GLOBAL PLASTICS GOVERNANCE: OPPORTUNITIES AND CHALLENGES FOR ITS IMPROVEMENT FROM A LIFE CYCLE PERSPECTIVE

Giorgia Carratta* and Liv Jaeckel♣

Despite being an alarming and widespread environmental issue, plastic pollution is still lacking an adequate response from the international community. The interconnection between upstream human activities and downstream environmental consequences has recently been recognized as a crucial element to consider for the prevention and minimization of plastic pollution. Production, consumption, and waste management have only recently begun to come into focus. Moreover, plastic pollution has long been framed as a marine issue and the role played by other ecosystems, such as freshwater ones, has been widely underestimated. This article explores the relevant international legal framework by adopting a life cycle perspective. In particular, it highlights the opportunities and challenges existing instruments offer at each stage of the plastic life cycle: production and manufacturing, consumption, waste management and pollution. In parallel, the authors identify key aspects that could be covered by the upcoming 'plastic treaty' under the auspices of the United Nations Environment Assembly (UNEA). With

* Ph.D. Candidate at the HHL Leipzig Graduate School of Management, Germany. Early Stage Researcher for the EU-founded *LimnoPlast Project* (g.carratta@hhl.de).

♣ Education and Research Center of the German Federal Finance Administration, also Associate Professor at the HHL Leipzig Graduate School of Management, Chair of Law and Economic Regulation (liv.jaeckel@hhl.de). The opinions expressed in this contribution reflect the personal views of the author alone. This research is part of a project receiving funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 860720. Thank you to the reviewers for their suggestions towards improving the manuscript. The authors declare no conflict of interest.

a view to strengthening global plastics governance, it is argued that amending existing legal instruments is as crucial as adopting a new ad-hoc treaty.

Keywords: environment, international law, microplastics, plastic life cycle, plastic pollution

I. INTRODUCTION

'The difficulty of governing plastic has been rising as production accelerates, consumption globalizes, pollution sources diversify and international trade obscures responsibility'.[1]

There are still many uncertainties about the exact scale of plastic accumulation in the environment.[2] Nevertheless, increasing evidence has emerged over time on the many negative consequences of this type of pollution on ecosystems. Entanglement, toxicological effects via ingestion, suffocation, starvation, and alteration of the metabolism functions are only part of the lethal and sub-lethal consequences recently observed in wildlife.[3]

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1 Peter Dauvergne, 'Why is The Global Governance of Plastic Failing the Oceans?' (2018) 51 Global Environmental Change 22 (emphasis added).

2 Kennedy Bucci et al., 'What is Known and Unknown about the Effects of Plastic Pollution: A Meta-Analysis and Systematic Review' (2020) 30 Ecological Applications 2 <https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/eap.2044> accessed 16 July 2023.

3 Stephanie Avery-Gomm et al., 'Linking Plastic Ingestion Research with Marine Wildlife Conservation' (2018) 637-638 Science of The Total Environment <https://doi.org/10.1016/j.scitotenv.2018.04.409> accessed 16 July 2023. Jesse F. Senko et al., 'Understanding Individual and Population-level Effects of Plastic Pollution on Marine Megafauna' (2020) 43 Endangered Species < https://doi.org/10.3354/esr01064> accessed 16 July 2023. G.G.N. Thushari and J.D.M. Senevirathna, 'Plastic Pollution in the Marine Environment' (2020) 6 Heliyon e04709. Pengui Li et al., 'Characteristics of Plastic Pollution in the Environment: A Review' (2021) 107 Bulletin of Environmental Contamination and Toxicology <https://doi.org/10.1007/s00128-020-02820-1> accessed 16 July

Additionally, plastic debris is suspected to behave as a transporter of species from one ecosystem to the other with potential risks in terms of biodiversity.[4] Although more research is needed, current evidence suggests that human health is also under threat.[5] Small plastic particles are of particular concern. These *micro-* and *nanoplastics* (MNP) range respectively from 0,001 to 5 millimeters and from 0,001 to 0,1 micrometers.[6] Microplastics are usually

2023. Christian Laforsch et al., 'Microplastics: A Novel Suite of Environmental Contaminants but Present for Decades' in Franz-Xaver Reichl and Michael Schwenk (eds) *Regulatory Toxicology* (Springer, 2021).

[4] See e.g. Giorgio Smiroldo et al., 'Anthropogenically Altered Trophic Webs: Alien Catfish and Microplastics in the Diet of Eurasian Otters' (2019) 64 Mammal Research <https://doi.org/10.1007/s13364-018-00412-3> accessed 16 July 2023. Duofei Hu et al., 'Microplastics and Nanoplastics: Would They Affect Global Biodiversity Change?' (2019) 26 Environmental Science and Pollution Research <https://doi.org/10.1007/s11356-019-05414-5> accessed 16 July 2023.

[5] For instance, in 2014 a study of the University of Ghent discovered that every human consumes up to 11,000 microscopic fragments of plastic every year eating seafood. Lisbeth Van Cauwenberghe and Colin R. Janssen, 'Microplastics in Bivalves Cultured for Human Consumption' (2014) 193 Environmental Pollution. In 2021, small plastic fragments were detected in human placenta. Antonio Ragusa et al., 'Plasticenta: First Evidence of Microplastics in Human Placenta' (2021) 146 Environment International 106274. In 2022, the first study quantifying polymer mass concentrations in human whole blood was published. Heather A. Leslie et al., 'Discovery and Quantification of Plastic Particle Pollution in Human Blood' (2022) 163 Environment International 107199. See also e.g. Leah Shipton and Peter Dauvergne, 'Health Concerns of Plastics: Energizing the Global Diffusion of Anti-Plastic Norms' (2021) 65 Journal of Environmental Planning and Management 11 < https://doi.org/10.1080/09640568.2021.1957796 > accessed 16 July 2023.

[6] This classification is still debated. Nanna B. Hartmann et al., 'Are We Speaking the Same Language? Recommendations for a Definition and Categorization Framework for Plastic Debris' (2019) 53 Environmental Science & Technology 1039. See also Yanina K. Müller et al., 'Microplastic Analysis-Are We Measuring the Same? Results on the First Global Comparative Study for Microplastic Analysis in a Water Sample' (2020) 412 Analytical and Bioanalytical Chemistry. It should also be noted that, since smaller plastics generally fall under the field of application of most of the regulations on plastic pollution, the word *plastic* will be used whenever a distinction based on the size is not relevant in the context of our analysis.

referred to as *primary* microplastics, when directly released in the environment in the form of small particles, as an effect of laundering of synthetic clothes, abrasion of tires through driving, or as intentional additives to personal care and hygiene products;[7] and as *secondary* microplastics, when they originate from larger plastic materials degrading in the environment under the influence of solar UV radiation, wind, currents, and other environmental factors.[8] More efforts are needed to deepen our understanding of the sources, fates, effects, and risks of microplastics.[9] Overall, research suggests that the environmental impact of plastic pollution is worsened by the coaction with other stressors such as different pollutants, climate change, ocean acidification, and overexploitation of marine resources.[10] Plastic production is projected to triple by 2050, raising concerns that some effects of plastic pollution could become irreversible.[11] As a wide-ranging phenomenon, plastic pollution also has socio-economic implications.[12] On the one hand, the over-accumulation of plastic in the environment tends to result in income losses, *inter alia*, in tourism, fishery, and shipping, in addition to the costs generated by health-related issues.[13]

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[7] See 'Microplastics: Sources, Effects and Solutions' (European Parliament News) <https://www.europarl.europa.eu/news/en/headlines/society/20181116STO19217/microplastics-sources-effects-and-solutions> accessed 16 July 2023.

[8] Bethanie Carney Almroth and Håkan Eggert, 'Marine Plastic Pollution: Sources, Impacts, and Policy Issues' (2019) 13 Review of Environmental Economics and Policy 317.

[9] Science Advice for Policy by European Academies (SAPEA), 'A Scientific Perspective on Microplastics in Nature and Society' (2019).

[10] Nicola J. Beaumont et al., 'Global Ecological, Social and Economic Impacts of Marine Plastic' (2019) 142 Marine Pollution Bulletin 189.

[11] Agenda Industry, 'The New Plastics Economy Rethinking the future of plastics' (2016) World Economic Forum 36. Villarrubia-Gómez et al., 'Marine Plastic Pollution as a Planetary Boundary Threat – The Drifting Piece in the Sustainability Puzzle' (2018) 96 Marine Policy 213.

[12] Joanna Vince and Britta Denise Hardesty, 'Plastic Pollution Challenges in Marine and Coastal Environments: from Local to Global Governance' (2017) 25 Restoration Ecology 123.

[13] Thushari (n 3).

Ecosystem recovery is another economic burden to be considered (e.g. carrying out clean-up activities).

