Elisabeth Losasso
Sustainability Consulting – Environmental Policy & Advocacy
September 2018

INITIATIVES AGAINST MARINE PLASTIC LITTER

A Review for Fondation Didier et Martine Primat

By Elisabeth Losasso

FOREWORD

The mandate of this report was to provide an executive **overview** about **key actors, initiatives, main solutions and gaps** on marine plastic litter for the use of Fondation Didier et Martine Primat. The aim of the report is to highlight potential areas to engage against plastic pollution.

The initiatives presented herein were identified through web and literature research and expert input[1]. While efforts have been made to identify the most pertinent initiatives worldwide, the overview is not exhaustive, as there is a myriad of different scale initiatives. Selected initiatives showcase the diversity of major global initiatives and regional where particularly relevant. The choice of examples has been guided by geographic and other interests of the Foundation. While the selection of information can be of interest for a broader audience, the main intention was to inform the client. This version of the report is based on an internal report for the Foundation that was written in June 2018. Data and developments have been considered till June 2018.

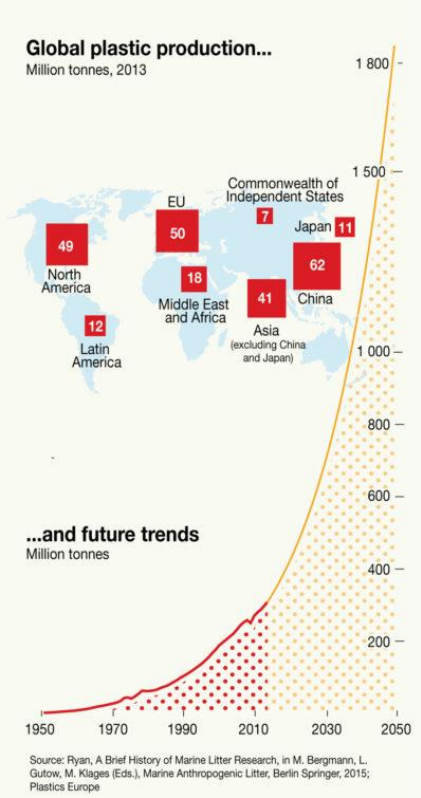
CONTENTS

1. PLASTIC FACTS

Marine plastic debris has been a concern amongst scientists since the extensive plastic production and consumption began in the 1950s. Only in the 1990s, when the five massive ocean gyres of plastic debris and microplastics were discovered, the issue became widely recognized and a **global concern** amongst decision-makers and the public.

[1] Interviews with five experts on marine plastic litter were conducted: Karlijn Steinbusch and Martijn Meijer (Adessium Foundation), Joao Sousa (IUCN), Francesca Cenni (UNEP, Basel Rotterdam Stockholm Convention Secretariat), and Steve Campbell (Oak Foundation).

Illustration No. 1: Global plastic production and future trends



Today, the world produces more than **400 million tons** of plastics every year[2]. Over the **last 50 years**, plastic production increased **twenty-fold** and is **expected to double** again in the next 20 years.[3]

Most plastic is made from **oil and other fossil materials,** though it can also be made from other sources like cellulose and corn starch.

It is estimated that between **4 – 8 % of the world's annual petroleum production** is used to make plastics, roughly half of this is used as material feedstock and half as fuel for the production process.[4] If the current strong growth of plastics usage continues as expected (*see illustration No. 1 on the left*), the consumption of oil by the entire plastics sector will account for **20% of the total consumption by 2050**.[5]

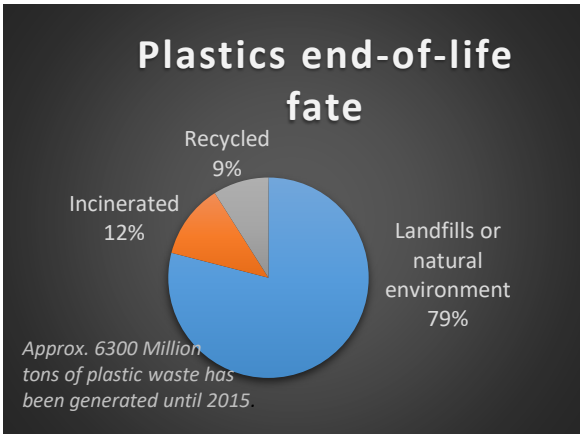
Most plastics **do not biodegrade**, but instead photodegrade. They slowly break down into small fragments known as **microplastics**.[6]

Cartographer: Maphoto/Riccardo Pravettoni http://www.grida.no/resources/6923

Only a **small portion** of plastic is currently being **recycled**, with considerable geographical differences: **Globally, 9 percent of all plastic is recycled**[7] (see illustration No. 2).

Illustration No. 2: Where does our plastic waste go?

Europe recycles 30 percent, China 25, the United States only 9 per cent.[8] The rest is burned, sent to landfills, or disperses into the environment. Since most plastics are not biodegradable, all the plastics present in the environment will remain there for hundreds or thousands of years.[9]



Adapted from Geyer, R. et al. (2017). Production, use, and fate of all plastics ever made. Sci. Adv., 3(7), e1700782.

[2] UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability
[3] Ellen MacArthur Foundation (2016). The New Plastics Economy: Rethinking the future of plastics.
[4] Ellen MacArthur Foundation (2016)
[5] Ellen MacArthur Foundation (2016)
[6] UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability
[7] Geyer, R. et al. (2017). Production, use, and fate of all plastics ever made. *Sci. Adv.*, 3(7), e1700782.
[8] National Geographic (2018)
[9] Geyer, R. et al. (2017). Production, use, and fate of all plastics ever made. *Sci. Adv.*, 3(7), e1700782.

