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By Nils Simon and Maro Luisa Schulte

Edited by the Heinrich Böll Foundation

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PREFACE

Plastics have boosted our economy because they are highly flexible, durable, and cheap. They are used for food packaging and as shopping bags, for consumer products like toys, clothing and smartphones, as well as for car parts, medical appliances and many other things. Plastics have become a key material within all economies, and we can hardly imagine a world without them anymore. However, their massive use has also created an enormous global problem with environmental, economic, social, and health repercussions that needs to be tackled much more decisively.

Too much plastic waste that goes uncollected domestically eventually flows into the ocean. There it breaks down into ever smaller pieces, and these microplastic particles can now be found in every larger water body including remote mountain lakes, rivers, and even in polar ice and deep sea sediments. It is ingested by fish and enters the food chain, so we shouldn't be surprised when one day we end up eating our own plastic trash.

Existing international measures to deal with plastic pollution are insufficient to successfully address the problem. Neither legal provisions banning the dumping of plastic waste at sea, nor voluntary action plans or multi-stakeholder partnerships working on waste management or marine litter have been adequate to reduce the amount of plastic waste that reaches the marine environment.

Without large-scale efforts targeting plastic waste at its land-based sources, the problem will get worse. Plastic production is expected to grow massively in the coming decades. The only viable solution to the problem would therefore be to stop plastic waste from entering the oceans in the first place. Especially when considering that more than 80% of the plastic marine debris is estimated to stem from land-based sources, it becomes apparent that it is these sources which we must tackle most decisively.

What Nils Simon and Maro Luisa Schulte propose in this paper would be a bold step forward: Negotiating a global convention that tackles plastic pollution where it originates, fosters innovation for more sustainable plastics, and supports countries in enhancing their domestic waste collection and recycling systems. It is the necessary next step and should have priority, rather than focusing on the Sisyphean task of cleaning up entire oceans while millions of tons of plastic waste keep streaming into them. A plastics convention is not assumed to replace all other existing efforts, but to complement them: To establish a legally binding roof on top of the many strategies, action plans, and partnerships out there.

The form of a treaty will need to reflect both great ambition and political feasibility. At first sight a more traditional top-down structure seems a promising way to ensure compliance and effectiveness compared to more flexible bottom-up

approaches, which may offer significant loopholes to non-complying parties. However, experiences from other multilateral environmental agreements have taught us that this is not necessarily the case. Instead, it will be important to create ownership and to engage all stakeholders in the endeavour to establish another convention. As with the Paris agreement – whose efficiency remains yet to be tested – the convention model suggested here builds more on flexible mechanisms under a firm goal to ensure agreeability between and finally compliance of parties.

The international community must step up its game and act much more decisively on global plastic pollution. The plastics industry achieves annual revenues of US$ 750 billion. It can't be too costly to take a small share of that money and use it to clean up the mess we ourselves have created. When you manufacture and sell a product, you ought to be responsible for what happens with it afterwards. When it is designed in a way that it will take centuries to dissolve, the design is flawed. The plastic that is already floating around in the ocean and the many millions of tons that are going to join it over the next years will remain there for centuries. It is time to launch negotiations on a plastics convention and begin to end this irresponsible disaster.

Berlin, March 2017

Barbara Unmüßig
Co-President, Heinrich Böll Foundation

Alexander Carius
Managing Director, adelphi

ABSTRACT

Global plastic production is continuously increasing and reached 322 million tonnes in 2015, generating revenues for plastic manufacturers of about US$ 750 billion. However, adequate waste collection systems are lacking in many countries. As a consequence, discarded plastic often ends up in the environment, where it can cause health and other problems. Every year between 4.8 and 12.7 million tonnes of plastic end up in the ocean. There, it endangers sea life, breaks down into ever smaller pieces and can wind up in the food chain with unknown consequences. These plastic pieces spread across the globe, creating a transnational problem with high costs for economically important sectors such as tourism and fishing. Although public awareness of the problem has grown in recent years, international efforts to limit plastic pollution have so far failed to successfully address the problem. Most approaches have concentrated on the oceans, although the majority of plastic waste does not originate there, whereas a legally binding international treaty that deals with hazardous waste on land, the Basel Convention, is hardly applicable to plastic waste.

To fill this gap and to address the transnational problem of plastic pollution, we propose to commence negotiations on a global plastics convention. Such a convention should be built on five pillars. First, a clear and binding goal is needed to eliminate plastic waste discharge into the ocean as a top-down mechanism. Second, each country should propose, in a bottom-up manner, an action plan containing specific measures based on a toolbox. Third, implementation of these action plans should be fostered by a supporting structure and other capacity development measures, including a financing mechanism. Fourth, the success of this framework will need to be assessed through a stringent follow-up and review mechanism. Fifth, the involvement of non-governmental stakeholders from civil society, business, and academia is vital both for launching negotiations on such a convention and for making it an effective instrument for curbing plastic pollution.

A coalition of stakeholders could take up the call and begin campaigning for a global plastics convention, negotiations on which could be launched by the UN Environment Assembly or the UN General Assembly. In addition, existing frameworks could be strengthened to further prevent marine dumping and other sources of plastic pollution at sea. Although the international community currently tends to prefer voluntary measures to legally binding treaties, the plastic pollution problem is global, costly, and will keep growing. This represents a strong case for overcoming the treaty fatigue in global politics and writing a new chapter in international environmental governance.

ZUSAMMENFASSUNG

Die Produktion von Plastik ist in den vergangenen Jahren weltweit kontinuierlich gestiegen. Im Jahr 2015 stellte die Kunststoffindustrie 322 Millionen Tonnen Kunststoffe her, wodurch sie 750 Milliarden US-Dollar erwirtschaftete. In vielen Ländern fehlt es jedoch an adäquaten Systemen zur Abfallentsorgung, was dazu führt, dass Plastik häufig in der Umwelt landet und dort zu Gesundheitsschäden und anderen Problemen führt. Pro Jahr geraten zwischen 4,8 und 12,7 Millionen Tonnen Plastik in die Weltmeere. Einmal dort angekommen, zerfällt es in immer kleinere Teile, die nicht nur Meeresbewohner gefährden, sondern auch die Nahrungskette «hinaufwandern». Die daraus resultierenden Schäden für Mensch und Umwelt sind bislang kaum abzusehen. Darüber hinaus wird der Plastikmüll mit den Meeresströmungen weltweit verbreitet. Dadurch ist ein transnationales Problem entstanden, das erhebliche ökonomische Schäden in wichtigen Wirtschaftssektoren wie der Fischerei und dem Tourismus verursacht. Obwohl die öffentliche Aufmerksamkeit für das Problem in den vergangenen Jahren gestiegen ist, konnten internationale Ansätze zur Einschränkung von Verschmutzungen der Umwelt durch Plastik bislang kaum nennenswerte Erfolge erzielen. Die meisten dieser Ansätze konzentrierten sich bislang auf die Ozeane, obwohl das Gros des Plastikmülls nicht von dort stammt. Das Basler Übereinkommen wiederum und damit der einzige rechtlich verbindliche internationale Vertrag, der sich mit gefährlichen Abfällen an Land beschäftigt, ist nicht auf Plastikabfälle fokussiert.

Um diese Regulierungslücke zu schließen und dem transnationalen Problem der Verschmutzung durch Plastik entgegenzuwirken, sollten Verhandlungen über eine globale Plastik-Konvention angestoßen werden. Eine solche Konvention sollte auf folgenden fünf Säulen fußen: erstens ein klares und verbindliches Ziel als Top-down-Mechanismus, das verhindert, dass Plastikabfälle in die Weltmeere gelangen; zweitens sollte jedes Land als Bottom-up-Mechanismus einen Aktionsplan mit spezifischen Maßnahmen zur Erreichung dieses Ziels vorlegen; drittens sollte die Implementierung dieser Aktionspläne durch eine unterstützende Struktur gefördert werden, die kapazitätsbildende Maßnahmen inklusive eines Finanzierungsmechanismus bereitstellt; viertens kann diese Struktur nur erfolgreich sein, wenn sie von einem stringenten Prozess der Nachbereitung und Bewertung begleitet wird; fünftens ist die Einbeziehung von nichtstaatlichen Akteuren aus der Zivilgesellschaft, der Wirtschaft und der Wissenschaft unabdingbar für das Zustandekommen internationaler Verhandlungen, um damit ein effektives Instrument zur Verminderung der Umweltverschmutzung durch Plastik zu schaffen.

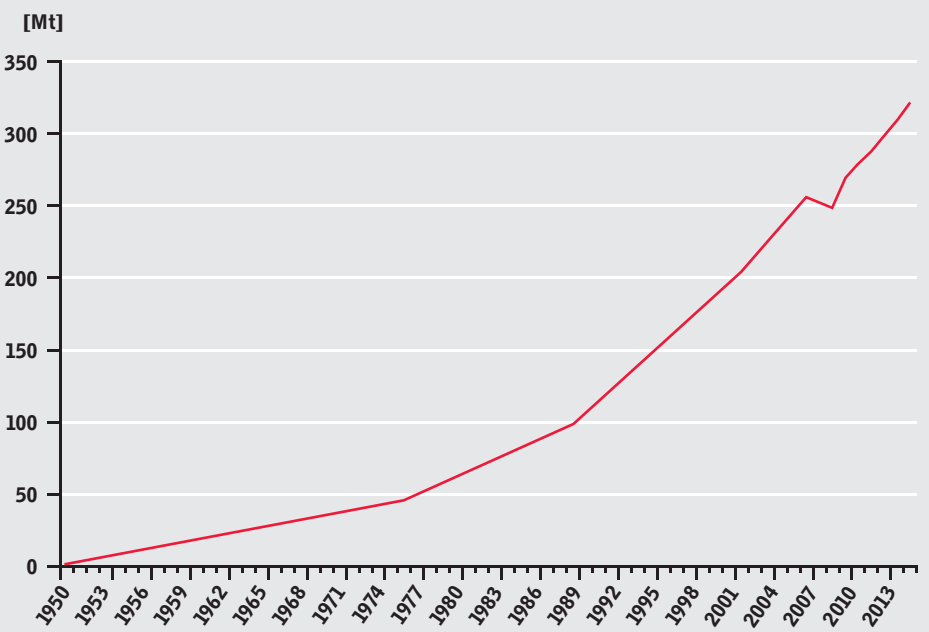
Eine Koalition aus verschiedenen Stakeholdern könnte diesen Appell aufgreifen und eine globale Plastik-Konvention einfordern. Die Verhandlungen hierzu könnten

unter der UN-Umweltversammlung oder der UN-Generalversammlung angestoßen werden. Außerdem könnten bestehende Rahmenwerke zur Verhinderung der Verklappung und anderer Quellen von Plastikverschmutzung gestärkt werden. Entgegen dem Trend der internationalen Gemeinschaft, sich vermehrt auf freiwillige Maßnahmen anstelle von rechtlich verbindlichen Verträgen zu verlassen, erfordert das weltweit verbreitete, wirtschaftlich teure und weiter wachsende Problem der Plastikverschmutzung, dass die momentan bestehende Vertragsmüdigkeit überwunden und ein neues Kapitel in der internationalen Umwelt-Governance geschrieben wird.