Without any doubt, an improved plastics economy could contribute to the achievement of at least four of the seventeen Sustainable Development Goals (SDG): SDG 6 'Clean water and sanitation', SDG 11 'Sustainable cities and communities', SDG 12 'Responsible consumption and production' and SDG 14 'Life below water' – embedded in the United Nations Agenda for Sustainable Development.[14] As a result, plastic pollution has become a crucial element in the international political agenda.[15] In 2014, the United Nations Environment Assembly (UNEA) adopted Resolution 1/6 on 'Marine Plastic Debris and Microplastics' which stressed the need to apply a precautionary principle to plastic pollution, supported scientific research in the field and urged state authorities to establish action plans to tackle marine litter.[16] Subsequently, UNEA established an Ad Hoc Open-Ended Expert Group (AHEG) and commissioned it a study on the existing strategies of plastics governance.[17] In the resulting document, published in 2017, the AHEG promoted two options as 'technically and politically feasible' and potentially 'effective' - namely (i) 'revising and strengthening the existing [legal] framework', and (ii) establishing 'a new global architecture with a multi-

[14] A/RES/70/1, United Nations General Assembly, Resolution 70/1. Transforming Our World: the 2030 Agenda for Sustainable Development. 25.09.2015.

[15] UNEP/EA.1/10, United Nations Environment Assembly of the United Nations Environment Programme, Resolution 1/6. Marine Plastic Debris and Microplastics, 02.09.2014.

[16] Principle 15 of the Rio Declaration, Rio Declaration on Environment and Development of 13 June 1992, 31 ILM 876 (1992). Article 191 TFEU, European Union, Consolidated version of the Treaty on the Functioning of the European Union, 13 December 2007, 2008/C 115/01.

[17] UNEP/EA.3/INF/5, United Nations Environment Assembly of the United Nations Environment Programme, 'Combating Marine Plastic Litter and Microplastics: An Assessment of the Effectiveness of Relevant International, Regional and Subregional Governance Strategies and Approaches'.

layered governance approach, including a new international legally binding instrument'.[18]

At the fifth session of UNEA (March 2022), an International Negotiating Committee (INC) was finally established with the aim of developing a legally binding instrument on plastic pollution, including in the marine environment.[19] The first and second rounds of negotiations took place, respectively, in Uruguay from 28 November to 2 December 2022 (INC-1) and in France from 29 May to 2 June 2023 (INC-2). Despite a clear recognition of the negative effects of plastic pollution, these meetings revealed diverging perspectives on the prospected scope, objectives, structure, core obligations, control measures, voluntary approaches, and national action plans under the upcoming treaty. During the INC-2, the delegates finally started the discussion of substantial matters based on an options paper prepared by the UNEA Secretariat,[20] after overcoming an initial impasse around the provisional application of the draft rules of procedure agreed upon in Uruguay.[21]

[18] UNEP/AHEG/2018/1/6, United Nations Environment Assembly of the United Nations Environment Programme, Report of the first meeting of the ad hoc open-ended expert group on marine litter and microplastics.

[19] UNEP/EA.5/Res.14, United Nations Environment Assembly of the United Nations Environment Programme, Resolution 5/14. End of Plastic Pollution: Towards an International Legally Binding Instrument.

[20] UNEP/PP/INC.2/4, United Nations Environment Programme, Potential Options for Elements towards an International Legally Binding Instrument, based on a Comprehensive Approach that Addresses the Full Life Cycle of Plastics as Called for by United Nations Environment Assembly Resolution 5/14.

[21] UNEP/PP/INC.1/3, United Nations Environment Programme, Draft Rules of Procedure for the Work of the Intergovernmental Negotiating Committee to Develop an International Legally Binding Instrument on Plastic Pollution, including in the Marine Environment.

Regardless the latest developments, the current legal framework is still unable to meet the expectations of the international community.[22] As of writing, there is no binding international instrument whose primary objective is to address the plastic crisis. Instead, the uncoordinated coexistence of a multitude of legal instruments, whose field of application is often unclear, compromises the effectiveness of the current plastics governance. Horizontally, different areas in international law are equally relevant: for instance, the law of the sea, international watercourses law as well as biodiversity law, chemical law, waste- and wastewater law. Vertically, several levels of governance should be coordinated: international law, regional law (e.g., EU regulation), and national and local measures. Notably, this lack of a shared understanding of plastic pollution has encouraged a sectorial decision-making process at all levels of governance. In the EU, for instance, plastic-related matters are regulated separately (e.g., waste management, single-use plastic items, packaging, and others), even if soft law facilitates a certain level of coherence.[23]

Against this background, there is still no clear consensus among legal scholars on how international environmental law should equip itself to deal

[22] See e.g. Elizabeth A. Kirk and Naporn Popattanachai, 'Marine Plastics: Fragmentation, Effectiveness and Legitimacy in International Lawmaking' (2018), 27 Review of European, Comparative and International Environmental Law 222. Peter Dauvergne (n 1).

[23] The following are the most relevant soft law instruments: European Commission, Communication from the Commission, the European Green Deal, COM(2019) 640 final; European Parliament, New Circular Economy Action Plan, European Parliament resolution of 10 February 2021 on the New Circular Economy Action Plan (2020/2077(INI)), P9_TA(2021)0040; European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A European Strategy for Plastics in a Circular Economy, COM(2018) 28 final; European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Pathway to a Healthy Planet for All EU Action Plan: Towards Zero Pollution for Air, Water and Soil, COM(2021) 400 final.

with the issue of plastic pollution. Some authors see the adoption of a new binding instrument on plastic pollution as a promising opportunity,[24] while others have stressed the potential of non-binding approaches. Among these, McIntyre (2020) highlights the strengths of 'informal governance initiatives characteristic of transnational environmental law'.[25] Raubenheimer et al. (2018) point to the need to combine voluntary and mandatory measures.[26] Others promote a multi-level model of governance to tackle global plastic pollution.[27] Moreover, a few scholars have focused their attention on the legal implications of microplastic pollution.[28] It should be noted that, in

[24] See e.g. Nils Simon and Maro Luisa Schulte, 'Stopping Global Plastic Pollution: The Case for an International Convention' (2017) 43 Heinrich Böll Stiftung Ecology. Stephanie B. Borrelle et al., 'Opinion: Why We Need an International Agreement on Marine Plastic Pollution' (2017) 114 Proceedings of the National Academy of Sciences of the United States of America 9994. Elizabeth A. Kirk (n 22). Peter Dauvergne (n 1).

[25] Owen McIntyre, 'Addressing Marine Plastic Pollution as a 'Wicked' Problem of Transnational Environmental Governance' (2020) 25 Environmental Liability: Law, Policy and Practice 282.

[26] Karen Raubenheimer et al., 'Towards an Improved International Framework to Govern the Life Cycle of Plastics' (2018) 27 Review of European, Comparative & International Environmental Law 3 <https://doi.org/10.1111/reel.12267> accessed 16 July 2023.

[27] See e.g. Joanna Vince (n 12). João Pinto da Costa et al., 'The Role of Legislation, Regulatory Initiatives and Guidelines on the Control of Plastic Pollution' (2020) Frontiers in Environmental Science <https://doi.org/10.3389/fenvs.2020.00104> accessed 16 July 2023. Peter Stoett, 'Plastic pollution: A Global Challenge in Need of Multi-Level Justice-Centered Solutions' (2022) 5 One Earth 6 <https://doi.org/10.1016/j.oneear.2022.05.017> accessed 16 July 2023.

[28] See e.g. Nicole Brennholt et al., 'Freshwater Microplastics: Challenges for Regulation and Management' in Martin Wagner and Scott Lambert (eds), *Freshwater Microplastics - Emerging Environmental Contaminants?* (Springer 2018). João Pinto da Costa, 'Micro-and Nanoplastics in the Environment: Research and Policymaking' (2018) 1 Current Opinion in Environmental Science & Health <https://doi.org/10.1016/j.coesh.2017.11.002> accessed 16 July 2023. Peter Dauvergne, 'The Power of Environmental Norms: Marine Plastic Pollution and the Politics of Microbeads' (2018), 27 Environmental Politics 4 <https://doi.org/10.1080/09644016.2018.1449090> accessed 16 July 2023. Denise M. Mitrano and Wendel Wohlleben, 'Microplastic Regulation Should Be More

academia, marine plastic pollution has long been framed as the most relevant topic.[29] More recently, many have suggested broadening the scope of legal intervention to cover the full life cycle of plastics.[30] In line with this approach, embraced also by UNEA in Resolution 5/14,[31] this article addresses the following questions: how is the international legal framework applicable to the plastic life cycle currently structured? In which direction is it desirable for it to evolve?

In our view, there is no space for choosing between amending the existing legal instruments and adopting a new one. In the attempt to regulate the full life cycle of plastics on a global scale, the two strategies should coexist and support each other. In the next section, the concept of 'life cycle' will be shortly introduced in the context of today's plastics economy. Then, in the following sections, an analysis of existing legal instruments will be provided throughout the main phases of the plastic life cycle - production and manufacturing, consumption, waste management and plastic pollution. For each of these, evidence will be provided about the fact that, notably, the modification of current regimes and the establishment of a new one would serve different functions, and cover different areas, with a view to improve the current plastics governance. Although our main focus is international

Precise to Incentivize Both Innovation and Environmental Safety' (2020) 11 Nature Communications 5324.