Impacts of plastic debris in the oceans

Scientists estimated that in 2010 alone, between **4.8-12.7 million metric tons** of plastic **found their way into our oceans**. [10]

According to the Ellen McArthur Foundation, **by 2050 there will be more plastic than fish** by weight in our oceans if the business-as-usual-model continues.

Plastic debris in our oceans has serious **environmental, social and economic consequences**. It harms wildlife, safety of sea transport, fisheries, tourism, recreation and threatens marine ecosystems[11].

Microplastic particles- pieces smaller than 5mm- are found in a large variety of marine organisms, including species consumed as seafood. The sparse knowledge on levels and effects does not indicate a **health risk** to humans now, but the **uncertainty** is high. There is also **growing evidence that plastic particles may carry and transfer toxic substances** (in particular, persistent organic pollutants and **endocrine disruptors**) to marine organisms. [12] In addition, there is great uncertainty about the possible effects of nano-sized plastic particles (particles smaller than 1 mm), which are capable of crossing cell walls.

The World Health Organisation (WHO) launched in March 2018 a review into the potential risks of plastic in drinking water. This initiative was triggered by the investigation by journalism organisation Orb Media that found plastic particles in many major brands of bottled water.

Microplastics **damage aquatic creatures, as well as turtles and birds:** They block digestive tracts, diminish the urge to eat, and alter feeding behaviour, all of which reduce growth and reproductive output. **90% of seabirds have fragments of plastic in their stomach**.[13]

Not capturing single-use plastic packaging material after use creates an **annual economic loss of $80-120 billion**[14]. This reflects the material value of plastic packaging that is disposed after a single use instead of being re-used.

2. POLICY FRAMEWORK

a. The international policy framework and Action Plans

With the recognition of marine plastic pollution as a global threat to the environment, society and economy, the topic became **increasingly present on the international agenda**. In the last years, the international community adopted a number of legislative initiatives against plastic pollution. These are either declarations at the global level or Action Plans, which are not legally binding, but contribute to build momentum to address the issue and demonstrate its importance on the global agenda.

The **Sustainable Development Goals** (SDGs), agreed by all Heads of States in 2015, aim to **significantly reduce marine debris by 2025** (SDG 14 "Life below water").

[10] Jambeck, J. (2015). Plastic waste inputs from land into the ocean. *Science* 347 (6223), 768-771.
[11] UNEP (2016). Marine plastic debris and microplastics – Global lessons and research to inspire action and guide policy change.
[12] FAO (2017). Microplastics in fisheries and aquaculture. Status of knowledge on their occurrence and implications for aquatic organisms and food safety.
[13] Alessi, E. et al. (2018). Out of the plastic trap: saving the Mediterranean from plastic pollution. WWF Mediterranean Marine Initiative.
[14] World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company. (2016). The New Plastics Economy — Rethinking the future of plastics. http://www.ellenmacarthurfoundation.org/publications).

In May 2016, the **UN Environment Assembly** (UNEA) adopted a resolution on Marine plastic litter and microplastics, encouraging and inviting to action from relevant actors. [15]

In 2017, the UNEA adopted another resolution[16] to eliminate plastic pollution. Although this resolution is not legally binding, it could pave the way for an international agreement on marine pollution, as discussions are going on.

The **Group of Twenty (G20**), the international forum of the world's 20 leading industrialized and emerging economies, adopted in 2017 an Action Plan on Marine Litter.

The **G7** (the 7 leading industrialized economies) adopted **two Actions Plans** to combat Marine Litter, in 2015[17] and 2018[18]. Although these plans are legally not binding, they were adopted by the Heads of States of the leading economies in fora that were created to guard financial stability, which reflects the multi-dimensional relevance of the topic.

Other international policy processes are also playing a role in reducing the impact of marine plastic litter in the environment, such as the **Convention on Biological Diversity** (CBD) and the International **Convention for the Prevention of Pollution from Ships** (MARPOL).

b. The regional policy framework

Under UNEP's Regional Seas Programme, initiated in 1974 as a global programme implemented through regional components, a number of **regional conventions and action plans** are important mechanisms against plastic pollution. The geographic focus of the Programme are 12 regional seas[19] with more than 140 coastal states and territories.

Following are some examples from Europe:

- In 2013, the **Mediterranean Region** became the first-ever to adopt a **legally binding Regional Plan on Marine Litter Management,** in the framework of the UN Environment/Mediterranean Action Plan of the Barcelona Convention (UNEP/MAP)[20]. The **Cooperation Platform on Marine Litter in the Mediterranean,** established in 2016, brings together stakeholders from academia, policymaking, industry, fisheries, research institutions and NGOs to facilitate the implementation of the Regional Plan.
- HELCOM (Baltic Marine Environment Protection Commission - Helsinki Commission): Regional action plan for the **Baltic Sea** on marine litter, adopted in 2015, with the aim of achieving a significant reduction of marine litter by 2025 and to prevent harm to the coastal and marine environment.
- OSPAR (Convention for the Protection of the Marine Environment of the **North-East Atlantic**), developed a Regional Action Plan for Marine Litter to be implemented between 2014-2021.
- The Commission on the Protection of the **Black Sea** against Pollution: Protocol on the Protection of the Marine Environment of the Black Sea from Land-Based Sources and Activities.

