



The challenge of plastics in the oceans

Highlights from
the Veolia Institute Foresight
Committee's 2018 annual meeting

The Veolia Institute

Thinking together to illuminate the future

Conceived as a platform for discussion and collective thinking, the Veolia Institute has been exploring the future at the interface between society and the environment since its foundation in 2001. Drawing on its connections to the global intellectual ecosystem, it facilitates multi-stakeholder analysis to explore emerging trends, particularly the environmental and societal challenges for the decades ahead.

Over the years, the Veolia Institute has built up a network of intellectual and scientific experts, universities and research bodies, NGOs, international organisations around the world. The Institute pursues its mission through its high-level publications and conferences, its foresight working groups and its diversified network of experts.



Foresight Committee meeting - October 2018

Harvey Fineberg, Andrew Morlet, Patrick Labat, Julien Boucher, Maria Luiza Pedrotti, Romain Troublé, Fanny Arnaud, Nicholas Stern, Philippe Kourilsky, Mamphela Ramphele, Lucy Woodall, Jean-Pierre Tardieu, Pierre-Marc Johnson, Dinah Louda.

Editorial



The Foresight Committee of the Veolia Institute is there precisely to contribute to foresight approaches related to the environment.

We are dead set on addressing environmental issues from both a science based approach and a public policy and citizens' involvement approach in a context of sustainable development philosophy. We probe major sustainable development issues with a multidisciplinary approach, engaging actors from science, industry, public policy and civil society. As part of this commitment, its recent annual meeting addressed the issue of plastics and the oceans with an invited panel of international experts from various disciplines.

We were able to discuss quantitative assessments of the amount of plastics produced and their reuse or disposal in many forms. We were mostly confronted with staggering assessment of both the future mass produced and as well as that disposed of in the future, particularly as it relates to oceans. An estimated 8 million tons of plastics leak annually into the oceans. Plastics are essentially non-biodegradable: it takes hundreds of years for a plastic bottle to break down. The mass considered for these, if changes do not occur in production, use and disposal, are phenomenal : it has been projected that by 2050 the mass of plastic in the oceans may exceed the mass of marine life.

The obvious ocean surface and coastal waste of plastics objects are nuisances aesthetically, obtrusive for navigation and leisure with considerable impacts on the attractiveness of coastal tourism: according to the UN, plastic waste costs a minimum of US\$13 billion in damage to marine ecosystems annually.

More importantly the sheer amount of sinking plastics, hardly biodegradable in the seas, represents potential destruction of ocean ecosystems, transportability of diseases and introduction in the food chain. Ocean plastic is estimated to kill millions of marine animals every year, from plankton to whales. The potential impact to human health is currently unknown; the possibility that toxic chemicals may be entering the food chain cannot be disregarded.

It is thus important from a foresight perspective to encourage more science as to the effects of disposal of massive amounts of plastics in the oceans. However, an important message to come out of this meeting is that the solutions are not in the sea: the plastic "bleeding" must be stopped on land. Therefore, it is also opportune and relevant to address now the necessity of the diminution of such waste thru re-use and even non waste producing design in many industrial sectors of products, moving from our throwaway society towards to a circular economy approach.

Pierre-Marc JOHNSON

*Chair of the Foresight Committee, former Prime Minister of Québec,
Of Counsel Lavery attorneys Montreal.*

The Foresight Committee

Drawing on the expertise and international reputation of its members, the Foresight Committee guides the Veolia Institute and steers its development. Each year, during its annual meeting, it invites a multidisciplinary panel of experts (academics, politicians, scientists, economists, etc) to engage in discussion on a given topic.