1 Introduction

Plastics have boosted our economy because they are highly flexible, durable, and cheap. They are used for plastic bags and water bottles, for toy cars and clothes, smartphones and innumerable other things. They have become an indispensable material within the global economy; 322 million tonnes of plastic were produced in 2015 alone (Plastics Europe 2016). Yet, in establishing an industry with annual revenues over US$ 750 billion (First Research 2016), chemical manufacturers have also created a massive problem with global repercussions.

Fig. 1: Global production volume of plastics from 1950–2015 (in million tonnes)



Source: Plastics Europe 2016 (2013); own graphic chart

Why have measures to curb plastic pollution proven so ineffective? The underlying problem may be that most of them are conceived within an oceans-based frame. There certainly is a strong case to be made for strengthening environmental stipulations in oceans governance, including on plastic waste. Yet the question is whether

any treaty focusing on environmentally harmful behaviour at sea (like waste dumping) could ever successfully address the massive land-based sources of pollution. It has rightly been pointed out that there is a «large gap in international hard law specifically addressing land-based plastic marine pollution.» (Vince and Hardesty 2016: 2) After all, plastic ends up in the oceans, but it does not originate there.

In this paper, we outline how a new multilateral convention dealing with plastics could enhance the global governance on plastic pollution, and how such a convention could be designed. After first introducing the scope of this study, we revisit the challenge of plastic pollution and find that plastic waste is a quickly growing global environmental problem that clearly goes beyond national and regional boundaries, warranting a multilateral approach to solving it. We then analyse existing frameworks dealing with plastic pollution and assess their strengths and weaknesses. We find a fragmented landscape of institutions that covers some aspects of the issue yet leaves the core problem – the amount of plastic waste that is not collected and properly disposed of on land – unresolved. Next, we outline what an improved governance framework would have to entail to be effective by identifying the core elements of a global plastics convention. Finally, we discuss additional steps that could support the launch of negotiations for a plastics convention or that would strengthen existing frameworks and thus complement such a convention within the diversified governance landscape dealing with plastic pollution.

We have screened the literature especially for proposals on how to deal multilaterally with the plastic challenge and have found some insightful sources (e.g. Gold et al. 2013; Ocean Conservancy 2015; Chen 2016). To directly assess the perceptions and ideas of actors working closely with issues of plastic pollution, marine litter, and waste management, we conducted nine semi-structured interviews with stakeholders from international organizations, civil society, academia, and industry. We asked them about their perception of the scale and salience of the problem, what they think about the idea of negotiating a global plastics convention, and what kinds of regulatory elements such a convention would have to entail to be realistic and effective. In addition, we held a larger number of informal discussions with representatives of other bodies, including governments. The names of the interviewees can be found in the Annex, yet their contributions are used anonymously throughout this paper. Most of the people we interviewed agreed that current efforts do not suffice to tackle the problem, and that much broader and more effective solutions are required.

2 The challenge of plastic pollution and the case for a multilateral convention

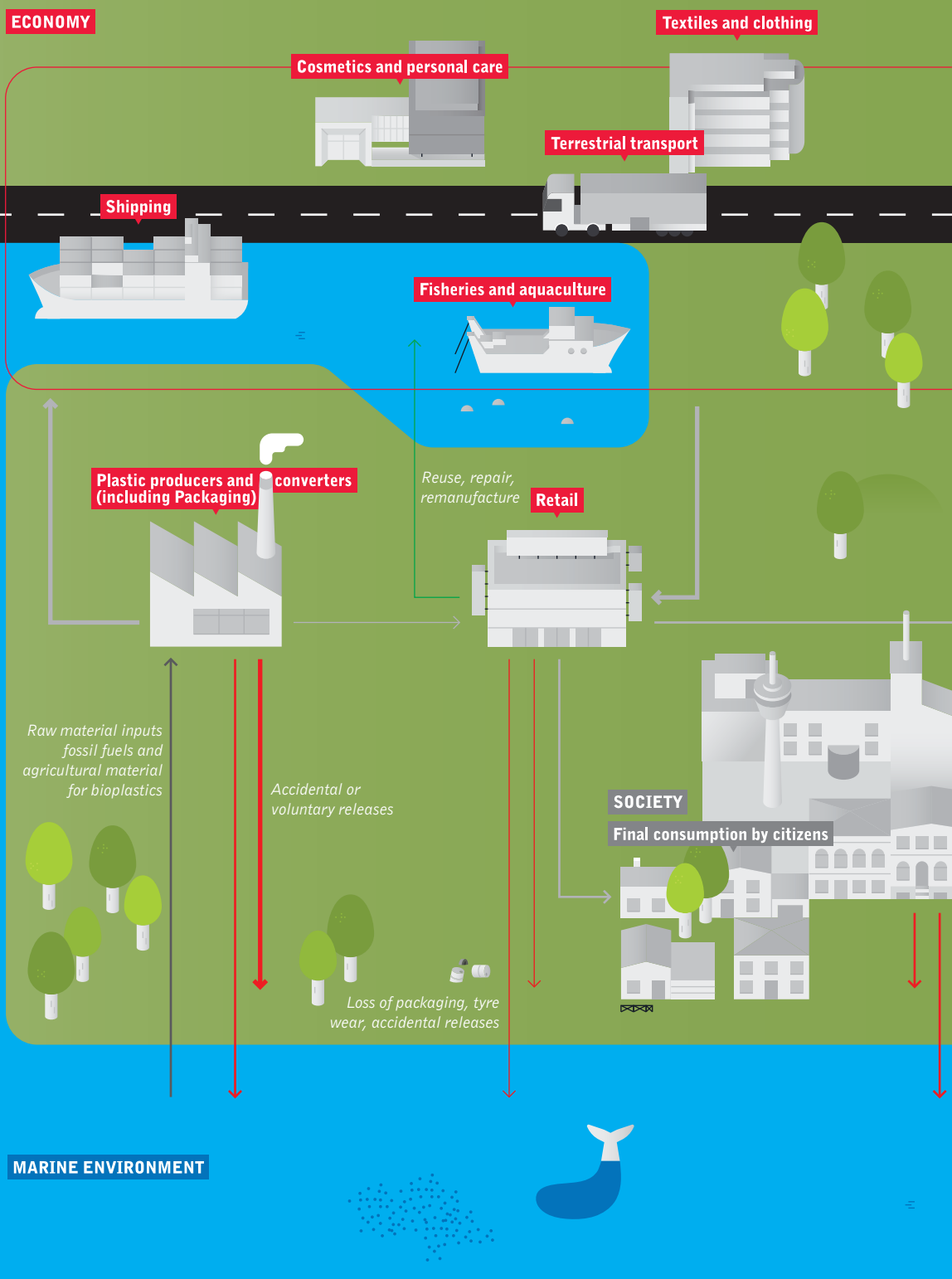
The problem of plastic pollution has received growing awareness over the past few years, and an increasing number of studies reveal the detrimental effects of plastic on our economies, on human health, and on wildlife, especially in the oceans (for an overview see Bergmann, Gutow and Klages 2015). Plastic items like shopping bags or food packaging that are not properly disposed of often end up in rivers or on shores, and then reach the ocean, where they become a global environmental, health, and economic problem. In this chapter, we outline that plastic pollution has become a transnational problem that warrants a multilateral approach, highlight the costs of inaction, which can be especially high for regions relying on tourism and for fishing communities, and critically review possible technological solutions including biodegradable plastics.

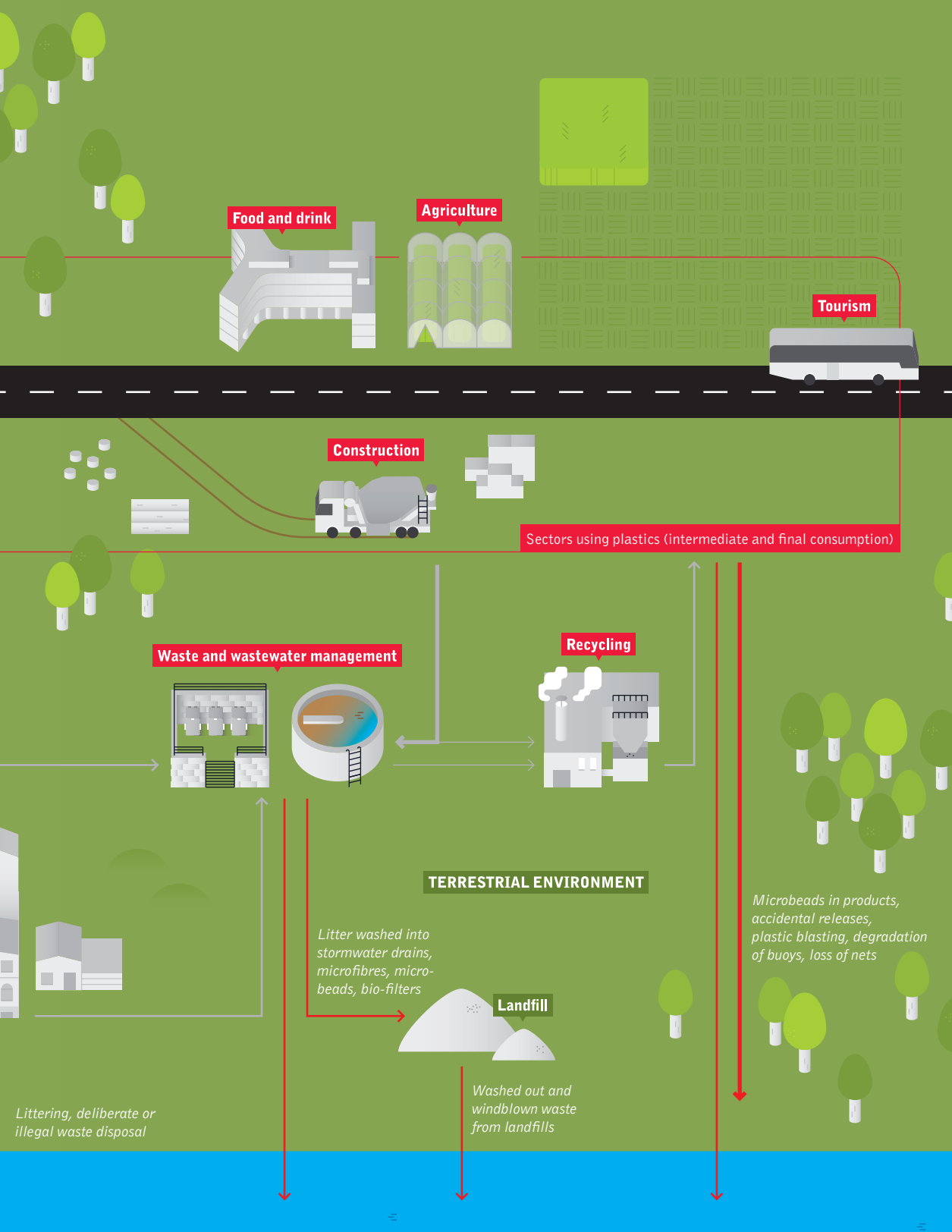
2.1 Sources of plastic pollution

Six basic types of plastic dominate today's markets: Polyethylene (PE, high and low density), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS, and expanded EPS), polyurethane (PUR), and polyethylene terephthalate (PET) (GESAMP 2015: 14). The durability of plastics is simultaneously one of their major advantages and one of their most devastating properties once discarded. As plastic degrades very slowly, the increasing production of these polymers will lead to ever larger amounts of plastic waste in the environment. If untreated, this waste will continue to leak to and accumulate in the world's oceans, where it may take hundreds of years to dissolve. Production of plastics «has increased twentyfold in the past half-century» and «is expected to double again in the next 20 years», according to the Ellen MacArthur Foundation (2016: 17). With the recent growth in the production volume of plastics and in light of projected future increases, it is also obvious that the problem will not solve itself.