[15] http://wedocs.unep.org//handle/20.500.11822/13444
[16] UNEA Resolution UNEP/EA.2/Res.11 Marine plastic debris and microplastics 2017
[17] http://ec.europa.eu/environment/marine/good-environmentalstatus/descriptor-10/pdf/g7_abschluss_annex_eng_en.pdf
[18] 5 countries (Canada, France, Germany, Italy, and the U.K.) as well as the European Union signed the Ocean Plastics Charter, USA and Japan abstained.
[19] Baltic Sea, Black Sea, Caspian, East Asian Seas, Eastern Africa, Mediterranean, Northeast Atlantic, Northwest Pacific, Red Sea and Gulf of Aden, South Asian Seas, Southeast Pacific, and Wider Caribbean
[20] The Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean has 22 contracting parties.

c. National policy frameworks and legislative initiatives

An **increasing number of countries**, states, provinces, cities, municipalities, and institutions all over the world have been adopting policies and **measures to curb plastics use and pollution**.

More than **60 countries**[21] around the world have introduced **bans or taxes to curb single-use plastic**[22] waste.

Microbeads are also the subject of increasing restrictions in a growing list of countries, for example in UK.[23]

The number of policies **regulating plastic bags and Styrofoam products** at the national level increased steeply after 2015[24]. This is partially due to EU Directive 2015/720 which encourages member states to set reduction targets or adopt economic instruments to achieve a sustained reduction of ''lightweight'' carrier bags.

Plastic bags and, to a certain extent, foamed plastic products like Styrofoam have been the focus of government action so far, being the most visible form of plastic pollution. It is estimated that almost **10 million plastic bags per minute** are consumed worldwide. [25]

UNEP analysed in a recent report national plastic bag bans and concludes "*Plastic bag bans, if properly planned and enforced, can effectively counter one of the causes of plastic overuse. […] Public-private partnerships and voluntary agreements can be good alternatives to bans."*[26] The main factors that contribute to the effectiveness of bans are good enforcement and availability of affordable alternatives. If no alternatives are available, smuggling of and black markets for plastic bags may arise.[27]

Notable country examples

Africa is the continent with the largest number of countries (25) that instituted a total ban on the production and use of plastic bags. **Kenya and Rwanda** impose particularly steep fines and jail time on offenders. Key triggering factors for bans were threats to agricultural production, health concerns, contamination of water sources, killing fish and creating visual pollution.

In **Europe, France** is leading the way with a strict ban on non-compostable plastic bags, as well as on all single-use plastic cups, cutlery and plates by 2020.

The **United Kingdom** is working to ban plastic straws, stirrers and plastic earbuds. **Italy** banned plastic bags in 2011 — it has reduced its plastic bag consumption by more than 55 percent since then — and will soon ban plastic earbuds and microbeads in cosmetics.

In **North America**, regulations have been introduced mostly at the **state or city level**.

[21] UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability. Legislative initiatives until February 2018 were considered in the report.
[22] Single-use plastics (SUPs) are generally intended to be used only once and disposed of immediately thereafter. These include plastic bags, bottle caps, lids, straws, food containers and wrappers, coffee stirrers, cutlery, plastic water bottles, sachets, etc.
[23] Break free from plastics (2018): Stemming the plastic flood – increasing restrictions and prohibitions on single-use plastics (SUPs) worldwide.
[24] UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability
[25] UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability
[26] UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability, p. vii - viii
[27] UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability, p. viii

Costa Rica aims to ban **all single-use plastics** by 2021, becoming the first country in the world to do so.

India has announced intentions to **abolish single-use plastics** by 2022.

The **EU** released in January 2018 a **European Strategy for Plastics in a Circular Economy**[28], aiming that **all plastic packaging on the EU market will be recyclable by 2030**, the consumption of **single-use plastics will be reduced** and the intentional use of **microplastics will be restricted.** This strategy needs to be implemented by specific legislation. As a first step, in May 2018 the European Commission published a **draft directive on single-use plastics.** [29] This legislative proposal will be negotiated by EU Members States and afterwards transposed into national legislation.

To date, the most active group of NGOs engaged in influencing EU-legislation in Brussels is the Rethink Plastic Alliance, composed of ECOS, European Environmental Bureau, Environmental Investigation Agency (EIA), Friends of the Earth Europe, Seas at Risk, Surfrider Foundation Europe and Zero Waste Europe as coordinator. The World Wide Fund for Nature (WWF) is engaged via its offices in Brussels and Norway.

3. GLOBAL KEY PLAYERS, PROGRAMS AND INITIATIVES

UN Environment

Under the umbrella of UN Environment, the most comprehensive initiative is the Global Partnership on Marine Litter (GPML).

The GPML was launched in June 2012 as a voluntary, global multi-stakeholder partnership. It gathers international agencies, governments, NGOs, academia, private sector, civil society and individuals. It is the only global intergovernmental mechanism that addresses the connectivity between terrestrial, freshwater, and coastal and marine ecosystems.

GPML activities encompass policy work, awareness raising, clean-ups, coordination, education, monitoring, research and prevention. It published major studies[30] [31], and is organizing Massive Open Online Courses (MOOC) on Marine Litter with thousands of participants[32]. GPML partners contribute to activities in the form of financial support, in-kind contributions and/or technical expertise. The partnership seeks to achieve six objectives by 2025.[33] The Marine Litter Network is the on-line mechanism to facilitate collaboration among supporting partners. It collects the projects of network members, visualized by a global map.

As contribution to the GPML, in 2017 UN Environment launched the Clean seas campaign to address the root-cause of marine litter by targeting the production and consumption of non-recoverable and single-use plastic. The campaign also gives a platform to hundreds of local organizations, highlighting their work on marine litter.