Harvey FINEBERG

President of the Gordon and Betty Moore Foundation

“ Transforming the throwaway society requires broad public engagement, more than just conveying messages but instilling values. ”



Pierre-Marc JOHNSON

Chair of the Foresight Committee, former Prime Minister of Québec, Of Counsel Lavery attorneys Montreal

“ Public opinion may be faster to espouse certain stringent policies, ... even if it is out of disgust rather than science. ”



Philippe KOURILSKY

Emeritus Professor at the Collège de France, Honorary Director General of the Pasteur Institute

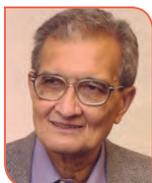
“ This is science which involves systems and complexity. I am almost sure that the 21st century will be the century of complexity. ”



Mamphela RAMPHELE

Former Managing Director of the World Bank

“ We are talking about organising the science, but why do we not stop the bleeding? We as human beings are generating this problem. ”



Amartya SEN

Economist, Nobel Prize 1998, Professor at Harvard University

Absent from this meeting



Nicholas STERN

IG Patel Professor of Economics and Government, London School of Economics and Chair of the Grantham Research Institute on Climate Change and the Environment

“ My guess is that the time is ripe for an inter-governmental panel on oceans. ”

The invited experts

To explore the theme of plastics and oceans, the Foresight Committee assembled the following international panel of experts, whose diverse backgrounds and experiences brought a range of perspectives to the table:



Lucy WOODALL

Principal Scientist,
Department of Zoology,
University of Oxford

“ Plastic is ubiquitous. It is a sad statement, because our world is very big, but everywhere we have looked for plastics we have found them. ”



Maria Luiza PEDROTTI

Researcher, National Center
for Scientific Research (CNRS)
and Scientific Coordinator of
Tara Expeditions Foundation

“ It is not possible to clean the ocean. The solution is not in the sea; the solution is on land. ”



Romain TROUBLÉ

Executive Director,
Tara Expeditions Foundation

“ In four years, we took 40 000 samples from the surface down to 700 metres. We collected plastic everywhere. ”



Julien BOUCHER

Director of EA, an innovation and
eco-design center and expert
to the International Union for
Conservation of Nature (IUCN)

“ We need to be able to forecast and to use metrics to guide design decisions, industry decisions and policymaking regarding plastics. ”



Andrew MORLET

Chief Executive,
Ellen MacArthur Foundation

“ We need to find new and innovative ways of mobilising global responses that are not dependent on the traditional methods and organisations. ”



Patrick LABAT

Senior Executive Vice President,
Northern Europe Zone,
Veolia

“ The problem of recycling is really a problem of cost, and the more we think about eco-design, the easier the recycling loop will be. ”



Marine plastics are ubiquitous, but their impacts are currently poorly understood.

Presentation by Lucy Woodall, Oxford University

Plastics are ubiquitous in our oceans. Ranging in size from large items to microplastics, they can be observed along coasts and in the middle of oceans, at the surface and on the sea floor—in fact, the abundance of microplastics in the seabed is around four orders of magnitude greater than at the sea surface. So what are the impacts of all these plastics?

There is not a simple answer to this question. While **many potential risks** have been identified, measures of actual risk must also take into account the probability of exposure to that risk—and currently, there is **very little data** on which to base estimates of that probability. The most quantifiable impacts are the socioeconomic ones, which are visibly already occurring, and come with a sizeable price tag—such as reduced tourism. Many potential **biological risks** have been identified, particularly risks to individual organisms. These include **ingestion of plastics** by marine organisms; this certainly occurs, and there is some evidence from laboratory studies that when worms are fed microplastics they have reduced energy, but the reason for this is not yet known; and notions of how this might affect the worm population as a whole, or how it might affect humans via the food chain, are largely speculation. Rafting, in which microbes or larger fauna “hitch a ride” by attaching themselves to plastic debris, has the potential to transport species long distances, into previously uncharted territories. This might result in **spreading disease**, or causing **functional shifts in ecosystems**; but again, **solid data is lacking**. A recent study in *Science* has shown that when corals come into direct contact with plastics, the probability of disease can increase from 4% to 80%; this is striking, but again, the reason for it is not yet understood.