Packaging is the world's largest plastics sector, making up about one quarter of overall production. It appears as convenient food-wrappings, milk cartons, shopping bags, and water bottles and is thus largely incorporated into our daily routines. However, the Ellen MacArthur Foundation (2016: 24) estimates that «after a short first-use cycle, 95% of plastic packaging material value, or USD 80–120 billion annually, is lost to the economy.» Treating the plastics problem could thus have immense economic benefits.

Fig. 2: Transmission channels for plastic into the environment





Source: GRID-Arendal and Maphoto/Riccardo Pravettoni, www.grida.no/graphicslib/detail/how-plastic-moves-from-the-economy-to-the-environment_e3d5; own graphic chart

Fig. 3: Plastic waste produced and mismanaged

Coastal population

Million people

- Less than 1
- 1 to 2
- 2 to 10
- 10 to 50
- 50 to 263
- Land locked country

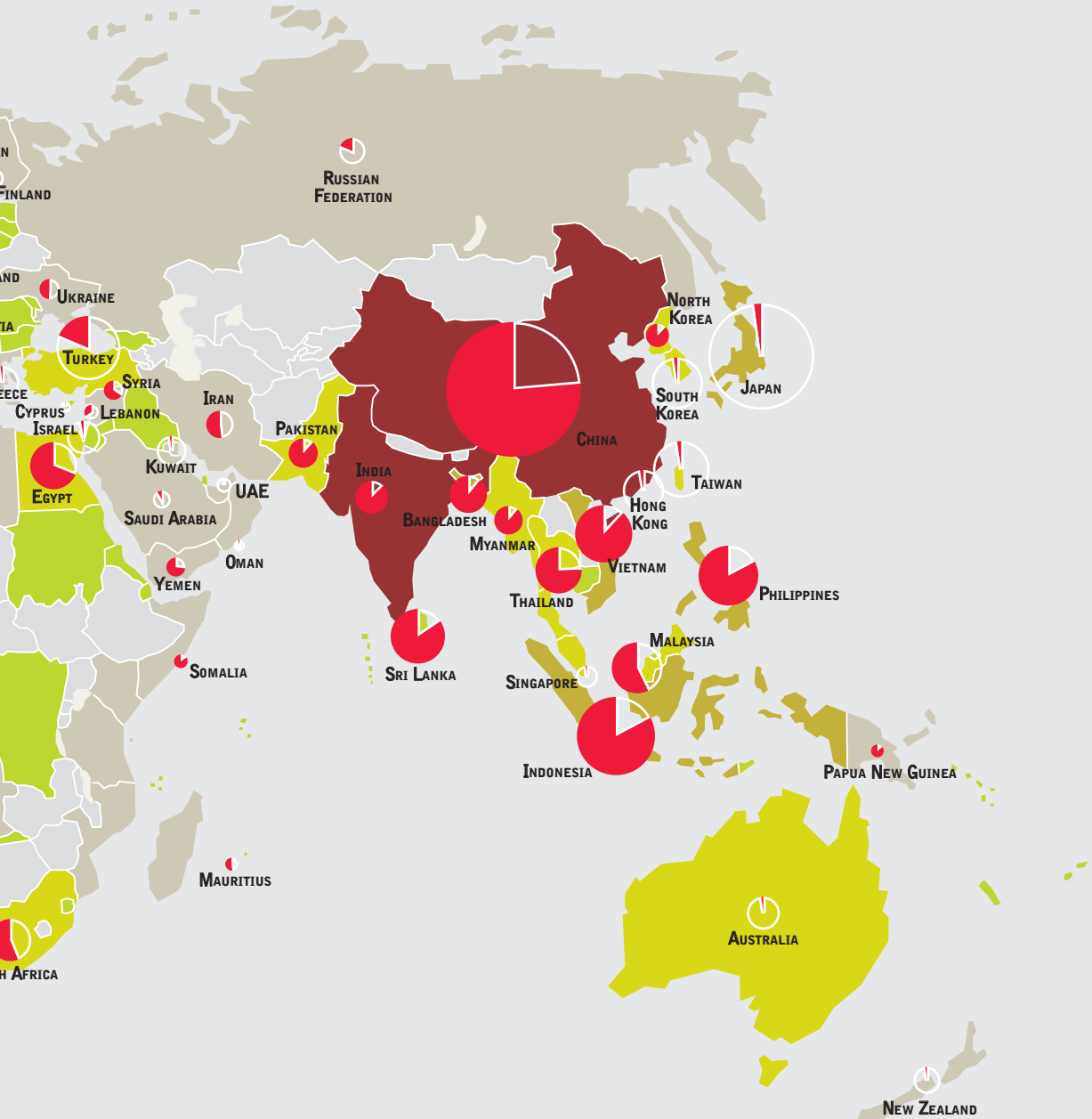
Plastic waste production

Thousand tonnes per day (2010)

37
10
1
0,2

Total plastic waste produced

Portion of plastic waste mismanaged



Source: Jambeck, et al., Plastic waste inputs from land into the ocean, Science, 2015; Neumann, et. al., Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding – A Global Assessment. PLoS ONE (2015), www.grida.no/graphicslib/detail/how-plastic-moves-from-the-economy-to-the-environment_e3d5; own graphic chart

This is especially relevant for the many developing countries where collection systems are either very porous or hardly existent (Goleman 2011).

It has been known for many years that plastic pollution is an increasingly urgent problem and of global concern (Derraik 2002). In fact, in the early 1970s, there were already thousands of pieces of plastics per square kilometre found in the Sargasso Sea in the North Atlantic (Carpenter and Smith 1972). Similarly, more than 40 years ago, plastic particles were already abundantly found in coastal waters, and it was known that aquatic species feed on them (Carpenter et al. 1972).

There are various pathways plastic pollution takes to reach the ocean, as Figure 2 shows. Small particles find their way into waterways in the form of microbeads found in facial scrubs and other cosmetic products, or as polymer fibres used in clothing. Other entry sources include industrial processing sites and spills from ships (for an overview of sources and pathways, see Browne 2015).

It was estimated that in 2010, between 4.8 and 12.7 million tonnes of plastic were streaming into the sea, and the authors calculated that without large-scale improvements to waste management systems, this number might increase tenfold by 2025 (Jambeck et al. 2015). In such a business-as-usual scenario, there would be 1kg of plastics for every 3kg of fish in the oceans by 2025, and even more plastic than fish mass by 2050 (Ellen MacArthur Foundation 2015: 17).

More than half of all plastic is produced in Asia, where the development of sufficient infrastructure for waste collection and treatment lag far behind recent rapid economic development (Ellen MacArthur Foundation 2016: 33). It does not come as much of a surprise, then, that up to 60% of the plastic waste reaching the ocean is attributed to five Asian countries, namely, China, Indonesia, the Philippines, Thailand, and Vietnam (Ocean Conservancy 2015: 3). Figure 3 shows the amount of plastic produced in key economies, and the percentage of mismanaged waste in these countries.

2.2 A transnational problem that gets bigger the smaller it becomes

UN Environment (UNEP) has published several reports on the environmental impact of plastics and dealt with microplastics and marine litter at both the first and the second sessions of the UN Environment Assembly (UNEA) in 2014 and 2016, with resolution 2/11 from UNEA-2 recognizing plastic pollution as «a rapidly increasing serious issue of global concern that needs an urgent global response.»

There is no lack of images illustrating the enormous impact of plastic pollution: Rivers filled with plastic garbage. Beaches soiled with plastic bottles. Pieces of plastic floating around in the ocean and accumulating in giant garbage patches. Images of dead seals entangled in plastic pieces, of deceased birds and even whales have added to the rise in public awareness (GESAMP 2015: 54–60). Ingestion of and entanglement in the larger pieces of plastic waste is a major threat for marine wildlife, which can suffer internal injuries or even starve to death when their stomachs are filled with plastics (Gregory 2009). Almost 800 species are now known to be affected by marine debris, much of which is plastic (CBD 2016).

Plastic has been found in the most remote areas, including Arctic ice and pristine mountain lakes, and in every zone of the water column in every single one of the world's oceans (Imhof et al. 2013). Larger pieces photodegrade into ever-smaller pieces and these microplastic particles can now be found in all major rivers and oceans, and even in deep-sea sediments (UNEP 2016a). Indeed, microplastic pollution in some sediments was found to be up to four times as high than in surface waters (UNEP/CBD/SBSTTA 2016). Plastics may therefore be the only problem that gets even bigger the smaller it becomes.

Plastic comes in innumerable forms and often contains various additives like colouring or softeners. Many varieties of plastics are therefore not only problematic because of their physical, but also their chemical properties (GESAMP 2015: 45–53). On the one hand, the process of breaking plastics down into microplastics releases sometimes toxic additives into the marine environment. On the other hand, these microplastics can absorb toxic chemicals such as persistent organic pollutants. Through ingestion by fish, hazardous chemical additives can find a pathway into human bodies (Galloway 2015; Rochman et al. 2013; Rochman 2016; UNEP/CBD/SBSTTA 2016). One such additive is bisphenol A (BPA), a chemical with estrogenic activity that is known to cause disruptions e.g. in the reproductive capacity of mammals and which has been found even in products that were labelled «BPA-free» (Yang et al. 2011). Furthermore, plastic particles can even serve as vectors for invasive species that may adversely affect their new habitats (UNEP/CBD/SBSTTA 2016; see also: Sigler 2014).

The omnipresence of plastic waste and its impact on wildlife and humans has been further popularized by documentary movies such as Plastic Planet, Plasticized, Bag It, The Plastic Age, Midway, and A Plastic Ocean. Though public attention to the problem is on the rise, plastic pollution keeps growing and causes considerable costs.

2.3 Costs of inaction and the benefits of addressing plastic waste

Plastic pollution has considerable environmental, social, and economic impacts. Within national boundaries, and especially in urban areas, plastic bags and bottles can clog sewers and other drainage systems and increase the risk of flooding during heavy rainfall. Plastic items lying in streets or on fields can contain water and become a breeding ground for mosquitoes, causing health problems by spreading malaria, Zika, or other diseases. Plastics may leach chemicals into the soil, contaminating agricultural areas and reaching the groundwater. While these impacts are mostly due to domestic problems with plastic pollution and do not in themselves warrant a global framework, they can serve to highlight the benefits of action and make it more compelling for governments to become active on the issue.

Turning towards the impacts of global plastic pollution, several economic sectors are directly or indirectly affected by marine litter (CBD 2016: 30–32). Sectors connected with food security are agriculture, aquaculture, and fisheries, though all of them are also considered extensive contributors to the problem in the first place.