[29] See e.g. Joanna Vince (n 12). Elizabeth A. Kirk (n 22). Oluniyi Solomon Ogunola et al., 'Mitigation Measures to Avert the Impacts of Plastics and Microplastics in the Marine Environment (A Review)' (2018) 25 Environmental Science and Pollution Research <https://doi.org/10.1007/s11356-018-1499-z> accessed 16 July 2023. Owen McIntyre (n 25).

[30] See e.g. Karen Raubenheimer (n 26). Giulia Carlini and Konstantin Kleine, 'Advancing the International Regulation of Plastic Pollution beyond the United Nations Environment Assembly Resolution on Marine Litter and Microplastics' (2018) 27 Review of European, Comparative & International Environmental Law 3 <https://doi.org/10.1111/reel.12258> accessed 16 July 2023. Tobias D. Nielsen et al., 'Politics and the Plastic Crisis: A Review throughout the Plastic Life Cycle' (2019) 9 WIREs Energy and Environment 1 <https://wires.onlinelibrary.wiley.com/doi/10.1002/wene.360> accessed 16 July 2023.

[31] UNEP (n 19).

law, we also mention regional and national legal instruments, where appropriate.

II. The Life Cycle of Plastics: Overview

In the last decades, the concept of life cycle has been increasingly used in social sciences, including in economics and law. Life cycle assessments have proven particularly useful to uncover the environmental consequences of a product or service from production to disposal, and to establish measures to minimize them in a cost-effective way.[32] As a result, this concept has gained a role as a key tool to support decision-making in public and private institutions.[33] Although we do not intend to conduct an analysis of the plastic life cycle, this methodological framework remains suitable for investigating the effectiveness of the relevant international legislation. In general terms, plastics are at the center of a transformation from raw materials to consumer products, to waste, to potential litter in the environment - usually referred to as plastic pollution. Greatly simplified here, each stage of the plastic life cycle presents many risks for leakage of synthetic items, or fragments of them, into the environment. Fortunately, numerous are also the options to

[32] See e.g. Walter Klöpffer, 'Life cycle Assessment: From the Beginning to the Current State' (1997) 7 Environmental Science and Pollution Research. Göran Finnveden et al., 'Recent Developments in Life Cycle Assessment' (2009) 91 Journal of Environmental Management 1 <https://doi.org/10.1016/j.jenvman.2009.06.018> accessed 16 July 2023. Annekatrin Lehmann et al., 'Policy Options for Life Cycle Assessment Deployment in Legislation' in Guido Sonnemann and Manuele Margni (eds), *Life Cycle Management. LCA Compendium – The Complete World of Life Cycle Assessment* (Springer, 2015).

[33] For instance, the European Commission identified Life Cycle Assessment (LCA) as the "best framework for assessing the potential environmental impacts of products". It stressed that environmental policies should tackle not only large point sources of pollution (e.g., industrial emissions and waste management), but also [consumption] products by looking at the whole of a product's lifecycle, including the use phase. European Commission. (2003, June 18). Communication from the Commission to the Council and the European Parliament, Integrated Product Policy, Building on Environmental Life-Cycle Thinking.

prevent plastic pollution, considering its strict interconnection with human decisions and related behaviors.[34]

Present and future decision-making processes on plastic pollution can be effective only when considering the interests of plastic-related businesses. In the 1950s, 2 million tons of plastic per year were produced worldwide. Since then, the production rate has increased exponentially, reaching 381 million tons in 2015.[35] Today a plethora of plastic items are on the market. Despite the dominance, in terms of quantity, of packaging, other economic sectors remain relevant: building and construction, automotive, electronic equipment, textile, and agriculture.[36] A few players in the petrochemical segment and countless converters, recyclers, and plastics machinery manufacturers all constitute the plastic industry. The negative consequences of plastic pollution, also in economic terms, are increasingly evident.[37] Therefore, it is desirable for companies to start conducting their operations in a more sustainable manner.

Consumers may also impact the fate of plastic products through their purchasing preferences. Although this environmental issue causes growing concern, research shows that consumption choices have not changed significantly.[38] Obstacles to a behavioral shift include misconceptions about

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[34] Sabine Pahl et al., 'Human Perceptions and Behaviour Determine Aquatic Plastic Pollution' in Friederike Stock, George Reifferscheid, Nicole Brennholt, and Evgeniia Kostianaia (eds), *Plastics in the Aquatic Environment - Part II* (Springer 2020).

[35] R. Geyer et al., 'Production, use, and fate of all plastics ever made' (2017) 3 Science Advances e1700782 <https://www.science.org/doi/epdf/10.1126/sciadv.1700782> accessed 16 July 2023.

[36] PlasticsEurope, 'Plastics – The Facts 2020 An Analysis of European Plastics Production, Demand and Waste Data' (2020) <https://plasticseurope.org/knowledge-hub/plastics-the-facts-2020/> accessed 16 July 2023.

[37] The following study has estimated a US$ 1.5 trillion per year loss only considering the damage caused to oceans in terms of their capacity to provide ecosystem services. Nicola J. Beaumont (n 10).

[38] See e.g., Lesley Henderson and Christopher Green, 'Making Sense of Microplastics? Public Understandings of Plastic Pollution' (2020) 152 Marine

biodegradability and composability, routinized activities and strong habits, knowledge gaps such as on disposal of plastic items and alternative products, and the transfer of responsibility to businesses and policymakers.[39] As for microplastic pollution, studies on the knowledge and perceived risks by the general public are still scarce.[40] Since a change in social practices may be encouraged by effective lawmaking, a closer give-and-take between behavioral scientists and policymakers is desirable to shape broad and long-term strategies.

Waste management is another relevant stage in the plastic life cycle offering various avenues for legal intervention. Waste management is generally referred to as the set of scientific techniques allowing the collection, transportation, processing, recovery, and disposal of any type of waste, including plastic.[41] The main methods to handle plastic waste lawfully are recycling, thermal destruction (pyrolysis and incineration), and landfilling.[42] The reduction of plastic waste generated is the priority to restore our

Pollution Bulletin 110908. Sea Circular, 'Perceptions on Plastic Waste: Insights, Interventions, and Incentives to Action from Businesses and Consumers in South-East Asia' (2020).

39 Lea Marie Heidbreder et al., 'Tackling the Plastic Problem: A Review on Perceptions, Behaviors, and Interventions' (2019) 668 Science of the Total Environment 1077. Luca Marazzi et al., 'Consumer-based Actions to Reduce Plastic Pollution in Rivers: A Multicriteria Decision Analysis Approach' (2020) Plos One e0236410 <https://doi.org/10.1371/journal.pone.0236410> accessed 16 July 23.

40 GESAMP, 'Sources, Fate and Effects of Microplastics in the Marine Environment: A Global Assessment' (2015) <http://www.gesamp.org/publications/reports-and-studies-no-90> accessed 16 July 2023.

41 Christopher Igwe Idumah and Iheoma C. Nwuzor, 'Novel Trends in Plastic Waste Management' (2019) 1 SN Applied Sciences 1402 <https://doi.org/10.1007/s42452-019-1468-2> accessed 16 July 2023.

42 The World Bank has estimated that globally 37% of solid waste is dumped or landfilled, 33% ends up in open dumps, 19% is recycled or composted, and 11% is incenerated. Silpa Kaza et al., 'What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050' (2018) <https://openknowledge.worldbank.org/handle/10986/30317> accessed 16 July 2023.

ecosystems and give relief to wildlife.[43] However, good practices at the end-of-life of plastic products can also make a difference in minimizing plastic pollution. Over the last few decades, the Global North has exported significant amounts of plastic waste to the Global South. According to data collected by the UN Comtrade Platform, Japan, the U.S. and France were in 2020 among the largest net exporters of scrap and waste plastics while the largest net importers were Thailand, Indonesia and Vietnam.[44] In 2017, the Chinese government decided to scale back the country's role in global plastic waste management and restrict imports to its 'National Sword' policy.[45] As a consequence, plastic waste trade streams have largely been diverted to Southeast Asia over the last few years.[46] Should more countries take the Chinese example, a further transformation of global plastic waste management will undoubtedly follow.

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[43] Vince (n 12).

[44] In 2020, net exports for the three largest exporting countries, Japan, and the US were respectively: +818,764 tons, +206,422 tons, and +189,233 tons. Germany, a major exporter in previous years, did not report any data. Net imports for the three largest importing countries, Thailand, Indonesia and Vietnam, were respectively: -65,487 tons, -138,009 tons, and -291,699 tons. UN Comtrade Database, UN Statistical Office, <https://www.statista.com/chart/18229/biggest-exporters-of-plastic-waste-and-scrap/> accessed 16 July 2023. Some authors tend to resize the relevance of plastic waste trade to the plastic issue. They highlight that 'ca. 3 million tonnes plastic waste exported' is a significant amount but 'it pales into insignificance in the context of the 90 million tonnes mismanaged worldwide as a result of lack of waste collection'. Ed Cook et al., 'Plastic Waste Exports and Recycling: Myths, Misunderstandings and Inconvenient Truths' (2022), 40 Waste Management & Research 10, <https://doi.org/10.1177/0734242X221132336> accessed 16 July 2023.

