of the environment. Recovery and recycling is not in tension with sustainability policy, but cables and the cable industry are lost in the limited scope and particular framings of these policies.

It is clear that both awareness and collaboration is essential to ensure that legal efforts to increase sustainability align with and facilitate initiatives in recovery and recycling. We hope that by highlighting the successes and conflicts of different environmentally-conscious regulations we can contribute to the international discourse on subsea cable operations, particularly recovery, and ultimately, promote legal frameworks incentivize rather than disincentivize these practices. This way, the environmental benefits of recovery and recycling cables can be fully realized.

Works Cited

Appleby, Simon., and Stephen Dawe, “Submarine Cable Recovery and Recovery”, 2019 Suboptic Conference Paper, New Orleans.

Benson, Emily, and Sarah Mortensen, “The Basel Convention: From Hazardous Waste to Plastic Pollution”, *Center for Strategic and International Studies*, 7 October, 2021. Available at https://www.csis.org/analysis/basel-convention-hazardous-waste-plastic-pollution.

Bressie, Kent. “Submarine Cables and the Need for Regulatory Certainty in Oceans Law and Regulation”, 2023 Presentation at Suboptic Presentation, Bangkok.

Bruckschen, Eckhard and Alwyn du Plessis, “Recovering And Recycling Redundant Submarine Telecommunication Cables”, *InterGlobix Magazine*, 18 November, 2022. Available at: https://www.interglobixmagazine.com/recovering-and-recycling-redundant-submarine-telecommunication-cables/.

Burnett, Douglas R., and Lionel Carter. "International Submarine Cables and Biodiversity of Areas Beyond National Jurisdiction: The Cloud Beneath the Sea", *Brill Research Perspectives in the Law of the Sea* 1, 2 (2017): 1-72. Available at: https://doi.org/10.1163/24519359-12340002.

Burnett, Douglas R., David Freestone and Tara Davenport, “Submarine Cables in the Sargasso Sea: Legal and Environmental Issues in Areas Beyond National Jurisdiction”, Workshop Report, 2015. Available at: https://cil.nus.edu.sg/publication/submarine-cables-sargasso-sea-legal-environmental-issues-areas-beyond-national-jurisdiction/.

Burnett, Douglas R., Robert Beckman, and Tara M. Davenport, eds. Submarine Cables, (Leiden, The Netherlands: Brill | Nijhoff, 24 Oct. 2013). Available at: https://doi.org/10.1163/9789004260337.

Carter, Lionel, Douglas Burnett, and Tara Davenport. "Chapter 7. The Relationship between Submarine Cables and the Marine Environment". In *Submarine Cables: The Handbook of Law and Policy*, (Leiden, The Netherlands: Brill | Nijhoff, 2014): 179-212. Available at: https://doi.org/10.1163/9789004260337_009.

Epiney, Astrid. "Environmental Impact Assessment", *Max Planck Encyclopedia of Public International Law*, (2009), 580–592. Available at: https://opil.ouplaw.com/display/10.1093/law:epil/9780199231690/law-9780199231690-e1581?prd=EPIL.

Friedman, Andrew. "Submarine Telecommunication Cables and a Biodiversity Agreement in ABNJ: Finding New Routes for Cooperation", *The International Journal of Marine and Coastal Law* 32, 1 (2017): 1-35, doi: https://doi.org/10.1163/15718085-12341425.

Gluckman, Peter "The Place of Science in Environmental Policy and Law", The Salmon Lecture to the Resource Management Law Association, Wellington, New Zealand, (2015). Available at: https://static1.squarespace.com/static/650b8bab23e9e609fd42e851/t/652dd801f4bc4b6dfbf5cedf/1697503235495/salmon_lecture_final2015.pdf.

Installing and Maintaining Commercial Submarine Cables in National Marine Sanctuaries, 65 FR 51264, (2000). Available at:

https://www.federalregister.gov/documents/2000/08/23/00-21539/installing-and-maintaining-commercial-submarine-cables-in-national-marine-sanctuaries.

Igini, Martina. "Thailand Announces Ban on Plastic Waste Imports by 2025", *Earth.org*, 22 February, 2023. Available at: https://earth.org/thailand-ban-plastic-imports/.

Igini, Martina. "What Are the Consequences of China's Import Ban on Global Plastic Waste?", *Earth.org*, 7 April, 2022. Available at: https://earth.org/chinas-import-ban/.

International Cable Protection Committee, "Submarine Cables and BBNJ", (2016). Available at: https://repository.oceanbestpractices.org/bitstream/handle/11329/2115/Submarine-Cables-_-BBNJ-August-2016.pdf?sequence=1.

ICPC Recommendation #1, Management of Decommissioned and Out-of-Service Cables, Issue 14A, 12 June, 2020.

Identification and Listing of Hazardous Waste, 40 C.F.R. § 261.4a, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-261/subpart-A/section-261.4.