In general, it has been found that those sectors incurring the greatest economic costs are tourism, fisheries, and shipping (Watkins et al. 2015). One study estimates the damage related to marine debris to US$ 1.26 billion per year for the 21 countries of the Asia-Pacific Economic Cooperation (APEC), with the tourism sector taking the largest share of the costs, at US$ 622 million (McIlgorm et al. 2011). Concerning the shipping sector, it has been estimated that cleaning harbours of marine litter costs UK ports € 2.4 million annually, an estimate that would increase significantly if all harbours would undertake such action (Mouat et al. 2010). Other costs emerge for both the fishing and the shipping sectors caused by damages to vessels or (fishing) gear due to entanglement or other impacts of marine debris (Newman et al. 2015: 273). Mouat et al. (2010) estimated the cost generated from such damage to Scottish fishing vessels to be between € 17,000 and € 19,000 per year and fishing vessel.

While these numbers may serve as an indication, the full economic costs of marine plastic litter are not easily quantified. Ecosystem degradation, for example, includes both the effects of marine litter on biodiversity as well as the impacts marine litter has on the services the ecosystem provides, such as providing food or being a driver of tourism. Furthermore, one needs to differentiate between direct costs (for beach clean-ups or costs generated by health impacts on humans), costs due to a loss of revenue (due to decreased fish populations or fewer tourists visiting polluted beaches), and welfare costs (Newman et al. 2015: 368). Other factors that are not specifically connected to plastic as part of marine debris but nevertheless ought to be included in estimations of negative externalities are the impact of plastics on global climate change through emissions from plastics production and end-of-life incineration instead of reusing or recycling, as well as the chemical impact of plastic additives (Ellen MacArthur Foundation 2016: 28).

2.4 Sustainable plastics? On the role of technological innovation

There is as yet no silver bullet solution for the problem of plastic pollution. Many hopes have been placed on more sustainable plastics, but these seem misplaced or at least exaggerated. First, it is necessary to distinguish between biobased and biodegradable plastics. Biobased plastics, on the one hand, are based to a varying percentage on renewable sources such as corn or other plants that provide starch, cellulose, or protein as base chemicals. Biobased plastics need not be biologically degradable, whereas biodegradable plastics can be based on either fossil or renewable base materials.

Most biodegradable plastics only decompose under conditions in industrial composting facilities with prolonged temperatures above 50°C, or under constant exposure to UV lights, both of which are quite rare in the ocean (Vaughan 2016). Even if plastics biodegraded faster, they would still pose a danger when they are relatively young and close to the shores. Since most marine wildlife resides close to the shores, even degradable plastics will be ingested and cause just as much harm as non-biodegradable plastics. Even biodegradable fishing nets may not solve the problem of «ghost gear», though Wilcox and Hardesty (2016) find they may at least be a

minor contribution to the issue of lost fishing equipment threatening marine life for decades. Likewise, a report published by UNEP reached the conclusion that

> «the adoption of plastic products labelled as ‹biodegradable› will not bring about a significant decrease either in the quantity of plastic entering the ocean or the risk of physical and chemical impacts on the marine environment, on the balance of current scientific evidence.»
>
> (UNEP 2015a: 3)

The production of bioplastics through switching a factory's feedstock from fossil oil to renewable sources is likewise not as sustainable as it may seem. First, the resulting products can be just as environmentally problematic as those based on fossil sources. Furthermore, by switching to biobased raw materials, chemical companies might further increase the already high pressure on soils due to increasing food production and growing demand from the biofuel sector. Although one study found that «biobased chemicals create much less of a concern for land use than concerns associated with bioenergy» (Philp et al. 2013: 220), changing the feedstock of the global plastics industry on a large scale would require further intensification of agricultural production. This would compete with increasing demand from a growing world population, which, to make things worse, has an increasing appetite for land and resource-intensive meat.

Another innovation measure that could be called «downgrading» might also not be as sustainable as it may seem at first. In principle, plastic packaging could be replaced by other materials such as cardboard, glass, or aluminium. Trucost (2016) calculated that switching to such alternatives might lead to steeply increased environmental costs that could be up to four times as high as those inferred by plastics alone, whereas more sustainable plastics might at least be able to reduce those externalities by up to 30%. Further reductions of externalities might be gained by increasing the share of renewable energy used in plastic factories, by developing more efficient packaging designs, and by peripheral solutions such as increasing the fuel efficiency of vehicles used to transport plastics. These would, however, mostly tackle externalities connected with climate change, rather than reducing the impact of plastic waste on people and the environment.

This already shows that technological innovations can certainly be helpful, but the most critical ones are not necessarily to be found in tweaking plastic production processes. One innovation that might instead be worthy of investment is improved waste sorting technologies. These need to become able to better distinguish between different kinds of polymers, thereby offering a cleaner source of recyclable waste plastic for second-life use. In countries with lacking waste collection systems, sustainability improvements will be achieved less through technological innovation, and more through infrastructure improvements such as significantly enhancing waste collection systems and building capacities for recycling plastic waste.

3 Existing frameworks: Taking stock and identifying gaps

Which frameworks are already dealing with plastic pollution? The most encompassing and overarching framework is probably the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs). Both Goal 6 (clean water and sanitation) and Goal 14 (ocean conservation) are partially concerned with the issue of plastics (Stoett 2016: 6).

In this chapter, we examine existing institutions, outline their scope and highlight their limits. We begin with marine-based treaties and voluntary initiatives, as ocean-centred agreements are currently the main area where plastic pollution is being dealt with. Next is the Basel Convention as the main international treaty dealing with hazardous waste, followed by regional and local approaches. Finally, we outline the strengths and weaknesses of existing institutions, thereby making the case for a new convention specifically dealing with land-based sources of plastic pollution.

3.1 Marine-based treaties and voluntary frameworks

The *Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter*, also known as the London Convention of 1972, was the first international agreement on wastes entering the marine environment. It initially allowed some dumping of wastes, until it was amended by the London Protocol which prohibits all dumping. The protocol was agreed upon in 1996, entered into force in 2006 and thus far counts 45 parties. It is much stricter and more far-reaching than its preceding convention. In its so-called «reverse list», it names materials that are exempted from the no-dumping rule. Nevertheless, even the materials listed in the reverse list require permission in line with Annex II of the Convention (Chen 2015). As plastics are not listed in the reverse list, they are de jure prohibited.

The *International Convention for the Prevention of Pollution from Ships* (MARPOL) of 1973 (amended in 1978) is the main international convention to protect the marine environment. Through its Annex V (agreed in 1988), it also bans the disposal of garbage at sea, with a particular focus on all forms of plastics (IMO, 2016). Annex V was last revised in 2011, entering into force in 2013. However, though ships are thereby prohibited from dumping plastic or other wastes into the sea, compliance with the provisions of Annex V remains problematic. Ships of a certain size (≥ 400 GT) are required to record any discharge of waste, either at sea or at reception facilities at ports, in a so-called Garbage Record Book (GRB). The GRB may then

be inspected at ports in states that are party to MARPOL by competent authorities (Chen 2015).

The *United Nations Convention on the Law of the Sea* (UNCLOS) in its current form was established in 1982 and entered into force in 1994. It currently counts 167 parties. The Convention does not specifically mention plastics. Nevertheless, it defines dumping as «any deliberate disposal of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea» (UNCLOS, Art. 1[5][a][i]). In rather broad fashion, the Convention calls on states to protect and preserve the marine environment, and obliges them to take both land-based pollution and pollution from ships into account. However, the treaty largely leaves the legislation on preventing pollution dumped by ships to the states. Prevention of pollution from land-based sources is encouraged in Article 207.

Voluntary marine-based frameworks

At the Fifth International Marine Debris Conference (5IMDC) in 2011, representatives of 64 governments and the European Commission signed the Honolulu Commitment to tackle marine litter. To facilitate this work, stakeholders around the world were invited to contribute to the development and implementation of the Honolulu Strategy. As a voluntary framework, the Honolulu Strategy sets three overarching goals to reduce the threats of marine debris. Goal A is to reduce land-based pollution by litter and waste and impacts thereof; Goal B is to reduce the amount and impact of waste and debris dumped into or lost in the oceans; and Goal C concerns shorelines, benthic habitats, and pelagic waters where marine debris from both land-based and at-sea sources accumulates (Stoett 2016). Rather than these goals being left as hollow shells, they are accompanied by 19 specified strategies directed at multiple stakeholders such as civil society, government agencies, intergovernmental organizations, and the private sector and name awareness-raising and the provision of incentives for proper waste storage and disposal as possible options for action. Acknowledging the different needs and capabilities of states, the strategy furthermore stresses the importance of improved research, assessment and monitoring, but refrains from setting specific binding targets (UNEP/NOAA 2011). Instead, the strategy is used as an additional tool for the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA; see land-based agreements below), and was introduced at the latter's Third Intergovernmental Review Meeting (IGR-3) in 2012.

Guided by the Honolulu Strategy, the focal areas of the Global Partnership on Marine Litter (GPML) mirror the three goals mentioned above. The partnership is voluntary, open-ended, and accessible to a multitude of stakeholders such as governments, international agencies, the private sector, local authorities, academia, and civil society organizations (CSOs). It works as a global coordination mechanism aimed at reducing the ecologic impacts of marine litter. In this way, duplication is to be avoided, synergies created, and the efficiency and efficacy of operations and resources optimized (UNEP/GPA 2014). To facilitate coordination, the GPML launched the Marine Litter Network, an online platform to share knowledge and

news about the latest projects and developments. The network is managed by the GPML secretariat, which is provided by UN Environment. At the regional level, the GPML also sets out to involve the different Regional Seas Programmes (conventions/action plans) in implementing the Honolulu Strategy. Finally, the GPML sets out to facilitate further public-private partnerships to engage the private sector (GPML 2016).

Another voluntary instrument is the Code of Conduct for Responsible Fisheries of the Food and Agriculture Organization of the United Nations (FAO), which has so far been adopted by 170 states. While plastics are not specifically mentioned, with its inclusion of lost or abandoned fishing gear and their impacts on fish and non-fish species, it makes ports and harbours responsible for providing adequate disposal systems.

3.2 The Basel Convention on Hazardous Waste and voluntary land-based frameworks

Adopted in 1989, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention, or BC) aims at preventing environmental and health damage from hazardous waste, especially in developing countries, where these were often dumped. The convention offers its parties the right to prohibit the import of hazardous wastes and other wastes for disposal. Written prior consent for the import of such wastes is needed from the importing state. Meanwhile, trade of hazardous or other wastes with non-parties is banned, as is exporting them to Antarctica. In addition to these rules for transboundary movements, states are encouraged to reduce waste generation and ensure environmentally sound management of wastes. To facilitate these objectives, a number of non-binding policy measures have been approved by the Conference of the Parties (COPs). These measures include technical guidelines which offer stakeholders practical guidance in managing the different waste streams. One of these technical guidelines concerns the environmentally sound management of plastic wastes and their disposal. In contrast to the sea-based treaties and frameworks, the Basel Convention, and hence also the technical guidelines, are concerned with land-based management of wastes. The guidelines on plastic wastes differentiate between plastic waste generated before it reaches the consumer, and post-user plastic waste. Furthermore, they warn that plastics usually consist not only of polymers but also of sometimes toxic additives, such as lead stabilizers. On the matter of waste management, the guidelines indicate that not all plastics (plus their additives) are suitable for recycling, and they offer different recycling options to choose from, as well as options for recovery or final disposal. Nevertheless, the technical guidelines do not mention the accumulation of plastic waste in the oceans. This may well be because they were issued in 2002, when the subject of marine litter was still a topic of low salience to the international community. A more severe drawback of these guidelines is that they are entirely voluntary and, according to our interviewees with some knowledge of the Basel Convention, have been scarcely used, if at all.