[28] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN
[29] "Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the reduction of the impact of certain plastic products on the environment", available at https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1528883325261&uri=CELEX:52018PC0340
[30] UNEP (2016). Marine plastic debris and microplastics – Global lessons and research to inspire action and guide policy change.
[31] UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability
[32] https://sustainabledevelopment.un.org/partnership/?p=7471
[33] UNEP (2016). Marine plastic debris and microplastics – Global lessons and research to inspire action and guide policy change. pp. 128

Ellen MacArthur Foundation: New Plastics Economy

In 2016, the Foundation launched The New Plastics Economy, a three-year initiative to rethink and redesign the future of plastics, starting with packaging. Applying the principles of the circular economy, it brings together key stakeholders. The initiative is led by the Ellen MacArthur Foundation (EMF) in collaboration with a broad group of leading companies, the World Economic Forum, cities, philanthropists, governments, academics, students, NGOs, and citizens.

The initiative is supported by Wendy Schmidt as Lead Philanthropic Partner, MAVA Foundation, Oak Foundation, and players of People's Postcode Lottery (GB) as Philanthropic Funders. Amcor, The Coca-Cola Company, Danone, MARS, Novamont, PepsiCo, Unilever, and Veolia are the initiative's core partners.

The New Plastics Economy initiative is built on five areas of action.[34]

Successes of this initiative include two major reports[35][36] presented at the World Economic Forum in Davos, stakeholder workshops and significant media attention.

In 2018, a **major outcome** was the **commitment by fourteen international leading companies** to achieve **100% reusable, recyclable, or compostable packaging by 2025** or earlier.[37] Some environmental groups have criticised the announcements with "greenwashing", based on low probability that these voluntary commitments will be implemented and because of lacking timelines for implementation. However, at least among the other members of the initiative, companies need to report about steps taken towards implementation.

Building upon the New Plastics Economy initiative, in June 2018 the EMF announced the creation of a **new coalition of businesses and governments** to address the root causes of plastics pollution. Signatories and detailed commitments will be unveiled later this year.[38]

Related to the New Plastics Economy is the new initiative "Make Fashion Circular[39]", that aims, among other objectives, making materials renewable and safe. According to studies, washing synthetic clothes releases thousands of microplastic particles into the environment.[40]

International Union for the Conservation of Nature (IUCN)

IUCN is one of the key players against plastic pollution with several ongoing and concluded programmes in different regions. IUCN supports policy and programmatic action in the Baltic, the Mediterranean seas, Eastern and Southern Africa and Asia Pacific regions and produced several analytical pieces of work.

- Marine Plastics and Coastal Communities - MARPLASTICCS

In late 2017, with the support of the Swedish International Development Cooperation Agency (Sida), IUCN launched a 3-year initiative on marine plastics and coastal communities in the Indian Ocean and

[34] 1. Dialogue Mechanism, 2. Global Plastics Protocol, 3. Innovation, 4. Evidence Base, 5. Stakeholder Engagement
[35] World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company (2016). The New Plastics Economy — Rethinking the future of plastics.
[36] World Economic Forum and Ellen MacArthur Foundation (2017). The New Plastics Economy – Catalysing action.
[37] Amcor, Colgate-Palmolive, Ecover, evian, L'Oréal, Mars, M&S, Nestlé, PepsiCo, The Coca-Cola Company, Unilever, Walmart and Werner & Mertz
[38] https://newplasticseconomy.org/news/ellen-macarthur-foundation-to-form-coalition-of-leaders-to-create-circular-economy-for-plastics
[39] https://www.ellenmacarthurfoundation.org/programmes/systemic-initiatives/make-fashion-circular
[40] Napper et al. (2016) Release of synthetic microplastic plastic fibres from domestic washing machines: Effects of fabric type and washing conditions. Marine Pollution Bulletin Volume 112, Issues 1–2, 15 November 2016, Pages 39-45.

Asia Pacific regions. IUCN is supporting governments, industry and society in Mozambique, Kenya, South Africa, Thailand and Vietnam with knowledge, capacity, policy options and plans of action.

- Baltic solutions for plastic pollution

With the objective to create a map with hot-spots of plastic pollution concentration and main sources, IUCN is assessing the total plastic influx from Baltic riparian countries. The project seeks to demonstrate the impacts of plastic pollution in the Baltic region on climate change, biodiversity and food safety.

- PLASTIMED

This two-year project undertaken in the Mediterranean aims to advance the understanding of plastic fluxes from source to sea and help with the design of local and achievable solutions

4. BUSINESS SECTOR INITIATIVES (Plastic industry, Business associations, Innovations)

The **Global Plastics Alliance** is a collaboration of plastics producers and manufacturers worldwide.

In 2011, leaders from plastics associations around the world signed The Declaration of the Global Plastics Associations for Solutions on Marine Litter. As of December 2017 a total of **75 plastic associations in 40 countries** have voluntarily signed the Declaration and now operate as the Global Plastics Alliance (GPA). The Declaration sets objectives for industry action to achieve progress in reducing damage to the marine environment. Since 2011 **more than 355 marine litter solutions projects** have been planned, put into action, or completed.[41] **Projects range** from **enhanced recovery** (for example recycling of used agriculture film[42]), **pellet loss prevention**[43], promoting **best policies** (waste management)[44], raising **awareness** (eg. European Waste reduction week)[45], **research** (for example inventory of plastic products used in fishing[46]) and **spreading knowledge**[47].

The World Business Council for Sustainable Development (WBCSD), a global organisation made up of over 200 transnational corporations working towards sustainability in business practice, established a Roadmap for reducing Ocean Waste (ROW) based on a compelling business case for reducing ocean waste[48]. Goal of this programme is to encourage business leaders, especially those in plastics, packaging, consumer products and waste management companies, to prioritize ocean waste prevention in their corporate agendas. ROW is part of "Factor10", a global programme set up by the WBCSD in January 2018 to implement the circular economy.