[45],OECD, 'Global Plastics Outlook. Economic Drivers, Environmental Impacts and Policy Options' (2022), p. 83-100. See also, Amy L. Brooks et. al., 'The Chinese Import Ban and its Impact on Global Plastic Waste Trade' (2018) 4 Science Advances 6. Wang C. at al, 'Structure of the Global Plastic Waste Trade Network and the Impact of China's Import Ban' (2020), 153 Resources, Conservation and Recycling. Trang Tran et al., 'The Impact of China's Tightening Environmental Regulations on International Waste Trade and Logistics' (2021) 13 Sustainability 2.

[46] Ibid.

Even if international law were to improve its effectiveness in addressing the early stages of the plastic life cycle, plastic pollution would remain a problem due to the extensive environmental damage already incurred. Plastic pollution extends beyond marine environments and even affects the atmosphere.[47] Recent estimates indicate that an annual influx of 4.4–12.7 million metric tons of plastic waste enters the marine environment each year.[48] While it is important not to overlook the impact of plastic pollution on seas and oceans in decision-making processes, it is equally important to address the issue in other affected areas.[49] Notably, rivers have been identified as significant pathways for plastic pollution, with only 10 international watercourses accounting for 90 per cent of the overall riverine input.[50] Our analysis primarily focuses on international waterways law and the law of the sea; nevertheless, we hope that regulatory efforts will expand to encompass a broader range of ecosystems as scientific understanding of the sources, pathways, and fate of plastic debris in the environment deepens.

We have introduced the main phases of the plastic life cycle: production and manufacturing, consumption, waste management and plastic pollution. In the subsequent sections, we will examine the primary deficiencies of international environmental law concerning each phase, propose potential amendments, and identify the key aspects the upcoming plastic treaty should

[47] See e.g. 'No Mountain High Enough: Study Finds Plastic in 'Clean' Air' (The Guardian) <https://www.theguardian.com/environment/2021/dec/21/no-mountain-high-enough-study-finds-plastic-in-clean-air> accessed 16 July 2023. See also Angelica Bianco and Monica Passananti, 'Atmospheric Micro and Nanoplastics: An Enormous Microscopic Problem' (2020) 12 Sustainability 7327.

[48] Jenna R. Jambeck et al., 'Plastic waste inputs from land into the ocean' (2015) 347 Science 768.

[49] It is also estimated that 94% of plastic entering the ocean ends up on the sea floor. Chris Sherrington et al., 'Leverage Points for Reducing Single-Use Plastics' (2017) Background report. Eunomia Research & Consulting Ltd.

[50] Christian Schmidt et al., 'Export of Plastic Debris by Rivers into the Sea' (2017) 51 Environmental Science & Technology 12246. See also Martín C.M. Blettler et al., 'Freshwater Plastic Pollution: Recognizing Research Biases and Identifying Knowledge Gaps' (2018) 143 Water Research <https://doi.org/10.1016/j.watres.2018.06.015> accessed 16 July 2023.

address. By doing so, we aim to demonstrate that amending existing international instruments relating to plastic waste is just as essential as adopting a new international agreement.

III. Plastic Production and Manufacturing

The current international legal framework suffers from a lack of any specific rule on plastic production and manufacturing. The Stockholm and the Rotterdam Conventions are the only two treaties indirectly addressing this stage of the plastic life cycle. Both these binding agreements establish rules on the production and use of dangerous chemicals, some of which are either constituents of plastic items or essential "ingredients" in production and manufacturing processes.[51] In particular, the Stockholm Convention on Persistent Organic Pollutants sets rules to ban, restrict, and minimize the production and use of covered substances.[52] The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade aims to facilitate informed decision-making by countries regarding the import-export of hazardous chemicals through a prior informed consent (PIC) procedure.[53] The provisions in the treaties are limited in scope to a specific class of chemicals, leaving several

[51] Karen Raubenheimer and Alistair McIlgorm, 'Can the Basel and Stockholm Conventions Provide a Global Framework to Reduce the Impact of Marine Plastic Litter?' (2018) 96 Marine Policy 285.

[52] Convention on Persistent Organic Pollutants (Stockholm Convention) (Stockholm) of 22 May 2001, in force 17 May 2004; 40 ILM 532 (2001). See also, <http://www.pops.int/TheConvention/Overview/tabid/3351/Default.aspx> accessed 16 July 2023.

[53] Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam Convention) (Rotterdam) of 10 September 1998, in force on 24 February 2004. See, Health and Environment Alliance (HEAL), 'Turning the Plastic Tide: the Chemicals on Plastic that Put Our Health at Risk' (2020) <https://www.env-health.org/wp-content/uploads/2022/03/HEAL_Plastics_report_v5.pdf accessed 16 July 2023. See also e.g. Atiq Zaman and Peter Newman, 'Plastics: Are They Part of the Zero-Waste Agenda or the Toxic-Waste Agenda?' (2021) 4 <https://doi.org/10.1186/s42055-021-00043-8> accessed 16 July 2023.

types of plastics outside their scope. Nonetheless, the international community appears willing to seize the opportunities presented by these legal instruments. In January 2022, the Persistent Organic Pollutants Review Committee (POPRC) suggested amending the Stockholm Convention to include six more chemicals under its scope. Among these, medium-chain chlorinated paraffins (MCCPs, CAS 85535-85-9), long-chain perfluorocarboxylic acids (LC-PFCAs), their salts and related compounds, and UV-328 (CAS 25973-55-1) are contained in various plastic materials. Moreover, following decisions BC-13/11 and SC-8/15, the regional centers of the Basel and Stockholm Conventions have begun cooperating to deliver joint technical assistance to public and private entities on marine plastic pollution and microplastics.[54] In our opinion, such efforts should be further strengthened to ensure better environmental protection under these existing regimes. Member States could consider applying stricter rules to the plastic-related chemicals already covered as well as incorporating additional ones within the scope of the Stockholm and Rotterdam Conventions. Furthermore, close cooperation between the Rotterdam and Basel Conventions regarding trade in hazardous waste and chemical waste should be encouraged.[55]

Despite the contribution of these potential amendments, further action is needed at the international level. In recent years, companies are increasingly switching from a 'production, use and dispose of' paradigm to a modified

[54] A list of activities related to plastic waste, marine plastic litter and microplastics undertaken by the Basel Convention regional and coordinating centers and the Stockholm Convention regional and sub-regional centers has been presented at the COPs from 29 April to 10 May 2019 in Geneva. The relevant working documents are UNEP/CHW.14/INF/29 and UNEP/CHW.14/INF/29/Add.1 respectively.

[55] After the Joint Conference 'Clean Planet, Healthy People: Sound Management of Chemicals and Waste', held in Geneva in May 2019, the adoption of harmonized measures on the trade of hazardous substances and waste is perceived as a compelling need. See <http://www.brsmeas.org/2019COPs/Overview/tabid/7523/language/en-US/Default.aspx> accessed 16 July 2023.

scheme focused on 'design, use, re-design, and re-use'.[56] Several startups have been promoting innovative technological solutions to combat plastic pollution, creating an unprecedented business opportunity.[57] Simultaneously, some of the more traditional companies have adopted measures such as codes of conduct, third-party certifications, ecolabelling, voluntary reporting, and compliance audits. Corporate Social Responsibility, generally defined as the voluntary integration of social and environmental purposes into a business plan,[58] is a widespread form of corporate self-governance that can have a positive impact plastic pollution.[59] At the regional and national levels, 'Extended Producer Responsibility' policies have compelled businesses to take responsibility for the end-of-life of plastic items they place on the market.[60] Corporate-oriented strategies are promising because of their adaptability, responsiveness, and potential transboundary effects.[61] In this context, the upcoming plastic treaty represents a unique opportunity. Ambitious provisions should compel

[56] See e.g. Micah Landon-Lane, 'Corporate Social Responsibility in Marine Plastic Debris Governance' (2018) 127 Marine Pollution Bulletin 310. Hanna Dijkstra et al., 'Business Models and Sustainable Plastic Management: A Systematic Review of the Literature' (2020) 258 Journal of Cleaner Production 120967.

[57] Hanna Dijkstra et al., 'In the Business of Dirty Oceans: Overview of Startups and Entrepreneurs Managing Marine Plastic' (2021) 162 Marine Pollution Bulletin 111880. See also e.g. Marcus Eriksen, Martin Thiel, Matt Prindiville, Tim Kiessling, 'Microplastic: What Are the Solutions?' in Martin Wagner and Scott Lambert (eds), *Freshwater Microplastics - Emerging Environmental Contaminants?* (Springer, 2018).

[58] Andrew Crane et al. (eds), The Oxford Handbook of Corporate Social Responsibility (OUP Oxford, 2008).