The Basel Convention, with its provisions on minimizing hazardous and other wastes and demands for sound disposal facilities as well as its network of regional centres, is in principle particularly capable of providing a framework for improving global plastics regulation. Article 4 of the convention obliges parties to «ensure that the generation of hazardous wastes and other wastes within it is reduced to a minimum», and to «ensure the availability of adequate disposal facilities, for the environmentally sound management of hazardous wastes and other wastes.» According to the European Commission, these requirements are considered to also apply to plastic waste (European Commission 2013: 19). The text of the Basel Convention refers to «other waste» as those contained in Annex II of the convention, which includes wastes collected from households, much of which is packaging material and other kinds of plastic. Two approaches are thinkable for extending the Basel Convention to more fully address plastic waste: The first is changing core elements of the convention so that it applies to all plastic wastes and for all parties, e.g. by extending Annex II. The second option is negotiating an amendment that would need to be ratified by interested parties before entering into force.

Regarding the first option, one interviewee noted that there are behind the scenes discussions on modernizing the convention, yet it remains unclear whether these efforts will eventually bear fruit, and whether even a relatively small step such as redrafting the technical guidelines on plastic waste treatment would be accomplished. A major overhaul, such as integrating a new set of substances with widespread use into the treaty, might open Pandora's box and invite other parties to suggest even more general changes to the convention. Another interviewee familiar with the work of intergovernmental organizations cautioned that the Basel Convention is a relatively old and rather old-fashioned instrument, and that building on such a framework would prevent a fresh start with the necessary new regulatory elements. A new convention, with targets attuned to achieving the goal of less plastic ending up in the oceans, might therefore be preferable.

As for the second option, an amendment to the Basel Convention to cover plastic waste would extend the BC for a third time (though both the convention's Ban Amendment and Liability Protocol are still awaiting entry into force). However, integrating plastics into the Basel Convention would be politically quite difficult. The convention's current area of application is hazardous wastes. One possible step to enable such a solution would thus be to classify plastic waste as hazardous, something which has already been proposed because of the hazards associated with plastic and, especially, microplastic pollution (Rochman et al. 2013). Rochman et al. (2013) do not link their suggestion specifically to the Basel Convention, and those interviewees questioned about this option were very sceptical that it might work.

Another problem is that that the Basel Convention does not have a financial mechanism that would be needed to implement a more thorough regulatory framework on plastics, as an interviewee with a public service background told us. Achieving legal obligations on plastic waste under the Basel Convention would seem impossible. As one possible way to further integrate plastics into the convention, the interviewee suggested redrafting the abovementioned technical guidelines on plastic

waste. In addition, the interviewee pointed towards the marine-based treaties and frameworks such as MARPOL, which should be easier to amend. Also, in his view, the IMO would be suitable to implement a clean-up process. However, as suggested above, even an improved version of MARPOL or UNCLOS would leave land-based sources unregulated. For a large proportion of land-based sources, this would be the case even if plastics were included as a hazardous substance under the Basel Convention, which mainly covers the international transport of wastes. Plastics entering from wastewater in coastal areas would thus remain unregulated, as another interviewee with an academic background cautioned. Last but not least, the Basel Convention is struggling to get sufficient financial support to achieve its current mandate. Extending its mandate towards plastic waste would require significantly increasing resources.

In summary, in its present form, the Basel Convention is illequipped to address plastic throughout its entire life cycle, and to change this would likely require reopening the treaty, for which there is very little political will. Refurbishing the Basel Convention is thus not a promising strategy to fill the huge regulatory gaps in global governance on plastic pollution.

Voluntary land-based frameworks

Connected with the work of the GPML is the Global Partnership on Waste Management (GPWM), of which marine litter is one of the focal areas. Like the GPML, the GPWM aims at facilitating coordination between different sectors and takes a multi-stakeholder approach. Its objectives are to enhance cooperation and awareness, increase knowledge-sharing, increase synergies whilst reducing duplication of actions, and to promote a holistic approach to the management of waste (GPML 2016). To break the broader issue of waste management down, eight focal areas for action have been identified: Waste and climate change, waste and agricultural biomass, integrated solid waste management, e-waste management, marine litter, waste minimization, hazardous waste management, and metal recycling. The focal area of marine litter, which is led by UN Environment's Division of Environmental Policy Implementation (DEPI), specifically mentions land-based sources of waste as most problematic (GPML 2016).

The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) describes itself as «the only intergovernmental mechanism directly addressing the connectivity between terrestrial, freshwater, coastal and marine ecosystems.» It is closely connected with several of the Regional Seas Programme (RSP) described in more detail below inasmuch as the conventions and protocols concerned with land-based pollution of the marine environment contribute to achieving the overall objectives of the GPA (GPA, 2014). Agreed upon in 1995, the intergovernmental mechanism covers nine categories of sources, one of which being litter. Plastics are specifically mentioned as one form of litter that seriously harms the marine environment. As a voluntary agreement, the GPA advises national and regional authorities to establish or improve waste collecting activities, to reduce the amount of litter produced, and to improve the management of

waste, including up-scaling of recycling (GPA, Art. 144). At its last Intergovernmental Review Meeting (IGR-3) in Manila, the Philippines in 2012, parties to the GPA introduced the above-mentioned Honolulu Strategy. A review of the GPA found a number of challenges as it lacked a binding compliance mechanism and sufficient funding for implementation in developing countries (Meier-Wehren 2013).

3.3 Regional agreements and subnational efforts

In 1974, the newly established UNEP inaugurated the Regional Seas Programme to deal with conserving the global marine and coastal environment and ecosystems. The programme acts as a pool for several multilateral agreements of different regional areas. Today, it covers 18 regions of the world, and comprises about fifty international treaties. The Caribbean region, East Asian seas, East African seas, Mediterranean seas, North-West Pacific region and West African region are the programmes directly administered by UN Environment, whereas others (e.g. Black Sea region) are merely affiliated programmes with their own governing bodies. Others still are so-called partner programmes such as the Antarctic, Arctic, Baltic Sea, Caspian Sea, and North-East Atlantic regions. All programmes have an action plan as their starting point, though with differences in the strength of the legal framework underpinning them. Fourteen of the RSPs have established conventions, some with added protocols on certain more specific issues.

There are twelve regions that support activities on marine litter through conventions and action plans: Baltic Sea, Black Sea, Caspian Sea, East Asian seas, Mediterranean, Eastern Africa, North East Atlantic (OSPAR), Northwest Pacific (NOWPAP), Red Sea and Gulf of Aden (PERSGA), South Asia seas (SACEP), South East Pacific (CPPS), and Wider Caribbean. The Convention for the Protection of the Mediterranean Sea against Pollution is one example of a related agreement, with its assigned Protocol for the Prevention of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft. The protocol, adopted in Barcelona in 1976, names «persistent plastic and other persistent synthetic materials» in its Annex I, thereby prohibiting their dumping into the Mediterranean Sea. Nevertheless, plastic waste has seemingly played only a minor role in most conventions and protocols under the Regional Seas Programmes thus far, as it often does not even find specific mention therein.

Governments from small-island developing states (SIDS) agreed the SAMOA Pathway at the Third International SIDS Conference and committed «to strengthen national, regional and international mechanisms for the management of waste, including chemical and hazardous waste, ship- and aircraft-generated waste and marine plastic litter». SIDS are particularly vulnerable to plastic pollution, especially when they rely on fishing and/or tourism. Many SIDS are located in the Western Pacific, where the fast-growing Asian economies continuously pour out plastics in massive amounts and too often do not dispose of them properly, leading to an ever-increasing stream of plastic waste that flows into the ocean.

To be clear, both developing and developed countries will have to take measures. Though the European Union (EU) is considered a frontrunner in dealing with

plastic waste, and indeed many EU member states have established well-functioning collection systems, less than 30% of plastic waste collected in the EU is actually recycled (Plastics Europe 2016). The European Commission published an EU Action Plan for the Circular Economy in 2015, which lists plastics as one of five priority sectors. A proposed directive on packaging waste is supposed to achieve a recycling rate of 75% for such waste by 2030. The Commission announced that its strategy on plastics would be published in late 2017. Whether these efforts will bear fruit remains to be seen.

On the local level, there are efforts such as those by the Global Alliance for Incinerator Alternatives (GAIA), a global network of grassroots and national NGOs acting on the ground to implement zero-waste solutions. The network comprises 800 organizations in 90 countries. In Europe, GAIA's branch Zero Waste Europe has convinced more than 300 municipalities totalling more than 6.6 million inhabitants to commit to reducing their waste generation and lay out related actions in a resolution or strategy document, and to establish quantitative targets to make progress measurable. The Zero Waste International Alliance (ZWIA), in a similar manner, has established multiple municipal networks linked by a set of Global Principles for Zero Waste Communities. These principles are based on three overarching goals covering producer responsibility for improved product design and industrial production; community responsibility for dealing with consumption, discarding and disposal issues; and political responsibility to align both producer and community actions.[1] Local zero waste networks are organized by regional or national chapters of Zero Waste. So far, these networks have led to some remarkable improvements in individual cities, but have not spearheaded a waste reduction revolution that could be counted on to successfully address plastic pollution on a global scale.

3.4 Strengths, weaknesses and gaps of existing institutions

Though undoubtedly well-intended, so far, none of the abovementioned instruments – be they hard or soft law, marine or land based – have been able to effectively tackle the problem of plastic waste. This is due to several shortcomings.

The first is that, though the majority of sources for marine plastic debris are land-based, these are hardly covered by the marine-based treaties (Tanaka 2006). Where these sources are covered, the instruments remain voluntary parts of legally binding conventions. UNCLOS, for example, although it includes land-based sources of marine litter, leaves addressing these problems to domestic regulation. This relates to another serious drawback: not all states have ratified UNCLOS, the most prominent example being the United States. As for the instruments that do indeed cover land-based sources of marine litter, none of them are legally binding when it comes to regulating plastics. Even the otherwise binding Basel Convention covers the issue

1 Zero Waste International Alliance, Global Principles For Zero Waste Communities, http://zwia.org/standards/zw-community-principles, accessed 12 November 2016.

in its technical guidelines, which are not only voluntary, but whose actual application is not even tracked.