World Economic Forum

The WEF hosts and facilitates the Platform for Accelerating the Circular Economy (PACE), plastic is one of the focus areas.[49]

The platform was launched in 2017 as a public-private collaboration, co-chaired by the CEO of Philips, the heads of the Global Environment Facility and UN Environment, with the Ellen MacArthur

[41] See a list of projects here: https://www.marinelittersolutions.com/projects/
[42] https://www.marinelittersolutions.com/projects/project-rafu-recycling-of-used-agriculture-films/
[43] https://www.marinelittersolutions.com/projects/preventing-pellet-loss/
[44] https://www.marinelittersolutions.com/projects/?location=all&objective%5B%5D=promoting-best-policies
[45] https://www.marinelittersolutions.com/projects/european-week-waste-reduction/
[46] http://www.pechpropre.fr
[47] https://www.marinelittersolutions.com/projects/?location=all&objective%5B%5D=spreading-knowledge
[48] WBCSD (2017). The business case for reducing ocean waste. Available at: https://www.wbcsd.org/contentwbc/download/3380/44205
[49] Other areas are electronics, food & bioeconomy and business model and market transformation across China, ASEAN, Europe and Africa.

Foundation, the International Resource Panel, Circle Economy and Accenture Strategy as knowledge partners. The Global Leadership Group currently includes over 40 CEOs, Ministers and heads of international organizations committed to leading a portfolio of projects and activities.

In 2018, the WEF also developed the New Vision for the Ocean (NVO) project that supports a range of initiatives and events from the public and private sectors to ensure the long term sustainable use of the Ocean. Designed as a PPP delivery mechanism to help advance SDG 14 ('Life Below Water'), the New Ocean Vision offers a platform for key industries to work together with government, civil society and the scientific community on implementation and accountability.

Nextwaveplastic

Initiative of the computer company Dell and led by Lonely Whale (US based NGO) to create a global ocean bound plastics supply chain, processing materials collected from river and coastal areas for use in products and packaging. Founding members include Bureo, GM, HermanMiller, Humanscale, Interface, Trek Bicycles, and Van De Sant.

The Bioplastic Feedstock Alliance (BFA)

The focus of BFA is to guide the responsible selection and harvesting of feedstocks—such as sugar cane, corn, bulrush, and switchgrass—used to make plastics from agricultural materials. BFA was created in 2015 by some of the world's leading consumer brand companies like The Coca-Cola Company, Danone, Ford Motor Company, Nestle, P&G, Unilever, The LEGO Group, McDonald's Corporation, and Target Corporation, together with WWF, and are supported by academic partners.

The Solar Impulse Foundation

Building upon the success of the first solar-powered flight around the world by Bertrand Piccard in 2016, the Solar Impulse Foundation is selecting 1000 solutions that protect the environment in a profitable way and awarding them the Solar Impulse Efficient Solution Label.

In the framework of the **World Alliance for Efficient Solutions**, established by the Solar Impulse Foundation, the Foundation launched with UN Environment a call for solutions to fight plastic pollution. Awarded companies are for example Greenrail that uses recycled plastic and end-of-life tyres as a material for railway sleepers, or Pellenc St, leader in the development of plastic sorting robots. The World Alliance collaborates with international institutions, states and cities around the world and is supported by companies such as Nestlé, Schlumberger, etc.

Project STOP was co-created in 2017 by SYSTEMIQ and Borealis, a global plastics producer, a EUR 4 million initiative to prevent plastic marine debris by accelerating waste management system in South-East Asia.

5. COALITIONS, CLEAN-UPS AND CAMPAIGNS

a. Coalitions

Break free from Plastics

A global movement envisioning a future free from plastic pollution. Since its launch in September 2016, over 1,060 groups from across the world have joined the movement to demand massive

reductions in single-use plastics and to push for lasting solutions to the plastic pollution crisis. Since OAK Foundation convened in 2015 a number of NGOs to improve collaboration, this group grew to 80 NGOs a year later and the break free from plastics movement started. The Plastic Solutions Fund was created that finances coordination, communication, individual projects and gives small grants.

Rethink Plastic Alliance

Alliance of European environmental NGOs that are part of the global Break free from plastics movement.

Plastic Pollution Coalition (PPC), established in 2009 as a US based non-profit, is a global alliance of more than 700 organizations, businesses, individuals and policy makers[50] in 60 countries working toward a world free of plastic pollution and its impacts.

The Friends of Ocean Action (FOA) is a global multi-stakeholder partnership comprised of committed and influential ocean leaders from the private, science and civil society sectors[51], set up in April 2018, to conserve and sustainably use the oceans, seas and marine resources. Plastic pollution is one of the work streams. FOA is co-chaired by **Ambassador Peter Thomson**, UN Special Envoy for the Ocean, and **Isabella Lövin**, Deputy Prime Minister of Sweden. FOA is supported by the Benioff Ocean Initiative at UC Santa Barbara and convened by the WEF in collaboration with the World Resources Institute.

b. Clean-ups

A multitude of projects and organizations worldwide dedicate their work to clean-ups. In the following, some examples are mentioned.

For over 30 years, Ocean Conservancy has worked to keep plastics out of the oceans, through organizing the International Coastal Cleanup, the world's largest volunteer effort on behalf of the ocean. The Ocean Conservancy also engages in partnerships with private companies, civil society, and governments through the Trash Free Seas Alliance, which has set a goal of reducing the flow of plastic into the ocean by 50% by 2025.

The Sea Cleaners

Construct a cleaning ship, the "Manta" to collect floating plastic macro-waste in 10 plastic waste hot spots before it degrades or disappears into the depths of the ocean. Starting in 2022, each of the targeted 10 waste-collecting ships aims to remove 20.000m3 of plastic per year. More than 7.500 donors contributed to the funding of the first cleaning ship.