[59] Landon-Lane (n 56).

[60] Oluniyi Solomon Ogunola (n 29). See also, Secretariat of the Convention on Biological Diversity and the Scientific and Technical Advisory Panel - GEF, 'Impacts of Marine Debris on Biodiversity: Current Status and Potential Solutions' (2012) CBD Technical Series No. 67 <https://www.cbd.int/doc/publications/cbd-ts-67-en.pdf> accessed 16 July 2023.

[61] Owen McIntyre, 'Transnational Environmental Regulation and the Narrativization of Global Environmental Governance Standards: The Promise of Order from Chaos?' (2018) 10 Journal of Property, Planning and Environmental Law 92.

countries to regulate plastic production and manufacturing, encouraging companies to eliminate unnecessary plastic products, produce only what is necessary, prioritize the use of bio-based raw materials over fossil-based ones, increase the incorporation of recycled materials in their production cycle, improve the transparency of industrial processes, with a focus on chemicals, and prevent the dispersion of microplastics.[62] In addition, a technical platform could be created to bring together operators from different economic sectors to agree on best practices and eco-design standards.

IV. Plastic Consumption

Although the international community has acknowledged the need for more sustainable plastic consumption,[63] there is a lack of binding tools specifically targeting consumers at the international level. At the EU level, several measures were recently approved within the so-called 'Plastic Strategy'. Established in 2018 as part of the Circular Economy Action Plan, the EU's Plastic Strategy aims to transform plastic items' production, use, and management across the 27 Member States.[64] Notably, the Single-Use Plastics Directive[65] and the Packaging and Packaging Waste Directive[66] have

[62] Karen Raubenheimer and Niko Urho, 'Possible Elements of a New Global Agreement to Prevent Plastic Pollution' (2020) Nordic Council of Ministers.

[63] In the UNEA Resolution "Marine plastic litter and microplastics" (UNEP/EA.4/RES.6), State Members decided to stress 'the importance of more sustainable management of plastics throughout their life cycle in order to increase sustainable consumption and production patterns […]'.

[64] See 'Plastic Strategy' (European Commission) <https://ec.europa.eu/environment/strategy/plastics-strategy_en> accessed 16 July 2023.

[65] European Commission. (2019, June 5). SUP Directive. Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment.

[66] European Commission. (1994, December 20). European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste. European Commission. (2015, April 29). This legal instrument has been recently amended by the so-called "Plastic Bags Directive" (Directive (EU) 2015/720 of the

changed plastic consumption patterns. Last year, the European Commission further evaluated the potential introduction of additional measures.[67] At the national level, regulations are structured to either disincentivize or incentivize certain behaviors relating to plastic consumption. Disincentives include levies and taxes,[68] while the most common incentive-based measures are deposit-refund systems, encouraging consumers to return plastic containers to retailers to obtain a monetary reward.[69] Several studies have confirmed the widespread acceptance of these measures by consumers.[70] A more straightforward way to obtain a reduction in plastic consumption is

European Parliament and of the Council of 29 April 2015 amending Directive 94/62/EC on packaging and packaging waste).

[67] European Commission, 'Scoping study to assess the feasibility of further EU measures on waste prevention and implementation of the Plastic Bags Directive' (2022), <https://op.europa.eu/en/publication-detail/-/publication/3f3ee30e-7cc5-11ec-8c40-01aa75ed71a1/language-en> accessed 16 July 2023. Moreover, in March 2022, the European Commission unveiled a directive proposal that seeks to empower consumers in the transition towards sustainability by enhancing their protection against unfair practices and improving access to information (European Commission, Proposal for a Directive of the European Parliament and of the Council amending Directives 2005/29/EC and 2011/83/EU as regards empowering consumers for the green transition through better protection against unfair practices and better information).

[68] For instance, in Portugal, thanks to a tax on plastic bags, an impressive reduction in the number of plastic bags used pro capita was observed (from 2.25 to 0.59). Graça Martinho et al., 'The Portuguese Plastic Carrier Bag Tax: The Effects on Consumers' Behavior' (2017) 61 Waste management 3.

[69] In the USA and Australia, recent findings demonstrate a lower level of coastal debris in areas where this type of incentive was established. Quamar Schuyler et al., 'Economic Incentives Reduce Plastic Inputs to the Ocean' (2018) 96 Marine Policy 250.

[70] Johane Dikgang and Martine Visser, 'Behavioural Response to Plastic Bag Legislation in Botswana' (2012) 80 South African Journal of Economics 123. Johane Dikgang et al., 'Elasticity of Demand, Price and Time: Lessons from South Africa's Plastic-Bag Levy' (2012) 44 Applied Economics. Wouter Poortinga et al., 'The Introduction of a Single-Use Carrier Bag Charge in Wales: Attitude Change and Behavioural Spillover Effects' (2013) 36 Journal of Environmental Psychology 240. Gregory Owen Thomas et al., 'The English Plastic Bag Charge Changed Behavior and Increased Support for Other Charges to Reduce Plastic Waste' (2019) 10 Frontiers in Psychology 266.

the implementation of bans.[71] For instance, in 2002, the Bangladeshi government became the first to prohibit plastic bags. A 2018 United Nations Environment Programme (UNEP) report provides a country-based overview of existing bans.[72] In recent years there has also been a widespread effort to phase out microplastics. In 2015, the Microbead-Free Waters Act in the U.S. banned plastic microbeads in a wide range of cosmetic products.[73] In 2017, a restriction proposal on intentionally-added microplastics was submitted to the European Chemicals Agency (ECHA) under the REACH regulation.[74] In August 2022, the draft amendment to Annex XVII was finalized by the European Commission.[75] On 27 April 2023, EU countries endorsed with their vote this text. At the moment of writing, the scrutiny from the Council and European Parliament is the last step missing before adoption.[76]

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[71] To date, only in a few cases banning schemes have been unsuccessful due to ineffective monitoring systems and low acceptance by consumers. Dikgang (n 70). Adriana Jakovcevic et al., 'Charges for Plastic Bags: Motivational and Behavioral Effects' (2014) 40 Journal of Environmental Psychology 372.

[72] UNEP, 'Single-Use Plastics: A Roadmap for Sustainability' (2018) (Rev. ed., pp. vi; 6).

[73] Jason P. McDevitt et al., 'Addressing the Issue of Microplastics in the Wake of the Microbead-Free Waters Act – A New Standard Can Facilitate Improved Policy' (2017) 51 Environmental Science & Technology 6611.

[74] ECHA (2019, March 20). Restricting the use of intentionally added microplastic particles to consumer or professional use products of any kind. Annex XV Restriction report – Proposal for a restriction. Helsinki: European Chemical Agency <https://echa.europa.eu/registry-of-restriction-intentions/-/dislist/details/0b0236e18244cd73> > accessed 16 July 2023.

[75] Draft of the Commission Regulation (EU) amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards synthetic polymer microparticles, <https://echa.europa.eu/hot-topics/microplastics> accessed 16 July 2023.

[76] Interestingly, the following authors reckon that banning primary microplastics, as the ECHA is proposing, will not significantly cut the amount of microplastics in the environment. They argue that significant reductions are only achievable through better waste management of macroplastics. Denise Mitrano (n 28). Lauge

To date, the outcomes of the measures implemented at the national and regional levels have shown promising results. However, the lack of any international binding agreement targeting this phase of the plastic life cycle has prompted the development of rules in a piecemeal manner. As a consequence, the INC established at UNEA 5.2 should consider the opportunity to include provisions on plastic consumption in the forthcoming plastic treaty. Undoubtedly, rules on plastic production and manufacturing will also affect consumption patterns. However, certain aspects relating to consumption still need to be addressed. For instance, consumers could benefit from standardized certification and labelling systems, shared criteria for compostable, bio-based, and biodegradable plastics, and clear warnings for products containing microplastics.

V. Plastic Waste Management

Despite its global dimension, plastic waste management remains largely beyond the scope of current binding international law instruments. With the exception of the Basel Convention, this stage of the plastic life cycle is primarily regulated through regional, national and local legal tools. In the EU, for instance, the Waste Framework Directive[77] and the Urban Wastewater Treatment Directive[78] set rules for, respectively, plastic waste and wastewater management. At the national level, well-defined rules and their effective enforcement can provide certainty to waste managers and

Peter Westergaard Clausen et al., Stakeholder Analysis with Regard to a Recent European Restriction Proposal on Microplastics (2020) 15 PLoS One 6 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7307934/> accessed 16 July 2023.