Secondly, enforcement mechanisms are rather weak. Under MARPOL, they leave the imposition of penalties to its parties domestically. For parties who have established such penalties (most have not), these remain seemingly insufficient. With its language remaining rather vague («shall endeavour» or «best practical means»), UNCLOS leaves a lot of room for interpretation, which makes monitoring of compliance a less straight-forward endeavour (Dehner 1995). Along the same lines, both conventions offer several opt-outs or exemptions. For example, they cover intentional dumping but not incidental losses of plastic and other waste, while, for example, US regulations under MARPOL exclude naval and other ships under state operation. Furthermore, when a case of illegal dumping is suspected, coastal states often face high burdens under MARPOL when trying to investigate a ship not flying their flag. Though these states may request information from vessels, they cannot simply inspect a vessel if such information is denied (Hagen 1990). Along the same lines, it is far from easy to prove that information given in the GRB, as required under Annex V, is truthful (Gold et al. 2013: 11). Under UNCLOS, the violator must be witnessed by a state, which, given the current state of tracking techniques, is highly unlikely (Schroeder 2010). In order to address UNCLOS' implementation gap, some have suggested achieving universal ratification through an implementation agreement. It has, however, been argued that for this to be successful, one would also need to give greater incentives to states to join the agreement to make freeriding less attractive and to make them willing to give up aspects of their sovereignty (Larik and Morgan 2016). One clear drawback of MARPOL's Annex V is that it is not applicable to enough vessels. Gold et al. (2013: 13) have suggested that the threshold of vessel size and tonnage ought to be set lower to be more inclusive of smaller fishing vessels, for example. Furthermore, they suggest an improvement in port reception facilities, as they currently lack qualitative and quantitative standards, resulting in confusion among ship owners as to where best to discharge their waste. Thirdly, an amended Annex V ought to offer a narrower definition of the term «accidental loss of fishing gear», as it is currently unclear what precautions vessels can be expected to undertake to prevent such losses (ibid.).

Thirdly, the Regional Seas Programme faces legislative gaps owing to its regional character. Though it is undoubtedly helpful to have programmes specific to the needs and capabilities of a certain region, this also implies that some regions lag far behind others in how far they reach or how strict their requirements, e.g. for compliance, are. Concerning the regulation of land-based sources of marine pollution, there are several programmes that so far lack a protocol on that matter (Tanaka 2006: 552). This may eventually lead to concentrations of plastic waste stemming from regions that require less strict regulations. Furthermore, even those regions with binding conventions and protocols face difficulties with compliance as none of them includes sanctions in case of violation (Gold et al. 2013: 10). Different Regional Seas Programmes could be improved by making sure that new programmes include (and old programmes are enlarged to include) not only coastlines and territorial seas, but

also land-based activities along rivers from delta to sea. Furthermore, it will be of utmost importance to explicitly mention marine litter in the conventions and/or protocols, and to adjust the scope of inclusion of both sources of marine litter, including to activities that produce such litter. Compliance will require explicit language that leaves less room for interpretation, instead offering clear timelines and enforcement and funding mechanisms. Assessment of compliance or enforcement should best be monitored by regional third-party organizations. To fund clean-up efforts, the RSPs could require importers to commit to financing recycling programmes or end-of-life reuse, which would in turn also reduce imports (Gold et al., 2013).

No matter how well-designed and possibly improved, these treaties are unlikely to ever successfully prevent plastic pollution of the oceans. Therefore, a standalone solution focusing on plastic waste management within national jurisdictions is warranted to prevent plastic disposed of on land from entering the seas.

4 Core elements of a plastics convention: Binding goals and flexible means

Five core elements are considered essential for a global plastics convention and outlined in detail in this chapter. The first is a binding goal to eliminate plastic pollution of the oceans from land-based sources. Second, to achieve this goal requires national implementation plans, which may be based on measures compiled in a toolbox to select those that are most applicable to national circumstances. Third, this combination of top-down goal setting and bottom-up implementation strategies should be accompanied by the provision of capacity development measures, including a knowledge exchange framework and a funding mechanism to improve waste collection systems and encourage infrastructure improvements as well as technological innovation. A fourth element should be a stringent follow-up and review mechanism to assess the implementation plans, to monitor progress and to enable learning from both successes as well as from failure cases. Finally, plastic pollution will not successfully be curbed by national governments alone, but it will also require significant efforts from non-governmental stakeholders, and thus a global plastic convention should build extensively on multi-stakeholder participation in both decision-making and implementation.

4.1 A binding goal to eliminate plastic pollution

A binding goal to eliminate plastic pollution should be the centrepiece of any global plastics convention. As the rationale for such a convention is to prevent plastics from entering the oceans, where they create a transnational environmental problem, the goal would likely have to be framed to refer to plastic discharged into the world's oceans from national territories. This proposal mirrors the call by the Global Ocean Commission (2016: 10) for «coordinated action by governments, the private sector and civil society to eliminate plastics entering the global ocean», including through «timebound, quantitative reduction targets» and «improved waste management».

When conceptualizing a binding goal, a balance needs to be struck between actually addressing the problem and the desire of governments to retain as much sovereignty as possible. Several interviewees considered an overall waste discharge elimination target to be more feasible than prescribing countries specific measures to reduce plastic discharge. Goals that would directly affect industrial output by aiming at a reduction in overall plastic production or even a phase-out and ultimate ban

on certain products, like plastic bottles or bags, are thus considered detrimental to a possible negotiation process.

One such option would call for a goal of reducing overall (plastic) waste generation, possibly on a per capita base, with one study calculating: «If per capita waste generation were reduced to the 2010 average (1.7 kg/day) in the 91 coastal countries that exceed it, and the percent plastic in the waste stream were capped at 11% (the 192-country average in 2010), a 26% decrease would be achieved by 2025.» (Jambeck et al 2015: 770) Despite having the appeal of demanding more action from developed than from developing countries, this would likely be disapproved of by many governments, as it impinges too strongly on national sovereignty. While such goals do exist in other areas and can be quite successful, as the example of the Montreal Protocol and its phase-out of ozone-depleting substances (ODS) shows, the major differences between plastics and ODS like chlorofluorocarbons (CFC) are that functionally equivalent substitutes existed in the latter case, and that CFCs had far fewer applications than plastics have today.

A goal of eliminating plastic pollution of the oceans needs some form of operationalization. One option to do so would translate the goal to cover the share of plastic waste that is not properly collected, and to demand an increase in waste collection rates. Though possibly touching on sensitive sovereignty issues already, such a goal could be interpreted as a proxy for the amount of plastic that enters the oceans through various pathways, which is much more difficult to measure. This goal has the advantage of being more directly translatable into measures targeting the main problem, i.e. lacking waste collection systems. In July 2015, the European Parliament called for targets to reduce marine litter by 50% by 2025 (Eunomia 2016: 3). If only the top 20 plastic waste-discharging countries would increase their waste collection by 50%, «the mass of mismanaged plastic waste would decrease 41% by 2025.» (Jambeck et al 2015: 770) The logical argument in favour of collective action this entails – to collect waste because it otherwise ends up in the oceans and pollutes foreign beaches – may outweigh the concerns that national-level waste collection rates are not, strictly speaking, an international issue.

4.2 National implementation plans

The goals of a plastics convention need to be implemented on the national level. Yet, instead of enshrining overly specific measures into the legal provisions of the convention, it might be more suitable to offer a range of tools and leave it to governments to decide how to achieve the goals. Thus, a top-down goal that is legally binding and requires the minimization of plastic waste reaching the ocean would be combined with a bottom-up and voluntary approach establishing a set of measures in line with each country's specific needs and conditions.

This would follow the model used by the SDGs and in specific issue areas like climate change, where the Paris Agreement has employed a similar mechanism through the Intended Nationally Determined Contributions (INDCs). The question here is less whether these examples are actually more effective, but whether a joint

agreement of the international community would have been possible without this model. There is good reason to believe that governments simply would not even launch negotiations on a plastics convention that imposes strict measures and thus touches upon sensitive aspects of national sovereignty.

Instead, governments should be required to hand in national implementation plans that show how they plan to achieve the goals. These plans should be designed so that all measures follow the SMART criteria, meaning they should be specific, measurable, achievable, resource-based, and with timebound deliverables.[2] Plans following the SMART criteria are much easier to assess and be reviewed, a critical element for enhancing compliance within such a bottom-up instrument.

Chen (2016) argues that four types of measures are needed to change the destructive pattern of plastic pollution, focusing on prevention, mitigation, removal, and behavioural change. It would make sense for a global plastics convention to include these in its implementation toolbox. Indeed, countries will need to identify and implement a mix of policy measures, as no single instrument will be able to deal with the challenge of plastic waste on its own (Wilts et al. 2016). Such a mix could include measures outlined by the CBD Secretariat (2016):

- Packaging and plastics reduction;
- Improved product and packaging design;
- Potential use of waste as a resource;
- Deposit return programmes;
- Economic instruments such as fees for single-use items;
- Regulatory measures to prevent marine debris;
- Bans for certain items (e.g., plastic bags, microbeads);
- Engaging with industry and corporations on sustainability, including plastics disclosure policies;
- Support for innovation in new materials, manufacturing, recycling and product design using alternatives to conventional plastics that are «fully biodegradable under ambient conditions», with comparable performance characteristics;
- Improving waste management infrastructure to prevent debris inflow (e.g., stormwater systems);
- Improving awareness of marine debris;
- Providing viable alternatives to synthetic plastic (e.g., bioplastics and natural compounds);
- Eco-labelling / certification schemes; and
- Encouraging reuse and reduction.

Further regulation of aquaculture operators, possibly including a certificate for sustainable aquacultures (e.g. clean-up or replacement of Styrofoam by substitutes),

2 Though there are other interpretations of what each SMART letter means, here we prefer using the concept as employed by the Division for Sustainable Development at the UN Department of Economic and Social Affairs (UNDESA) in its Partnerships for SDGs program.

could be considered as well. Other examples of policy options to include in such a toolbox can be drawn from UNEP's (2016b) toolkit for policymakers on marine litter legislation. Indirectly useful instruments may reduce plastic waste as a side-benefit while targeting quite different areas. For example, improvements to public water supply systems should be able to reduce the need for bottled water, which represents a large proportion of plastic waste in developing countries (Quartey et al. 2015).

4.3 Supporting capacity development and innovation measures

A capacity development support system equipped with a financing mechanism should be set up to foster the establishment and improvement of waste collection and recycling systems, to promote innovation through knowledge exchange and technology transfer.

Bolstering waste collection and recycling systems

Improvements to waste collection systems will be an essential element for reducing the discharge of plastic waste into the oceans. Such systems can be formal and state-driven, or informal, as in many developing countries. One of our interviewees familiar with the region pointed towards a program initiated by the administration of Jakarta, Indonesia, as a best practice example. The administration employs over 4,000 workers, providing them with health insurance and accommodation, to clean up the local rivers. According to the Jakarta Times (Wijaya, 2016), this has resulted in fewer river and canal clogging incidents during rainy periods, and the cleaner water surface has supposedly had the side benefit of working as a deterrence to people littering in the first place. In some places, the water quality has improved to such an extent that children can swim in the rivers again (Wijaya, 2016). According to one interviewee, if a system is successful in a city like Jakarta, this may work as a powerful image, encouraging other developing countries to implement affordable waste collection systems.

It is examples like these that indicate that it is not the European or American waste management systems that necessarily have to be used as blueprints for waste collection systems in developing states. Other sources likewise highlight the importance of the informal sector in waste collection and recycling (WBCSD et al. 2016; Heuër et al. 2016). Capacity building and knowledge sharing is therefore the way to go to prevent plastic waste from entering the marine environment. Supporting measures might include putting a refund system on plastic bottles and plastic bags to give these items an economic value and incentivize informal waste collection.