The Ocean Cleanup

Founded by Dutch inventor Boyan Slat at the age of 18, his aim is to clean up the largest garbage patch in the North Pacific. The organization has raised more than $30 million to construct an ocean-sweeping machine that will be launched in September 2018.

Marine Litter Watch (MLW)

The European Environment Agency set up a web platform where communities in Europe can publish their clean-up activities to better connect citizens to their communities and report on data. The platform is open to NGOs, businesses, coastal communities (e.g. local clubs, associations, scouts), schools and universities, science and research, and public authorities.

[50] Find a list of members here: http://www.plasticpollutioncoalition.org/the-coalition/
[51] See full list of members here: https://www.weforum.org/friends-of-ocean-action/who-we-are

c. Campaigns

National Geographic launched in June 2018 the "Planet or Plastics?" initiative, a multiyear effort to raise awareness about the global plastic trash crisis.

The Plastic Soup Surfer

Campaigns against plastic pollution with surf boards constructed from plastic litter.

Microbeads campaigns

In the last years many organisations over the world (**Greenpeace, the Plastic Soup Foundation**, etc.) campaigned against the use of microbeads (tiny plastic particles usually smaller than two millimetres) in personal care or cleaning products. These campaigns showed effect in a number of countries (eg. UK) that introduced or are planning to introduce bans on these types of plastics.

6. KEY LEARNINGS AND GAPS TO "CLOSE THE PLASTIC TAP"

Experts agree that to solve the plastic problem a **set of solutions** is needed. In this spirit, most key players did not choose a single solution, but base their strategy on a **multiple approach**.

Solutions need to be found at each stage of the value chain of plastic, from **raw materials, manufacturing, consumption, to waste management**. **Policy solutions** and **ongoing research** is needed across the whole value chain. Actions to close the plastic tap should focus not only on implementing better waste management, but also on finding solutions **to redesign, reduce, remove, reuse, recycle and recover** ("6Rs" framework) plastic. Depending on the region, priority setting could be very different, for example investing in waste management infrastructure in the South-East Asia, or prevention in Europe or US where most fast-moving consumer goods companies are headquartered.

Approaches against plastic pollution across the value chain

RESEARCH			
POLICY SOLUTIONS			
Raw Materials	Manufacturing	Consumption	Waste management
•Alternative plastics	•Product redesign for re-use and for recyclability •Valorization of plastic waste as resource •Waste prevention	•Behaviour change •Change the throwaway culture	• Recycling •Improved waste management •Clean ups •"Waste to energy" and incineration

RAW MATERIALS: ALTERNATIVE PLASTICS

Manufacturers and scientists are working to find sustainable solutions replacing fossil-based plastic. These can be alternative plastics made from renewable materials, agricultural by-products or food waste, or different packaging solutions. However, more sustainable alternatives have proved controversial. UN Environment expressed its concerns (2015) that the label "biodegradable" may actually encourage littering and its chief scientist, Jacqueline McGlade, described biodegradable plastics as "well-intentioned but wrong" since those that end up the oceans do not have the right conditions to break down.

Researchers have developed 100 percent biodegradable plastics made with special bacteria, but it is very expensive. Most methods tend to rely on feeding plastic-producing bacteria with sugar derived from agricultural crops, like corn or beets that also feed people and animals. There is a risk of competing for limited agricultural resources and driving food prices up in the long term.

> *Sustainable alternative solutions need to be economically accessible, and not creating food insecurity or adverse environmental consequences. As the most common feedstocks for biomaterials are agricultural commodities, adopting responsible agricultural practices is key to mitigate the risks and impacts of bio-based plastics.*[52]

MANUFACTURING: PRODUCT REDESIGN

Today, producers of plastic articles and packaging have little or no incentive to take into account the needs of recycling or reuse when they design their products. Plastics are made from a range of polymers and are highly customised, with specific additives to meet each manufacturer's functional and/or aesthetic requirements.

Industry needs to design new plastic products that are more recyclable, for example **making unrecyclable packaging recyclable.** Governments, research institutions and industries also need to work collaboratively redesigning products, and rethink their usage and disposal, in order to reduce microplastics waste from pellets, synthetic textiles and tyres.

Mostly **industry sponsored initiatives, like the Ellen MacArthur Foundation**, or industry associations are working on solutions for this part of the value chain applying the principles of the circular economy.

Product redesign requires substantial changes in the value chain of many sectors. For example, although not the biggest contributor to plastic pollution, plastic is deeply embedded in **modern agriculture.** Plastic films help to retain moisture and heat, and suppress weed. The global demand for agriculture film was 4,410.3 kilo tons in 2012 and is expected to grow by 5.7% per year.[53] China is the main user of films. At the end of their lifetime plastic materials used for crop covering, soil mulching, packaging, containers, pots, irrigation and drainage pipes, may became a pollution source when improperly disposed, leaved on the ground or burned. Currently only about 10 percent of farm plastics are recycled.

> *Plastic packaging needs to be redesigned for recyclability. The example of agriculture films shows that the design needs to change in a way that allows finding a second market after its use in agriculture.*

[52] The Bioplastic Feedstock Alliance. (2015). White Paper "Responsible Bioplastics. Sustainable Sourcing and the Circular Economy"
[53] Transparency Market Research (2015). Agricultural Films (LDPE, LLDPE, HDPE, EVA/EBA, Reclaims and Others) Market for Greenhouse, Mulching and Silage Applications - Global Industry Analysis, Size, Share, Growth, Trends and Forecast, 2013 – 2019.