[77] European Commission. (2008, 19 November). Waste Framework Directive. Directive (EU) 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

[78] Council of the European Communities. (1991, 21 May). Urban Wastewater Treatment Directive. Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment. This Directive is relevant to the extent that wastewater represents an important pathway of macro- and microplastics, especially in urban areas.

other relevant actors.[79] Furthermore, authorities often implement penalty systems at the local level to dissuade citizens from illegally disposing household plastic waste.[80]

Although it does not focus exclusively on plastic waste, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal plays an important role in governing its management worldwide.[81] Similar to the Stockholm and the Rotterdam Conventions, this international agreement targets a well-defined list of dangerous substances, some of which are contained in plastic items. However, the ultimate objective of the Basel Convention is to minimize the displacement of waste, including plastics, from high-income countries to middle- and low-income ones. Its provisions aim to: reduce the amount of hazardous waste produced, promote environmentally sound management, and minimize transboundary movements of hazardous waste.[82] In 2019, the Conference of Parties of the Basel Convention approved the so-called Plastic Waste Amendments.[83] Pursuant to decision BC-14/12, Annex VIII and Annex II were revised to classify certain types of plastic waste as 'hazardous'

[79] UNEP/ISWA, 'Global Waste Management Outlook' (2015), <https://wedocs.unep.org/bitstream/handle/20.500.11822/9672/-Global_Waste_Management_Outlook-2015Global_Waste_Management_Outlook.pdf.pdf> accessed 16 July 2023.

[80] Brennholt (n 28).

[81] Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention) of 22 March 1989, in force 5 May 1992; 1673 UNTS 126. See also Raubenheimer (n 51).

[82] Even when a transboundary movement is not prohibited, it may take place only if it represents an environmentally sound solution, if the principles of environmentally sound management and non-discrimination are observed and if it is carried out in accordance with the provisions under the Basel Convention. See, <http://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx> accessed 16 July 2023.

[83] Through the decision BC-14/12, the COP added three new entry groups to the Annexes II, VIII, and IX of the Basel Convention. See, <http://www.basel.int/Implementation/Plasticwaste/PlasticWasteAmendments/FAQs/tabid/8427/Default.aspx> accessed 16 July 2023.

or 'requiring special consideration', respectively.[84] It follows that their trade is now subject to a Prior Informed Consent (PIC) procedure. Another notable achievement is the establishment of the Partnership on Plastic Waste, which brings together key stakeholders and supports them in implementing the relevant rules.[85] According to UNEP, the revisions have positioned the Basel Convention, as the legal instrument offering 'the most comprehensive approach to [marine] plastic pollution'.[86] Interestingly, concerns have already been expressed regarding the amendments' effectiveness, including the need for 'a stronger law enforcement cooperation between customs and environmental protection authorities, both within and between countries'.[87] Moreover, numerous categories of plastic waste continue to be excluded from the scope of the Basel Convention.[88] From our perspective, the most contentious aspect of the Plastic Waste Amendments is the classification of certain types of plastic waste included under entry group B3011 (those 'destined for recycling in an environmentally sound manner (ESM)' and 'almost free from contamination and other types of wastes') as 'waste presumed to be not hazardous'.[89] The omission of such a broad category from the application of strict rules under the Basel Convention risks leading to plastic waste mismanagement. Furthermore, if the conditions for this entry group, such as 'environmentally sound manner recycling' and 'almost

[84] Respectively, new entry group A3210 and Y48.

[85] Through decision BC-14/13, the COP decided to establish the Partnership and its working group, adopted the terms of reference for the Partnership, and requested the working group to implement its workplan for the biennium 2020–2021. See, <http://www.basel.int/Implementation/Plasticwaste/PlasticWastePartnership/tabid/8096/Default.aspx> accessed 16 July 2023. See also, 'The United Nations Basel Convention's Global Plastic Waste Partnership: History, Evolution and Progress'.

[86] UNEP (n 17).

[87] Sabaa Ahmad Khan, 'Clearly Hazardous, Obscurely Regulated: Lessons from the Basel Convention on Waste Trade' (2020) 114 Cambridge University Press Scholarly Journal < DOI:10.1017/aju.2020.38> accessed 16 July 2023.

[88] Ibid.

[89] In Annex IX, waste presumed to not be hazardous is listed. As such, it is not subject to the PIC procedure. See, < http://www.basel.int/Implementation/Plasticwaste/PlasticWasteAmendments/FAQs/tabid/8427/Default.aspx> accessed 16 July 2023.

free from contamination', are not adequately defined, they can introduce a higher level of uncertainty for waste operators. Despite the important progress made in recent years, there is still room for improvement in the current legal framework.[90]

Against this backdrop, the contribution of the new plastic treaty to plastic waste management could be fundamental. Numerous barriers to effective action have been identified by experts: for instance, the variety of waste types, including e-waste,[91] down-cycling, the exclusion of informal waste pickers from decision-making processes, and the lack of adequate infrastructure in many locations worldwide.[92] As plastic production is expected to grow further in the coming years, waste management may face additional obstacles concerning governance, stakeholder engagements, financing, and technology.[93] A promising approach could consist in the adoption, implementation, and enforcement of international rules based on the waste hierarchy principles.[94] A mechanism providing technical and financial support to Member States should also be established. This

[90] For instance, in the attempt to encourage the implementation of the Basel Convention, as amended, the COP14 asked for updating the Technical Guidelines on the Environmentally Sound Management of Plastic Waste, through decision BC-14/13.

[91] See e.g. Sabaa Ahmad Khan, 'E-products, E-waste and the Basel Convention: Regulatory Challenges and Impossibilities of International Environmental Law' 25 Review of European, Comparative and International Environmental Law 2. Veena Sahajwalla and Vaibhav Gaikwad, 'The Present and Future of E-waste Plastics Recycling' (2018) 13 Current Opinion in Green and Sustainable Chemistry https://doi.org/10.1016/j.cogsc.2018.06.006 accessed 16 July 2023.

[92] Mari Williams et al., 'No Time to Waste: Tackling the Plastic Pollution Crisis Before It's Too Late' (2019), Teddington: Tearfund.

[93] Ibid. See e.g. Oliver Drzyzga and Auxiliadora Prieto, 'Plastic Waste Management, a Matter for the 'Community'' (2019) 12 Microbial biotechnology 66. Duo Pan et al., 'Research Progress for Plastic Waste Management and Manufacture of Value-Added Products' (2020) 3 Advanced Composites and Hybrid Materials 443.

[94] Raubenheimer (n 62).

mechanism should aim to enhance domestic waste treatment systems while considering local circumstances.[95]

VI. Plastic Pollution and Environmental Protection

Considering the severe impact of plastic pollution on the environment, the relevance and applicability of environmental law also need to be investigated. At the international level, at the time of writing, there is no dedicated binding instrument specifically aimed at protecting ecosystems from plastic pollution. However, such pollution tends to fall under the more general definition of 'pollution' provided by numerous environmental treaties. When plastic pollution affects an ecosystem or its components covered by an international agreement, state authorities already possess enforceable legal tools. Nevertheless, the 'indirect' coverage provided by the environmental treaties discussed in this paragraph has several implications. Firstly, any ecosystem falling outside the scope of existing legal instruments will receive no consideration, despite being potentially exposed to plastic pollution. Secondly, the implementation of preventive measures against plastic pollution can become challenging. Thus, the existing legal instruments appear inadequate, and the effectiveness of international environmental law is under scrutiny as it is currently structured.[96]

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[95] Under the Basel Convention, a soft-law mechanism (the Household Waste Partnership), was established in 2017 to provide technical assistance worldwide, supporting all countries to benefit from already available solutions for environmentally sound management, including issues such as separation at source, collection, transport, storage, recycling, energy recovery and final disposal <http://www.basel.int/Default.aspx?tabid=7994> accessed 16 July 2023.

[96] See e.g. Edith Brown Weiss, 'International Environmental Law: Contemporary Issues and the Emergence of a New World Order' (1993) 81 The Georgetown Law Journal 675 <https://core.ac.uk/download/pdf/70375508.pdf> accessed 16 July 2023. John K. Setear, 'Learning to Live with Losing: International Environmental Law in the New Millennium' (2001) 20 Virginia Environmental Law Journal 1. Martin Jänicke and Helge Jörgens, 'New Approaches to Environmental Governance' in Arthur P.J. Mol, David A. Sonnenfeld, Gert

In adopting a plastics treaty, the main tasks for the international community will likely be to (i) ensure the implementation and enforcement of existing environmental regulations; (ii) enhance coverage of land-based sources of plastic pollution within existing regimes; and (iii) improve the coordination of newly adopted rules with those already in place. Simultaneously, there is space for binding measures that address *primary* microplastic pollution in the environment.[97] Before shifting our attention to the international protection of freshwater and marine ecosystems, it is important to mention another treaty relevant to plastic pollution: the Convention on Biological Diversity (or 'CBD').[98] The Convention itself establishes that 'States have, in accordance with the Charter of the United Nations and the principles of international law, […] the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction'.[99] This provision could apply to plastic pollution where it is demonstrated that the consequences of plastic debris, especially on aquatic environments, pose a

Spaargaren (eds.) The Ecological Modernisation Reader: Environmental Reform in Theory and Practice (Routledge, 2009).