Promoting innovation

A global plastics convention should foster innovation for more sustainable plastic design, production, use, and disposal. As described above, it won't suffice to simply produce biobased or biodegradable plastics. Still, a treaty should support creating the conditions for a more circular plastic economy by incentivizing chemical companies towards innovation for more sustainable products. Common plastics

must degrade more easily under various environmental conditions, including in the ocean. This is a huge innovation challenge for the industry that could elicit a race to the top, especially if met with the prospect of legal provisions on the national level. The higher the probability of a piece of plastic becoming part of the pollution problem, the stricter the rules for its biodegradability should be. As plastic bags and bottles are among the most common items found in the environment, they should be at the centre of attention. Food packaging is another product type for which quick biodegradability should become commonplace. Again, the benefits are likely to outweigh the costs. For the industry, negotiations on a plastic convention could thus be the kick-off of a more sustainable polymer sector.

Financing mechanism

A plastics convention will require significant funds to be successfully implemented. It would be useful to explore if and how the polymer industry could be brought to contribute to a plastic pollution remediation fund. With US $750 billion in annual turnover, the plastic industry is economically strong enough to contribute a small fraction of their profits to deal with their products' legacy. A mere 0.1% levy on their turnover would lead to US $750 million available for capacity development, information sharing, and direct implementing activities including cleaning up of shores and rivers. Yet as the benefits of plastics are enjoyed by all societies, public funding should certainly play the central role in dealing with the unequally distributed yet transnational problem of plastic pollution. In its final report, the Global Ocean Commission recommended establishing a Global Marine Responsibility Fund, to be financed by «taxation and other levies [...] to build waste management capacity, coordinate action to combat marine plastics, grow sustainability initiatives, and change the behavior of industry and consumers.» (Global Ocean Commission 2016: 10) Whether funding will be channelled through a standalone fund, as is done in the Montreal Protocol, or through another body such as the Global Environment Facility (GEF) is of less importance than the amount of funding that should go into implementing a plastic convention's goals.

4.4 Stringent follow-up and review

Compliance with the binding goal will need to be strictly monitored to ensure the effectiveness of a global plastics convention. This requires an effective review process. Beisheim, in a study on the review process for the SDGs, posits that «review procedures should create transparency, foster learning effects, encourage accountability, strengthen political will, and promote capacity building.» (Beisheim 2015: 21) For the SDGs, she recommended a two-step «commit and review» process (ibid.: 24). This would «give states sovereign control over the national commitments they enter into» while linking «national commitments to globally agreed goals». In the first cycle, national commitments would be reviewed, and in a second cycle, the same would be done with actual implementation. Such a system could be employed for a plastics convention as well.

The first step of a follow-up and review process would be to assess the content of national implementation plans and to consider whether they, at least on paper, could successfully address the problem. The second step would then be to review to what extent these plans were implemented, and what the effects on plastic production, use, waste disposal, collection, recycling, or discharge are (depending on the kind of goal).

To the extent that a plastics convention would aim at banning plastic waste from entering the ocean, one interviewee with an academic background suggested that, to assess compliance, different measurement points could be used to track where the particular plastic waste had originated. This could be done either at major river deltas, or offshore at the end of a country's exclusive economic zone. However, several problems would have to be dealt with, including the high expense of establishing an ongoing measurement system around the entire globe. Furthermore, nations might challenge whether plastic pieces actually originated in their territory, might have moved there by ocean currents, or simply been transported via a river with the polluter located upstream. These issues could quickly be put on the table by states unwilling to address plastic pollution, making it not only technologically challenging but politically difficult.

To ensure that political salience is built and kept up, further research is needed on adverse impacts on the environment and human health. Gold et al. (2013) suggest an international scientific body, where experts convene to gather and publish further evidence on how plastic pollution harms health and environment, comparable to the Intergovernmental Panel on Climate Change (IPCC) periodic reports of the latest findings, could fuel negotiations and actions on the regulation of plastics. Along these lines, the same authors further suggest a data collection network. To invest in and thus strengthen the GPML Marine Litter Network might be a more resource-saving option.

To ensure that any possible new agreement not simply be a hollow shell, Gold et al. (2013) even call for penalties high enough to discourage violation. Such hard punishing mechanisms will be very contentious during negotiations and are likely going to be removed from any draft treaty, if they would ever find their way there in the first place. None of our interviewees assumed this was a realistic proposal.

4.5 Meaningful multi-stakeholder involvement

Dealing with plastic pollution will not be achieved by relying on (inter-)governmental regulation alone. While a more stringent approach with the establishment of legally binding reduction goals is considered essential, it will not be sufficient. It must be complemented by efforts from non-governmental stakeholders including civil society organizations, businesses, and academia.

A global plastics convention could build on models for multi-stakeholder engagement that can be found in both binding and, even more so, in voluntary agreements such as the Strategic Approach to International Chemicals Management (SAICM). There, stakeholders from all chemicals-related sectors are invited to participate. They

are given the opportunity to actively engage in the decision-making forum, they are represented in the bureau, and can fully participate in the steering bodies for dealing with specific problems, the so-called «emerging policy issues». Even though SAICM is at its core intergovernmental, and only governments may cast a vote, in practice, decision-making is done by consensus, and there are few forums where non-state stakeholder involvement is as far-ranging.

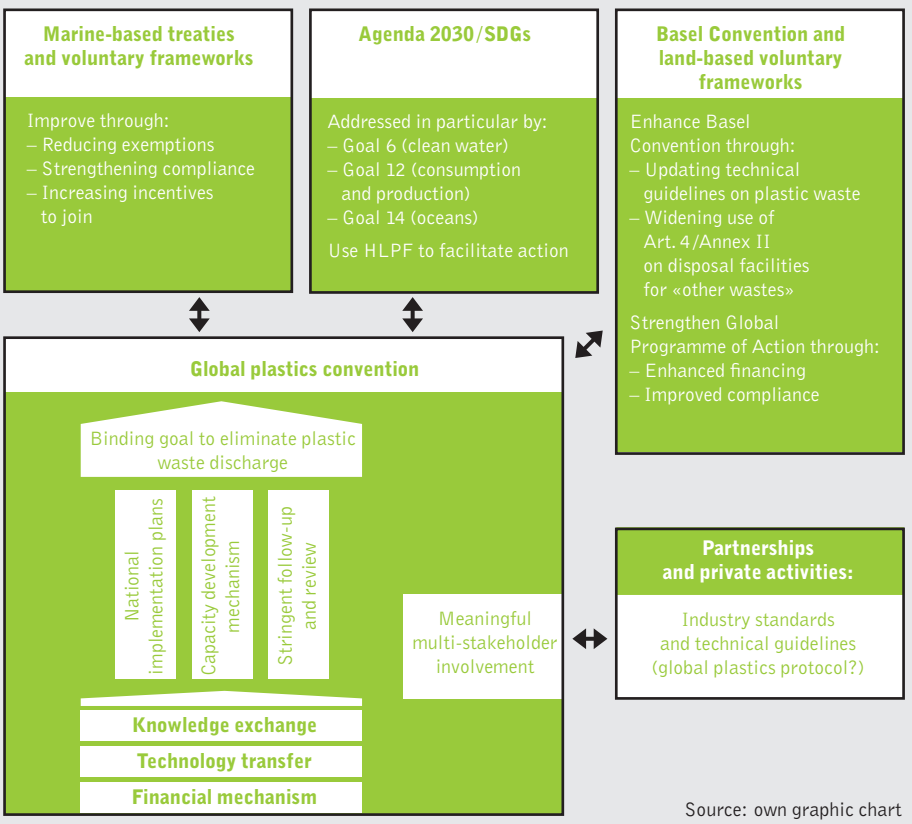
A multi-stakeholder-driven negotiation process and convention would most likely attract significant involvement of non-state actors. A range of multi-stakeholder frameworks dealing with plastic waste and marine litter already exist. In the civil society sector, the Plastic Pollution Coalition was founded in 2009 and today has more than 400 member organizations. Its aim is «a world free of plastic pollution and its toxic impact on humans, animals, the ocean and the environment» (Plastic Pollution Coalition, 2016). However, there seems to be a long way to go. In the meantime, researchers from public universities and private companies have stepped up their game and started researching more environmentally-friendly plastics and have made some promising inventions. Less institutionalized, but of major importance, are the countless educational and clean-up campaigns such as the International Coastal Clean-up (ICC) or the Monofilament Recovery & Recycling Program, which aim to raise awareness of the problem. Such clean-up campaigns can also be used to engage citizens in contributing to enlarging scientific knowledge, e.g. in the tracking of waste. Citizens participating in or adding to scientific studies represent a sort of link between academia and civil society. When it comes to marine litter, citizens have so far mainly contributed to studies on where to find marine litter and what it comprises. Another area of interest for citizen science studies has been how marine debris affects biota (Hidalgo-Ruz and Thiel, 2015).

Multi-stakeholder coalitions efforts include Parley for the Oceans, which brings together policymakers, producers, and consumers. Apart from organizing high-profile events ensuring considerable media attention, Parley seeks to intensify collaboration with SIDS, which are disproportionately affected by plastic pollution washing up on their shores. The Recycling Partnership is based in the US and attempts to bring together industry partners and cities to enhance recycling rates in urban areas.

Industry has also established some frameworks to enhance stewardship of its products, and individual companies have joined a range of partnerships and comparable efforts. Most notable is Responsible Care, the chemical industry's voluntary commitment to enhanced chemical safety and product stewardship. Though it may not have contributed much to improving sustainability performance in developed countries, its impact in emerging economies and developing countries appears to be more relevant (Conzelmann 2012; Prakash 2000). The European polyvinyl chloride (PVC) industry has committed itself to a set of sustainability goals that include increasing recycling rates and enhancing energy efficiency at PVC production facilities through VinylPlus, a private-sector partnership. Marine Litter Solutions is another private sector partnership that brings together 60 associations of plastic producers from 34 countries. They have signed the «Declaration of the Global Plastics Associations for Solutions on Marine Litter» and voluntarily agreed to a set of

principles and implementing measures to limit marine litter. To spearhead technological improvements for sustainability within industry, the Ellen MacArthur Foundation (2016) has proposed a global plastics protocol, a private voluntary agreement including sustainability standards for plastic design and waste management. As part of this endeavour, at the World Economic Forum in January 2017 in Davos, more than 40 industry leaders committed to drastically enhance recycling rates of plastic packaging (Ellen MacArthur Foundation 2017).

Fig. 4: Framework for enhancing global plastics governance



Source: own graphic chart

5 Recommendations on commencing negotiations and complementary measures

5.1 Forging a movement

To establish an international convention, the matter at hand must first be brought to the attention of policymakers, who then must bring the issue to the governing bodies of relevant international organizations. One such effort was undertaken by the UN Association of Finland, which started a petition for an international treaty to control ocean pollution. The petition focused on the issue of plastic and gained signatures from 21 organizations and nearly 4,000 individuals. Academics can assess the extent of the problem and highlight the viability of preventive action (Vegter et al. 2014), and they can develop and assess options for a global plastics convention, as done here. CSOs could take up these ideas and call upon governments to engage in negotiations for a legally binding agreement on plastic waste.

CSOs have so far launched a number of campaigns and are involved in numerous efforts to curb plastic pollution. These cover the collection of data about the state of pollution on beaches and coastlines, the publishing of practical guidance for businesses and consumers, as well as awareness-raising efforts on the issue of plastic debris in oceans. For example, in the cosmetics sector, the Plastic Soup Foundation brings together 69 CSOs from 33 different countries supporting the fight against microbeads mainly found in products such as facial scrubs. Another initiative that with the support of more than 90 CSOs from all over the world uses the social media hashtag #BreakFreeFromPlastic to raise awareness of the environmental impacts of plastic pollution among civil society and policymakers alike. The Plastic Disclosure Project is run by the Ocean Recovery Alliance and works with businesses and other organizations to assess their plastic footprints and reduce overall use and waste production. Zero Waste Europe is another network of CSOs campaigning for waste reduction, including plastic waste.