CONSUMPTION: BEHAVIOUR CHANGE

Biomaterials, recycling, improved waste management, will alone not be able to resolve the plastic problem, unless consumption is reduced. A general behaviour change is needed to avoid throwing things away after a single-use. For example, worldwide **one million of plastic bottles** are bought every minute. Education and awareness raising plays a major role, through campaigns and environmental education. **UN Environment**, for example, organizes MOOC on plastic pollution. Greenpeace developed a plastic footprint calculator.

Behavioural change can be promoted by introducing elements into educational curricula, or by providing educational and outreach materials targeted to specific interest groups (fishing industry, tourism) and age ranges.

WASTE MANAGEMENT: RECYCLING – INFRASTRUCTURE – CLEAN UPS – WASTE-TO-ENERGY

Current **recycling levels** are still very low on a global scale. Even if the recycling rates would be substantially increased, **only recycling will not solve the problem** with billions of tons of plastic already on the planet and more piling up. The source of the problem needs to addressed and the production of plastic waste slowed down, described as "closing the plastic tap" by experts. The **potential annual energy savings** that could be achieved from **recycling all global plastic waste** is estimated to be the equivalent of **3.5 billion barrels of oil** per year.[54] According to a report by GAIA and Zero Waste Europe, however, even the best available recycling technology, fully deployed, could only process a maximum of 53% of the current plastic mix.[55]

Plastic waste needs to be re-evaluated as a resource to avoid that it goes to waste.

While waste prevention is key, **improving waste collection and management** is the most urgent **short-term solution** to reducing plastic inputs, especially in developing economies. 90% of marine plastic pollution comes from 10 rivers which are all in developing countries; two in Africa and eight in Asia.[56] Because of lacking infrastructure and insufficient waste management, waste ends up in rivers and eventually in the sea. Investments in improved waste management is mostly done by the **World Bank[57] and regional development banks**, like the Asian Development Bank (ADB) or European Investment Bank (EIB), but there are also partnerships involving business and philanthropic funders, for example the **Trash Free Sea Alliance** by the Ocean Conservancy.

The Mediterranean is considered the sixth greatest accumulation zone for marine litter: this sea holds only 1% of the world's waters, but concentrates **7% of all global microplastics[58]**. According to UN Environment/MAP[59], the countries that dump most plastics into the Mediterranean Sea are Turkey (144 tonnes/day), Spain (126), Italy (90), Egypt (77) and France (66). With the recent Chinese import ban on waste, including plastic, there will be more pressure for some European countries to find recycling and waste management solutions. UNEP/MAP is a key player for waste management in Mediterranean countries, developing policies and legislation for plastic waste management, research projects on marine hot spots and awareness raising campaigns to reduce marine littering behaviour.

Clean-up activities are a **short-term necessity** to tackle the symptoms of the plastic pollution crisis, but they do not address the root causes. According to the Ellen MacArthur Foundation, more than 8

[54] Rahimi, A., & García, J. M. (2017). Chemical recycling of waste plastics for new materials production. Nat. Chem. Rev. 1, 0046.
[55] GAIA & Zero Waste Europe (2018). Recycling is Not Enough: It's Time to Rethink How to Solve the Plastic Waste Crisis.
[56] Schmidt, C., Krauth, T., & Wagner, S. (2017). Export of Plastic Debris by Rivers into the Sea. Environmental Science & Technology
[57] Since 2000, the World Bank has invested over $4.5 billion to help improve more than 300 solid waste management programs to reduce pollution leakage, including plastics, into the environment.
[58] Suaria, G. et al. (2016). The Mediterranean Plastic Soup: synthetic polymers in Mediterranean surface waters. Sci. Rep., 6, 37551.
[59] UNEP/MAP (2015). Marine Litter Assessment in the Mediterranean.

million tonnes of plastic enter the ocean each year, yet the three biggest clean-ups deal with just 0.5% of that pollution. According to UNEP (2016), "*the need for clean-up actions will unfortunately still be there, and even increase in many areas*". Clean-ups also represent the major source of information concerning the amounts and types of marine litter.

Clean-up activities should prioritize the clean-up of vulnerable areas and be combined with analysis of the collected waste.

Increasingly common in Europe, and more and more in the USA, are municipal "**waste-to-energy" incinerators**. But critics contend that these large-scale incinerators tend to discourage recycling and lead to greater waste. Plastics are particularly attractive for burning, as they are made with petroleum and generate more energy when incinerated than almost any other material.[60]

Burning plastic is also known to release harmful dioxins into the air. Waste-to-energy proponents say state-of-the-art plants filter out such toxic air pollution, but opponents believe even the best plants do not filter out all toxics and are major contributor to CO2 emissions.

RESEARCH

To date, there have been no studies of the **effects of microplastic consumption on human health**. Carrying out studies will be difficult—observational, population-based studies will be open to confounding, while experimental studies will be ethically impractical.

Recently, the UK government launched a £20m research fund to tackle plastic pollution.[61] This announcement comes just a few weeks after the creation of £**61-million Commonwealth fund to tackle plastic pollution**, with around one third also ear-marked for research. [62]

The gap in studying the effects of microplastic consumption on human health needs to be filled, despite the challenges this entails.

POLICY SOLUTIONS

Policy solutions are key to address the source of the problem in order to prevent plastic waste. Examples for policy measures to counter the over-use of plastic could be:

- A **global plastic tax** on every kilo of plastic resin manufactured. The tax could be used to finance waste management systems in developing nations.
- An **international agreement on plastics** following the model of the Paris Climate Agreement with binding reduction targets. Such an instrument can be categorized as a long-term solution, as more momentum is needed for countries to start negotiating a new treaty and negotiations would need approximately seven years.
- Regional (for example EU) or national **binding targets for reduction of plastic waste** and for use of recycled plastic.
- **Plastic bag bans**, and **bans on single-use plastic**, properly planned and enforced.
- **Extended producer responsibility** schemes (EPR) that require plastic producers to fund and manage recycling and disposal of their products (similar to existing EPR laws for electronic products in the US and Europe).