International Pollutants Elimination Network, "The Entry Into Force Of The Basel Ban Amendment A Guide to Implications and Next Steps", 2020. Available at: https://ipen.org/sites/default/files/documents/ban-basel-fact-sheet-v2_1-en.pdf

Law No. 12.305 on the National Policy on Solid Waste Management, Article 3, Section 16 (2010). Available at:

https://www.wiego.org/sites/default/files/resources/files/Pereira-Brazilian-Waste-Policy.pdf.

Louw, Arnold, Alwyn du Plessis, Bernard Logan, and Michael Logan, "The Benefits of Recycling the Right Way", 2016 SubOptic Conference paper, Dubai.

Mateen, Reja Khalid, Daniel Duckett, and Andrew Nunn, "Proactive Removal of Legacy Subsea Cables: Why An Owner Should recover?", 2023 Suboptic Conference Paper, Bangkok.

Marine Sanctuaries, 16 U.S.C. § 1435(a), https://www.law.cornell.edu/uscode/text/16/1435.

National Marine Sanctuary Program Regulations, 15 C.F.R. § 922, https://www.law.cornell.edu/cfr/text/15/part-922.

National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, "Chumash Heritage National Marine Sanctuary Draft Environmental Impact Statement", (2023). Available at: https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/chumash/2023-proposed-chumash-heritage-nms-deis.pdf.

Nascimento, Danielly Salgado do. "The Obligation to Conduct Environmental Impact Assessment in Areas Beyond National Jurisdiction: Proposals for a New Legal Regime", *The Arctic University of Norway*, (2018). Available at: https://munin.uit.no/bitstream/handle/10037/14250/thesis.pdf?isAllowed=y&sequence=2.

Nguyen, Dat. "Vietnam to End Plastic Scrap Imports From 2025", *E.Vnexpress*, 26 March, 2019. Available at:

https://e.vnexpress.net/news/business/economy/vietnam-to-end-plastic-scrap-imports-from-2025-3900351.html.

Pulp Mills on the River Uruguay (Argentina v Uruguay).

Resource Conservation and Recovery Act 1984, 42 U.S. Code § 6903.

Rosengren, Cole, and Katie Pyzyk, "Malaysia to End Plastic Imports within Three Years", *Wastedive,* 1 November, 2018. Available at: https://www.wastedive.com/news/malaysia-tighter-restrictions-scrap-plastic-imports/533288/.

Sasaki, So. "The Effects on Thailand of China's Import Restrictions on Waste: Measures and Challenges Related to the International Recycling of Waste Plastic and E-waste", *Journal of material cycles and waste management*, *23*(1), (2021): 77–83. Available at: https://doi.org/10.1007/s10163-020-01113-3.

Shi, Xinzheng, and Ming-ang Zhang, "Waste Import and Air Pollution: Evidence from China's Waste Import Ban", *Journal of Environmental Economics and Management*, Volume 120, (2023). Available at: https://www.sciencedirect.com/science/article/pii/S0095069623000554.

Starosielski, Nicole, Iago Bojczuk, Anne Pasek, George N. Ramírez, Nicholas R. Silcox, Anjali Sugadev, and Hunter Vaughan, "Report on Best Practices in Subsea Telecommunications", *Sustainable Subsea Networks*, 2023. Available at: https://suboptic.org/page/sustainable-subsea-networks-report.

Thapa, Kaustubh, Walter J. V. Vermeulen, Mo Ming De Waal, Pauline Deutz and Hồng Quân Nguyễn, "Towards a Just Circular Economy Transition: the Case of European Plastic Waste Trade to Vietnam for Recycling", *Circ.Econ.Sust,* (2024). Available at: https://doi.org/10.1007/s43615-023-00330-w.

Tran, Trang, Hiromasa Goto, and Takuma Matsuda, "The Impact of China's Tightening Environmental Regulations on International Waste Trade and Logistics", *Sustainability* 13, no. 2: 987 (2021). Available at: https://doi.org/10.3390/su13020987.

United Nations, "Intergovernmental Conference on Marine Biodiversity of Areas Beyond National Jurisdiction". Available at: https://www.un.org/bbnj/content/background.

UN General Assembly, *Convention on the Law of the Sea*, 10 December 1982. Available at: https://www.refworld.org/legal/agreements/unga/1982/en/40182.

"United Nations Convention on the Law of the Sea Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction". Available at: https://www.un.org/depts/los/bbnj.htm.

Wang, Enru, Changhong Miao, and Xiaofei Chen, "Circular Economy and the Changing Geography of International Trade in Plastic Waste", *International Journal of Environmental Research and Public Health* 19, no. 22: 15020 (2022). https://doi.org/10.3390/ijerph192215020.

Wen, Zongguo, Yiling Xie, Muhan Chen and Christian Doh Dinga, "China's Plastic Import Ban Increases Prospects of Environmental Impact Mitigation of Plastic Waste Trade Flow

Worldwide", *Nat Commun* 12, 425, (2021). Available at:

https://doi.org/10.1038/s41467-020-20741-9.