A strong enough CSO network should be able to convince at least some countries to pursue the idea further. For the idea of launching negotiations on a plastic convention to commence, it will need some champions – countries that want to bring the proposal to the governing bodies of relevant UN organizations. Such champions may be found among the group of Nordic countries, as these have been known to be frontrunners on waste policies and the tackling of plastic pollution of the seas

(Hennlock et al. 2014). Another way for CSO activists to identify who could be such a champion would be to seek countries experiencing the most negative effects and high costs of plastic pollution. Many of these will be among the group of SIDS, yet in principle every country with a beach that is generating significant income from tourism might take this role. Another option would be to approach countries that have already shown leadership in tackling plastic waste. Countries like Seychelles and Rwanda have already enacted bans on plastic bags. Others such as the UK have made a charge of 5p mandatory for plastic bags, thereby greatly reducing the number used by up to 85% (Smithers 2016). On the subnational level, California and Hawaii are among the US states that have banned at least some types of plastic bags.

As noted above, it would be forward-looking to involve plastic producers and other businesses early in the preparatory process, and even more so during the negotiation phase on a plastics convention. It will be extremely difficult to get a treaty off the ground against the active engagement of the chemicals and packaging industries. Instead, outlining to businesses how to avoid costs and highlighting the economic opportunities of a more circular plastic economy could go far towards getting their support for a legally binding agreement.

5.2 Getting a mandate to launch negotiations

For negotiations on a multilateral convention to commence, the international community must agree on a mandate to do so. There are two obvious forums where this can be achieved, and several platforms that could foster decision-making within one of these.

First, probably the most obvious place to get a mandate for negotiations is the *UN Environment Assembly*. UNEA has passed resolutions on marine plastic and microplastic in both of its past two sessions and will further build on these. Furthermore, as the transboundary movement of plastics across the oceans and their environmental impact on wildlife at sea and on beaches constitutes the central case for a multilateral legal approach, UNEA appears to be the prime forum for a multi-stakeholder driven coalition advocating a legally binding approach. UNEA-3 will take place in December 2017, though it will be a short interim meeting, making UNEA-4 in 2019 potentially more realistic.

Second, one interviewee pointed out that the *UN General Assembly (UNGA)* could take up the issue and decide on the need for launching negotiations on a global plastics convention. Many treaties have been negotiated as a result of UNGA decisions. It would underscore that plastic pollution is a problem that goes beyond environmental considerations (notwithstanding the fact that environmental issues are usually considered cross-cutting), requiring attention and action from a broad range of states and other stakeholders in many sectors.

In addition, there are several platforms which could be used to support decision-making in either UNEA or UNGA. These include:

The *High-Level Political Forum on Sustainable Development (HLPF)*, the UN's main platform for follow-up and review of the 2030 Agenda and the SDGs. It meets

annually under a common theme and has the task of reviewing a smaller set of SDGs in depth each year. Its next session in July 2017 will focus on «Eradicating poverty and promoting prosperity in a changing world», and among the goals to be reviewed is goal 14 on conservation and sustainable use of the oceans. It could be used to issue a call to step up the game on marine plastic debris by focusing on land-based sources. The 2018 theme is «Transformation towards sustainable and resilient societies», which would also offer some entry points for a call to launch negotiations as it will include goals 6 on clean water and sanitation, and most importantly goal 12 on responsible consumption and production. Depending on the time needed to forge an alliance, both sessions of the HLPF might be suitable platforms. The HLPF could not in itself decide to launch negotiations. However, as it meets under the auspices of either the Economic and Social Council (ECOSOC) or the UNGA, it could give a clear recommendation to either body to further pursue and prepare negotiations on such a convention.

The next *International Conference on Chemicals Management (ICCM5)*, the decision-making forum for SAICM, is scheduled for 2020 and might be another venue worth considering. As a voluntary multi-stakeholder and multi-sectoral forum, SAICM is well-positioned to bring together governmental and non-governmental actors for dialogue, though it is ill-equipped to launch legal negotiations. Nevertheless, it could at least establish a supporting work programme under its framework of emerging policy issues.

To further prepare a mandate, plastic waste could (again) be put on the agenda of the *G7/G8* or *G20* to have the leaders of the world's largest economies agree to much more decisive action on marine litter. The G7 already took up the issue at the 2015 Summit in Germany, where governments agreed on the G7 Action Plan to Combat Marine Litter, and committed in the Leaders' Declaration «to priority actions and solutions to combat marine litter [...], stressing the need to address land- and sea-based sources, removal actions, as well as education, research and outreach.» The G20 has yet to build on this call. The most direct impact on plastic pollution during the 2016 G20 Summit in Hangzhou, China, was probably the shutdown of about a dozen local plastic manufacturers to improve air quality during the meeting. Germany, as chair of the G20 Summit in Hamburg in July 2017, could build on the G7 declaration and call for more decisive global action, as voluntary mechanisms have proven insufficient.

These forums offer civil society multiple entry points for issuing a call for a global plastics convention. Wherever the mandate originates, it will be vital to also include industry early in the drafting process to prevent businesses from strongly opposing the idea of a convention on plastics. One interviewee close to the business sector assumed that industry would in general welcome stronger guidance from the international community to be able to plan more securely for the future, which could draw further investment in new technologies. It might therefore be most promising to convene multi-stakeholder meetings to promote an exchange of ideas and possibilities on how industry can contribute to the process, as it may well become an important partner in improving sustainable collection and recycling.

6 Conclusion: Towards a global plastics convention?

Plastic pollution is an already massive and quickly growing global environmental challenge. It seriously harms wildlife, can be detrimental to human health, and causes a number of other problems. Plastic waste causes damage from the local to the global level, resulting in considerable costs, especially in vulnerable sectors like fishing and tourism. It is its discharge into the oceans and subsequent distribution across the globe which makes plastic pollution a transnational issue warranting multilateral efforts to solve it.

The current governance landscape dealing with plastics is fragmented and exhibits huge gaps. It is mostly centred on the oceans but, even there, existing agreements suffer from loopholes or implementation problems. However, the most significant gap is a lack of a mechanism dealing with the major sources of plastic pollution, which are land-based. None of the ocean-based treaties, nor any agreements such as the Basel Convention, provide the necessary mandate or funds to engage in more stringent regulation and capacity development on a sufficient scale. Though well-intentioned, none of the existing frameworks and initiatives have kept the oceans clean.

This gap should be filled by a new multilateral convention specifically addressing land-based sources of oceanic plastic pollution. Multiple international declarations by the G7 and UNEA, and many CSOs and other activists have been calling for enhanced worldwide efforts dealing with plastic pollution. We received largely positive feedback on the idea of a global convention from most of our interview partners, though some cautioned that considerable time and effort would be required to get such a treaty negotiated. Furthermore, there was some disagreement as to what exactly a global plastics convention should entail. We synthesized our results into the proposal outlined in this paper.

We have argued that such a convention should be built on five core elements: First, the plastics convention should establish a strong and legally binding goal for eliminating plastic discharge into the oceans. Second, it should be flexible on the means parties may employ to achieve these goals. Countries should submit detailed national implementation plans based on a toolbox entailing exemplary provisions covering the entire life cycle of plastics, including their production, design, use, recycling, and disposal. Third, to foster implementation of these plans, the treaty should provide meaningful support systems for enhancing national and local capacities, e.g. for improving waste collection and recycling systems. Fourth, a follow-up and review mechanism should allow other governments and non-state actors like civil

society organizations and academia to assess and comment on these plans. Fifth, the convention should envision a strong role for non-state actors, including CSOs and businesses, and it should foster partnerships and employ other voluntary activities to boost implementation.

The problem of plastic pollution will not be resolved by simply negotiating a new international convention, an effort which will take many years anyway. Instead, such a convention must be designed as part of a multi-dimensional and multi-level approach, linking public and private actors, binding regulations and voluntary schemes, land-based and ocean-centred activities (see also Vince and Hardesty 2016). We have already seen considerable levels of partnership-based, ocean-focused, and mostly voluntary action on plastic pollution. It is time to go beyond that and craft a binding convention that can spearhead action on all levels.

LIST OF ABBREVIATIONS

APEC	Asia-Pacific Economic Cooperation
BC	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
BPA	Bisphenol A
BRS	Basel, Rotterdam and Stockholm (Conventions)
CBD	Convention on Biological Diversity
CFC	Chlorofluorocarbons
COP	Conference of the Parties
CSO	Civil society organization
EEZ	Exclusive Economic Zone
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection
GPA	The Global Programme of Action for the Protection of the Marine environment from Land-based Activities
GPML	Global Partnership on Marine Litter
GPWM	Global Partnership on Waste Management
GRB	Garbage Record Book
HLPF	High-level Political Forum on Sustainable Development
ICCM5	5th International Conference on Chemicals Management
IGR-3	Third Intergovernmental Review Meeting to the GPA
IMO	International Maritime Organization
INDCS	Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
MARPOL	International Convention for the Prevention of Pollution from Ships
ODS	Ozone depleting substance
PVC	Polyvinyl chloride
RSP	Regional Seas Programme
SAICM	Strategic Approach to International Chemicals Management

SDGS	Sustainable Development Goals
SIDS	Small Island Developing States
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNEA	United Nations Environment Assembly
UNEP	UN Environment
ZWIA	Zero Waste International Alliance

LIST OF INTERVIEWS

Between October and December 2016, interviews were held with the following individuals:

1. Delphine Levi Alvares and Joan Marc Simon, Zero Waste Europe, Brussels, Belgium
2. Andrea Brown, World Business Council for Sustainable Development (WBCSD), Geneva, Switzerland
3. Nicholas Mallos, Trash Free Seas Program, Ocean Conservancy, Washington, DC, USA
4. Antonio Oposa, environmental lawyer, Philippines
5. Anna Oposa, Save Philippine Seas, Bacoor, Philippines
6. Kerstin Stendahl and Juliette Kohler, BRS Conventions Secretariat, UN Environment, Geneva, Switzerland
7. Peter Stoett, Concordia University, Montreal, Canada
8. Barbara Ruis, UN Environment, Geneva, Switzerland
9. Chris Wilcox, CSIRO, Hobart, Australia

In addition, a larger number of informal discussions were held with anonymous sources from various stakeholder groups, whose feedback was also taken into account.

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Stopping Global Plastic Pollution: The Case for an International Convention

Plastics have boosted our economy because they are highly flexible, durable, and cheap. However, their massive use has created an enormous global problem with environmental, economic, social, and health repercussions. Existing international measures to deal with plastic pollution are insufficient to successfully addressing the problem. So legal provisions banning the dumping of plastic waste at sea for example have not been adequate to reduce the amount of plastic waste that reaches the marine environment.

Without large-scale efforts targeting plastic waste at its land-based sources, the problem will get worse. The only viable solution to the problem would therefore be to stop plastic waste from entering the oceans in the first place. That is what the authors Nils Simon and Maro Luisa Schulte propose in this paper: To launch negotiations on a plastics convention and begin to end this irresponsible disaster.

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