Until better, more comprehensive data is available, **it is very difficult to have a meaningful discussion** about the impacts of ocean plastics, particularly when we are talking about impacts at the level of ecosystems, not just individuals.

Discussion of the committee

How do we better coordinate research efforts?

“Clearly, if we wish to understand the impacts of plastic pollution, a vast amount of **primary research** needs to be done; and **it needs to be coordinated globally**. Currently there are **several obstacles** to this, including competition between researchers for limited funding, a lack of common methodologies for plastics research, and the inherently multidisciplinary nature of the work required. Indeed, the coordination required **extends beyond scientific communities, to include industry and the economy**. Nicholas Stern posited that “**the time is ripe**” for an **intergovernmental panel on oceans**, analogous to the IPCC for climate change: “...at bottom it is a global commons problem, so you will need some kind of international structure, formal or less formal, and you will need a lot of resources.””



tara
PACIFIC

Cleaning the oceans is not a solution: our focus must be on stopping pollution on land.

Presentation by Maria Luiza Pedrotti and Romain Troublé, Tara Expeditions Foundation

The **Tara Expeditions Foundation** is committed to collecting scientific data about the oceans, and also to outreach, education and advocacy. Since 2010, Tara has been carrying out a **global study of plankton and plastics**. The scientific team has developed a standardised methodology for collecting samples, and separating plastic from plankton based on physical parameters such as fractal dimension and circularity.

In the Mediterranean, they collected eight million plastic samples per square kilometre in some areas—the vast majority being polyethylene and polypropylene, which are associated with single-use packaging. In some places, **plastics outnumbered plankton**. The potential for transfer through the food chain was identified: many microplastics were observed to be the same size as the zooplankton that are eaten by filter feeders such as fish. Since plastics contain additives such as phthalates and bisphenols, which are endocrine disruptors, this raises the possibility of **potential health implications for humans**, at the other end of the food chain. Another observation was that five billion plastic particles are transported in ocean vectors, and that they are able to transport benthic species and bacteria into new environments. There are **potential ecological consequences** to this introduction of alien species and perhaps pathogens to the Mediterranean. Other missions, in the North Sea, have observed that bacteria of the genus *Vibrio* are often attached to plastics. Since this is the genus that includes cholera-causing strains, the **potential risks for spreading disease are clear**. After leaving the Mediterranean, Tara recently crossed the Great Garbage Patch, where it was observed that plastic outnumbered plankton by the ratio of 5:1.

The take-home message is that cleaning plastics out of the ocean is an impossible task: they are **ubiquitous**. The focus for action must be on land, through **reducing use of plastics, changing consumer behaviour, improving waste collection and recycling procedures, and creating truly biodegradable materials**.

Discussion of the committee

A multitiered approach to stopping plastics entering the ocean

“The clear message to come out of the Tara expeditions is that cleaning plastics out of the ocean is impossible: they are everywhere. Hence, the focus for action must be on land: as Mamphele Ramphele put it, we need to “**stop the bleeding**”. To achieve this, **policies that outlaw polluting behaviour**—such as littering—are unquestionably part of the solution; as are economic incentives for industries to develop alternatives to plastics, and for consumers to adopt them. However, there is also evidence that **simple, immediate actions can have significant consequences**: in Australia, placing more bins on beaches has reduced coastal plastic litter by as much as 70%. As Lucy Woodall argued, “There is not one solution; we need a suite of solutions. We can add more bins tomorrow, but we cannot change government tomorrow. It is about looking at it along a time scale.”

The challenge of measuring plastic pollution: understanding better our plastic footprint.

Presentation by Julien Boucher, EA & IUCN

Until recently, life cycle assessments have not accounted directly for plastic leakage into the oceans—only for indirect pollution associated with plastic, such as CO₂ emissions. To address this oversight, EA—an environmental management consultancy firm, which carries out life cycle assessments of products and guides companies towards better design—has begun developing the appropriate metrics for measuring the “**plastic footprints**” of products.