[60] https://e360.yale.edu/features/incineration_versus_recycling__in_europe_a_debate_over_trash
[61] http://www.climateactionprogramme.org/news/uk-government-launches-20m-research-fund-to-tackle-plastic-pollution
[62] https://resource.co/article/61-million-commonwealth-fund-tackle-plastic-pollution-12559

UN Environment developed a roadmap for policymakers how to curb single-use plastics. [63]

Supporting organizations engaged in policy work around one of the above-mentioned instruments is critical to close the plastic tap. At the regional level, the EU draft directive on single-use plastics[64], offers a medium-term opportunity to contribute to plastic reduction.

7. ACKNOWLEDGEMENTS

I would like to thank Karlijn Steinbusch and Martijn Meijer (Adessium Foundation), João Sousa (IUCN), and Francesca Cenni (UNEP, Basel Rotterdam Stockholm Convention Secretariat), who provided insight and expertise that greatly helped compile this review, although they may not agree with all of the interpretations. Further I want to express my thanks to Florence Rossetti (Fondation Primat) for discussing the issue and her feed-back.

8. REFERENCES

Alessi, E. et al. (2018). Out of the plastic trap: saving the Mediterranean from plastic pollution. WWF Mediterranean Marine Initiative. Available at: http://www.wwf.eu/media_centre/publications/?uNewsID=329098#

Break free from plastics (2018): Stemming the plastic flood – increasing restrictions and prohibitions on single-use plastics (SUPs) worldwide. Available at https://www.breakfreefromplastic.org/reports/

Ellen MacArthur Foundation (2016). The New Plastics Economy: Rethinking the future of plastics. Available at https://www.ellenmacarthurfoundation.org/publications/the-new-plastics-economy-rethinking-the-future-of-plastics

Ellen MacArthur Foundation (2017). The new plastics economy: Rethinking the future of plastics & Catalysing action. Available at http://www.ellenmacarthurfoundation.org/publications

FAO (2017). Microplastics in fisheries and aquaculture. Status of knowledge on their occurrence and implications for aquatic organisms and food safety. Available at http://www.fao.org/in-action/globefish/fishery-information/resource-detail/en/c/1043135/

GAIA & Zero Waste Europe (2018). Recycling is Not Enough: It's Time to Rethink How to Solve the Plastic Waste Crisis. Available at http://www.no-burn.org/wp-content/uploads/Recycling-is-Not-Enough-online-version.pdf.

Geyer, R. et al. (2017). Production, use, and fate of all plastics ever made. *Sci*. *Adv*., 3(7), e1700782.

Jambeck, J. (2015). Plastic waste inputs from land into the ocean. *Science* 347 (6223), 768-771.

Napper et al. (2016) Release of synthetic microplastic plastic fibres from domestic washing machines: Effects of fabric type and washing conditions. Marine Pollution Bulletin Volume 112, Issues 1–2, 15 November 2016, Pages 39-45.

Rahimi, A., & García, J. M. (2017). Chemical recycling of waste plastics for new materials production. Nat. Chem. Rev. 1, 0046.

[63] UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability, page ix

[64] "Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the reduction of the impact of certain plastic products on the environment", available at https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1528883325261&uri=CELEX:52018PC0340

Schmidt, C., Krauth, T., & Wagner, S. (2017). Export of Plastic Debris by Rivers into the Sea. *Environmental Science & Technology.* DOI: 10.1021/acs.est.7b02368

Suaria, G. et al. (2016). The Mediterranean Plastic Soup: synthetic polymers in Mediterranean surface waters. Sci. Rep., 6, 37551.

The Bioplastic Feedstock Alliance. (2015). White Paper "Responsible Bioplastics. Sustainable Sourcing and the Circular Economy" Available at http://bioplasticfeedstockalliance.org/bioplastics/BFA_Responsible_Bioplastics.pdf

Transparency Market Research (2015). Agricultural Films (LDPE, LLDPE, HDPE, EVA/EBA, Reclaims and Others) Market for Greenhouse, Mulching and Silage Applications - Global Industry Analysis, Size, Share, Growth, Trends and Forecast, 2013 – 2019. Available at https://rahul28feb86.files.wordpress.com/2013/10/agricultural-films-market-for-greenhouse-mulching-and-silage-applications-global-industry-analysis-size-share-growth-trends-and-forecast-2013-20191.pdf

UNEP (2016). Marine plastic debris and microplastics – Global lessons and research to inspire action and guide policy change. Available at https://www.unenvironment.org/resources/report/marine-plastic-debris-and-microplastics-global-lessons-and-research-inspire-action

UNEP (2018). SINGLE-USE PLASTICS: A Roadmap for Sustainability. Available at https://www.unenvironment.org/resources/report/single-use-plastics-roadmap-sustainability

UNEP/MAP (2015). Marine Litter Assessment in the Mediterranean. Available at http://web.unep.org/unepmap/marine-litter-assessment-mediterranean-2015-0

World Business Council for Sustainable Development (2017). The business case for reducing ocean waste. Available at https://www.wbcsd.org/contentwbc/download/3380/44205

World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company (2016). The New Plastics Economy — Rethinking the future of plastics. http://www.ellenmacarthurfoundation.org/publications

World Economic Forum and Ellen MacArthur Foundation (2017). The New Plastics Economy – Catalysing action. Available at http://www.ellenmacarthurfoundation.org/publications