97 The occurrence of primary microplastics would not decrease as a direct effect of a reduction in macroplastic flows, as is the case for secondary microplastics. To date, relevant measures have been enacted only in domestic jurisdictions. See e.g. Michaela Young, 'Then and Now: Reappraising Freedom of the Seas in Modern Law of the Sea' (2016) 47 Ocean Development and International Law 165. Joanna Vince and Britta D. Hardesty, 'Governance Solutions to the Tragedy of the Commons That Marine Plastics Have Become' (2018) Frontiers in Marine Science <https://doi.org/10.3389/fmars.2018.00214> accessed 16 July 2023.

98 Convention on Biological Diversity of 22 May 1992, in force 29 December 1993; 1760 UNTS 79, 31 ILM 818 (1992).

99 Article 3 of the Convention on Biological Diversity: 'States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction'.

threat to biodiversity.[100] Moreover, microplastics are specifically mentioned in the Annex 'Voluntary Practical Guidance on Preventing and Mitigating the Impacts of Marine Debris on Marine and Coastal Biodiversity and Habitats' to the Resolution CBD/COP/DEC/XIII/10, which addresses the impacts of marine debris and anthropogenic underwater noise on marine and coastal biodiversity.[101] In December 2022, at COP 15, 188 countries adopted a Kunming-Montreal Global Biodiversity Framework, which sets four long-term goals and 23 action-oriented targets to be achieved by 2050 and by 2030, respectively.[102] Target 7, which aims to 'reduce pollution risks and the negative impact of pollution from all sources, to levels that are not harmful to biodiversity and ecosystem functions and services', emphasizes the need to prevent, reduce, and work towards eliminating plastic pollution, among other measures.

1. International Watercourses

Multilateral treaties aimed at preventing, minimizing and controlling pollution in international watercourses were first adopted in the 1960s.[103] Over the past decades, some common principles have emerged. The well-established sovereign right of a riverine state to exploit the resources of an international watercourse is generally counterbalanced by the responsibility to ensure that the activities carried out within its territory or under its

[100] Secretariat of the Convention on Biological Diversity, CBD Technical Series No. 83, 'Marine Debris: Understanding, Preventing and Mitigating the Significant Adverse Impacts on Marine and Coastal Biodiversity'.

[101] Member States have been asked to 'assess whether different sources of microplastics and different products and processes that include both primary and secondary microplastics are covered by legislation, and strengthen, as appropriate, the existing legal framework […]' < https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-10-en.pdf> accessed 16 July 2023.

[102] CBD/COP/15/L.25, Conference of the Parties to the Convention on Biological Diversity, Kunming-Montreal Global biodiversity framework Draft decision submitted by the President. 18.12.2022.

[103] Laurence Boisson de Chazournes, 'Fresh Water in International Law' (2013), Oxford University Press, p. 118-9.

jurisdiction do not harm the environment of other states or territories beyond national jurisdiction.[104] Furthermore, an environmental impact assessment must be undertaken before proceeding with any activity that could adversely impact the environment of another country.[105]

More recently, international watercourses law has been strengthened by the adoption of two agreements with a universal vocation: the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses (also called 'Watercourses Convention')[106], and the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (also known as 'Water Convention').[107] Both of them are theoretically applicable to plastic pollution. In Part IV of the Watercourses Convention, pollution in international watercourses is targeted and defined as 'any detrimental alteration in the composition or quality of the waters of international watercourses which results directly and indirectly from human

[104] U.N. Doc. A/Conf.48/14/Rev.1(1973), Declaration of the United Nations Conference on the Human Environment of 16 June 1972 (Stockholm Declaration); 11 ILM 1416 (1972). Principle 2 of the Rio Declaration: 'States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction'. Principle 21 of the Stockholm Declaration: 'States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction'.

[105] This was also confirmed by the ruling of the International Court of Justice (ICJ). See, Pulp Mills on the River Uruguay case (Argentina v. Uruguay) paras. 204-5, pp. 351-5. See also Costa Rica v. Nicaragua cases, para. 104.

[106] Convention on the Law of the Non-Navigational Uses of International Watercourses of 21 May 1997, in force 17 August 2014; UNTS 2999.

[107] Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki Convention) of 17 March 1992, in force 6 October 1996; UNTS 1936 (1992); ILM 1312 (1992).

conduct'.[108] The Convention provides that States 'shall, individually and, where appropriate, jointly, prevent, reduce and control the pollution of an international watercourse that may cause *significant harm* to another watercourse States or their environment'.[109] Whenever plastic pollution occurs in rivers, it appears to fulfil the criteria in Art. 21(1) of the Watercourses Convention. However, it could be argued that the risks posed by plastics are still subject to debate within the scientific community, making it difficult to establish the requirement of "significant harm" under this provision.[110] Nonetheless, the obligation under Article 20, requiring watercourse States to '[…] individually and, where appropriate, jointly, protect and preserve the ecosystems of international watercourses', remains applicable.[111] This provision represents an important advancement as it calls on riparian States to protect riverine ecosystems, including through international cooperation, and not only based on a mere prohibition of transboundary harm.[112] An ecosystem approach is also incorporated in Article 23 which addresses the 'Protection and Preservation of the Marine

[108] Art. 21(1) of UNWC: 'For the purpose of this article, "pollution of an international watercourse" means any detrimental alteration in the composition or quality of the waters of an international watercourse which results directly or indirectly from human conduct'.

[109] Art. 21(2) of UNWC: 'Watercourse States shall, individually and, where appropriate, jointly, prevent, reduce and control the pollution of an international watercourse that may cause significant harm to other watercourse States or to their environment, including harm to human health or safety, to the use of the waters for any beneficial purpose or to the living resources of the watercourse. Watercourse States shall take steps to harmonize their policies in this connection' (emphasis added).

[110] Boisson de Chazournes (n 103), p. 120.

[111] Art. 20 of the Watercourses Convention: 'Watercourse States shall, individually and, where appropriate, jointly, protect and preserve the ecosystems of international watercourses'.

[112] ILC Commentary to the Draft Articles, ILC, Report of the International Law Commission on the Work of its Forty-Sixth Session, II(2) Yearbook of the International Law Commission (1994), p. 124.

Environment' and formally recognizes the role of international watercourses in preventing pollution at sea.[113]

The obligations under the Water Convention seem even more promising when referring to global plastics governance. In the Preamble, it is recognized that national and international measures are necessary to 'prevent, control and reduce the release of hazardous substances into the aquatic environment […], as well as pollution of the marine environment, in particular coastal areas, *from land-based sources* (emphasis added)'. In line with this objective, riparian states are required to cooperate in protecting transboundary waters and other geographic areas influenced by such waters, including the marine environment.[114] Additionally, Article 3 on 'Prevention, Control and Reduction' promotes the application of the ecosystem approach as a key strategy for sustainable management of aquatic natural resources.[115] Although the Water Convention focuses on the protection of transboundary rivers and international lakes, it acknowledges the significant role played by land-based human activities, which are crucial in the context of plastic pollution. As a result, this treaty can potentially provide broader protection

[113] Art. 23 of the Watercourses Convention: 'Watercourses States shall, individually and, where appropriate, in cooperation with other States, take all measures with respect to an international watercourse that are necessary to protect and preserve the marine environment, including estuaries, taking into account generally accepted international rules and standards'.

[114] Art. 2(6) of Water Convention: 'The Riparian Parties shall cooperate on the basis of equality and reciprocity, in particular through bilateral and multilateral agreements, in order to develop harmonized policies, programmes and strategies covering the relevant catchment areas, or parts thereof, aimed at the prevention, control and reduction of transboundary impact and aimed at the protection of the environment of transboundary waters or the environment influenced by such waters, including the marine environment'.

[115] Art. 3(1) of Water Convention: 'To prevent, control and reduce transboundary impact, the Parties shall develop, adopt, implement and, as far as possible, render compatible relevant legal, administrative, economic, financial and technical measures, in order to ensure, *inter alia*, that: (i) Sustainable water-resources management, including the application of the escosystems approach, is promoted'.

compared to the Watercourses Convention.[116] However, adopting bi- and multilateral agreements remains essential for effectively implementing the provisions of the Water Convention.[117]

2. The Marine Environment

Similar to international watercourses law, the law of the sea is well-suited to cover plastic pollution. The United Nations Convention on the Law of the Sea (or 'UNCLOS') often referred to as the 'constitution of the seas'[118], includes provisions that pertain to the pollution of the marine environment. In Article 1(4) of UNCLOS, the term 'pollution of the marine environment' is defined as follows:

> 'the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which result or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, a hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of seawater and reduction of amenities'.[119]

By mentioning estuaries, this provision makes explicit the interconnection of freshwater and marine environments. In broader terms, UNCLOS is the only international treaty with an obligation broad enough to cover all

[116] Boisson de Chazournes (n 103), p. 33. According to the author, this could depend on the fact that for the UNECE Water Convention 'the number of negotiating parties was smaller, and that the issues of water management at stake in the UNECE region concern mainly the protection of water quality and of related ecosystems'.

[117] Linda Finska and Julie Gjørtz Howden, 'Troubled waters – Where is the bridge? Confronting marine plastic pollution from international watercourses' (2018) 27 Review of European, Comparative & International Environmental Law 3 https://doi.org/10.1111/reel.12257 accessed 16 July 2023.

[118] United Nations, 'Ocean: the Sources of Life, UNCLOS 20th Anniversary (1982 – 2002)' <https://www.un.org/depts/los/convention_agreements/convention_20years.htm> accessed 16 July 2023.

[119] United Nations Convention on the Law of the Sea (UNCLOS) (Montego Bay) of 10 December 1982, in force 14 November 1994; 1833 UNTS 3.

sources of marine pollution.[120] Arguably, this regime also has its limitations. Given that it does not provide any technical rules,[121] each member state must adopt domestic rules to clarify the content of its *due diligence* obligations, which may lead to discrepancies from country to country.[122] Furthermore, in case of non-compliance by a state Party, other states have limited capacity to claim a violation, although the treaty does have a refined compliance mechanism at the International Tribunal of the Law of the Sea.[123]

The 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (also known as the 'London Convention'),[124] uses similar wording as in UNCLOS to address pollution, focusing however more on the effects rather than the reasons behind pollution.[125] The London Convention and its Protocol prohibit dumping

[120] Art. 194(1) UNCLOS: 'States shall take, individually or jointly as appropriate, all measures consistent with this Convention that are necessary to prevent, reduce and control pollution of the marine environment *from any source* (emphasis), using for this purpose the best practicable means at their disposal and in accordance with their capabilities, and they shall endeavor to harmonize their policies in this connection'.

[121] Stathis Palassis, 'Marine Pollution and Environmental Law' (2011) Federation Press.

[122] As it is structured, the treaty is difficult to implement as 'the precise measures that States need to take to meet their obligations may be unclear and the time frames in which such obligations are to be met may be equally unclear if not non-existent'. Elizabeth A. Kirk, 'Noncompliance and the Development of Regimes Addressing Marine Pollution from Land-based Sources' (2008) 39 Ocean Development & International Law 235.

[123] Aleke Stöfen-O'Brien, 'The International and European Legal Regime Regulating Marine Litter in the EU' (2015) Vol. 6. Nomos Verlag, p. 104.

[124] Protocol to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Protocol) (London) of 7 November 1996, in force 24 March 2006; 36 ILM 1 (1997).

[125] Art. 1(10) of the Protocol: '"Pollution" means the introduction, directly or indirectly, by human activity, of wastes or other matter into the sea which results or is likely to result in such deleterious effects as harm to living resources and marine ecosystems, hazards to human health, hindrance to marine activities, including fishing and other legitimates uses of the sea, impairment of quality for use of sea water and reduction of amenities'.

any type of waste at sea, including plastics. However, in the context of plastic pollution, the focus on marine pollution from vessels, aircraft, platforms, and other man-made structures at sea is necessary but insufficient, since plastic pollution mainly originates from land-based sources.[126]

The 1973 International Convention for the Prevention of Pollution from Ships, as modified by the Protocol of 1997 (or 'MARPOL') establishes the link between 'the introduction of anthropogenic materials at sea and their environmental impact in its definition of 'harmful substance'.[127] MARPOL represents a crucial legal regime: indeed, Annex V, as revised and entered into force in 2018, prohibits the discharge of certain types of garbage from ships, including 'all plastics'.[128] Over 150 countries have signed the amendment to Annex V so far. Unfortunately, the application of MARPOL is restricted to vessel-based pollution. Furthermore, how to ensure state compliance with MARPOL and the London Convention is still unclear. Given the attention paid to both potential ('likely to result') and already-occurred deleterious effects of pollution, UNCLOS, MARPOL, and the London Convention all adopt a preventive approach. At the same time, they also tend to focus almost exclusively on the marine environment. In our view, it is essential for international decision-makers to place greater emphasis on addressing plastic pollution originating from land-based sources. Possibly, the effectiveness of the aforementioned legal tools against plastic pollution would increase if they all explicitly included plastic waste

[126] The hoped-for reduction of dumping at sea would put further pressure on waste management systems. Stöfen-O'Brien (n 122), p. 153.

[127] Protocol relating to the 1973 International Convention for the Prevention of Pollution from Ships (London Protocol) (London) of 17 February 1978, in force 2 October 1983; 340 UNTS 184. Art. 2(2) of MARPOL: 'Harmful substance means any substance which, if introduced into the sea, is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea, and includes any substance subject to control by the present Convention'.

[128] Resolution MEPC.201(62), Amendments to the Annex of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973, Revised MARPOL Annex V, 15.07.2011.

management within their scope of application. The adoption of the plastic treaty could be an opportunity to deal with the shortcomings of the current legal framework.

VII. Conclusion

The adoption of the UNEA Resolution in March 2022 has marked a 'historical' change in the understanding of the plastic pollution issue by decision-makers.[129] After a long consensus-building process, the international community is finally committed to the establishment of a new regime addressing 'plastic pollution, in marine and in other environments, […] together with its impacts through a full life-cycle approach'. While it is clear that, as also stated in a recent report by the Nordic Council of Ministers, 'a new agreement for plastics must go beyond simply closing gaps in the current international policy framework',[130] the current international legal framework can still be effective if appropriately amended cover every stage of the plastic life cycle. In our opinion, the international community should design and establish an effective international agreement on plastics while making the best of existing legal tools. These two strategies do not appear to be mutually exclusive. Instead, each one is strategic to address different critical aspects in the production, consumption, and waste management of plastic products as well as in the case of plastic pollution. In this vein, overlaps in the renewed international legal framework can be avoided through the coordination of future rules and principles with those already in force. In addition, the expertise gained through voluntary

[129] The UN-Secretary General António Guterres has defined this document as 'the most important environmental deal after the Paris Agreement'. See, <https://www.firstpost.com/world/un-passes-historic-resolution-to-end-plastic-pollution-what-does-it-mean-why-this-is-a-need-of-the-hour-10430181.html> accessed 16 July 2023.

[130] Raubenheimer (n 62).

measures should also be built upon in terms of awareness-raising, monitoring and reporting.[131]

The twofold approach advocated here can have numerous advantages. While protecting other environmental compartments from plastic pollution is important, the existing international agreements such as UNCLOS, the London Convention, the MARPOL Convention, the Watercourses Convention, and the Water Convention already cover marine and freshwater ecosystems. In this case, implementing and enforcing existing regulations is the main challenge.[132] Looking at the earlier stages of the plastic life cycle, upstream and middle-stream measures in force leave many issues unsolved. The Basel, Stockholm and Rotterdam Conventions ensure some coverage. The first contains rules to control the transboundary movements of plastic waste and ensure environmentally sound waste management in receiving countries. The second and third address the production and use of certain chemicals. Their scope could be expanded to prioritize waste minimization, rather than environmental recovery, on a global scale.

At the same time, the upcoming plastic treaty has the potential to offer a more comprehensive regulation to plastic pollution. It should promote sustainable production and consumption of plastic items, improve waste treatment systems, and encourage effective domestic plastic waste management. Furthermore, the treaty should address environmental protection strategies and the impact of microplastics and other small plastic particles on a wider range of ecosystems. From a broader perspective, the

[131] The authors have mostly focused in this paper on binding instruments of international law. In fact, in the last decades soft-law has played an essential role in building consensus around this issue. See e.g. the 1995 Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, the 2011 Honolulu Strategy and the Global Partnership of Marine Litter, the 2017 G20 Action Plan on Marine Litter.

[132] See e.g. Arie Trouwborst, 'Managing Marine Litter: Exploring the Evolving Role of International and European Law in Confronting a Persistent Environmental Problem' (2011) 27 Utrecht Journal of International and European Law 4.

adoption of a plastic treaty will hopefully offer a solution to existing institutional deficiencies in global plastics governance, such as the lack of internationally agreed targets, a timeline, and mechanisms for monitoring, reporting, and assessing ongoing efforts, especially in the context of relative scientific uncertainty.[133] New provisions at the international level should also be coordinated with regional, national, and local measures.[134]

Discussions regarding the structure and content of a potential plastic treaty are currently underway. At present, an agreement combining mandatory and voluntary elements seems to be the most likely option: state parties would count on some flexibility to achieve the agreed-upon goals, but they would also be accountable in case of non-compliance with minimum requirements.[135] It seems clear that a problem as complex as plastic pollution requires the integration of more than one strategy. As argued here, existing instruments may prove as necessary as the treaty in the making.

[133] For instance, the following authors think that the attention paid to plastic pollution is distracting policy-makers from much more serious issues such as climate change and overfishing. Richard Stafford and Peter J.S. Jones, 'Viewpoint – Ocean Plastic Pollution: A Convenient but Distracting Truth?' (2019) 103 Marine Policy <https://doi.org/10.1016/j.marpol.2019.02.003> accessed 16 July 2023.

[134] Vince (n 12). See also e.g. João Pinto da Costa (n 27). Although looking at the other levels of governance could have been interesting, the authors have decided to focus, in this paper, primarily on international law.

[135] Raubenheimer (n 62). See also Simon (n 24).