This involves estimating the leakage in the various stages of product life cycle: production, conversion to product, use, and waste. Leakage during production and conversion to product tends to be unintentional leakage of primary microplastics; leakage during use is either loss of fishing gear, or leakage of microplastics from cosmetics; and it is in the waste stage that we find all the single-use plastics, which are designed to be thrown away. Leakage itself can be subdivided into loss from the activity, which is product-dependent—for example, loss rates from textiles are in the order of 500 mg per kg of textile washed, and from tyre abrasion are around 1g of rubber per 10 km driven—and release into waterways, which is infrastructure-dependent: in a **perfectly managed waste system, there need not be any release at all**. Knowledge of the plastic footprint of a product can **help companies identify “hotspots” of plastic leakage**, which can show them where they should prioritise efforts to improve. Currently, however, there are many uncertainties in the estimates used to produce a plastic footprint.

Often, data is unavailable; for example, rates of littering cannot be measured, and there is insufficient data for precise estimates of loss due to mismanaged waste. Sometimes data exists, but not in a useful form; for example, a lot of field data reports numbers of plastic items rather than the weight of the plastic. Finally, data is not standardised—different databases present different waste statistics.

Discussion of the committee

Public opinion as a catalyst for action

“The need to gather **better data concerning the impacts of plastics**, but also to take **immediate action** to reduce plastic waste, might seem to be antithetical objectives. However, lack of data need not be an obstacle to action; according to Philippe Kourilsky, the fact that we still don’t know whether plastics are toxic could actually provide useful political impetus, “... because people are so sensitive to the issue of health.” More generally, there may be value in **leveraging public awareness** of the marine plastics issue to influence industry, because industries are conscious that “if people see their products in the ocean, it will be a disaster for their brands” (Julien Boucher). Certainly, there is ever growing public awareness of plastics in the ocean, and this awareness comes **not from rational analysis** of data, **but as an emotional response** to stories and images. As Harvey Fineberg put it, “We know that [such] memorable events ... can be profoundly effective.”

How do we stop plastic leakage ?

Presentation by Patrick Labat, Veolia

In order to keep plastics from entering the ocean, **we need to improve the rate of recycling**. Recycling requires a pure stream of a polymer. This can be complicated, particularly in household collections, which contain many different types of plastic item. Sometimes a single item contains more than one polymer: for example, a polyethylene (PET) drink bottle may have a lid made from polypropylene (PP), which makes the recycling process extremely complicated and hence expensive.

Another issue is coloured plastics: it is expensive to separate plastics on the basis of colour; and any mixture of different coloured plastics will always end up brown. These points can be addressed through eco-design: for example, a drink bottle designed with recycling in mind would be made from a single, light-coloured polymer. **Eco-design** also adds an **incentive to manufacturers**, in that they are able to advertise that their product is **eco-friendly**. Such incentives are particularly important because in purely economical terms there is currently a disincentive for manufacturers to use recycled materials: it is cheaper to use virgin materials.

The issue of **incentivising the use of recycled materials** is therefore a key direction for future action. Recycling industrial products is relatively easy because the purity of the stream is easier to control. The Albert Heijn supermarket chain in the Netherlands recycles its blue plastic trollies to create blue plastic benches for its customers, which again boosts the reputation of the brand by providing visible evidence of its environmental action. Another way of incentivising recycling is **adding value to the recycled material**. This could be as simple as offering 15c to return a PET bottle to a store. In developing countries, Veolia works with informal plastic collectors by offering a piece rate for pure items, which provides income for the collectors and value to Veolia in terms of the purity of the stream. An interesting potential use for recycled plastics is currently being explored: **plastic roads**. A demonstration bicycle path has already been constructed: it is light, easy to unload, and is fabricated with pipes and cables built in. It will be important to measure leakage of microplastics due to abrasion; but the **potential market is huge**.

Discussion of the committee

Financial (dis)incentives and legislation

“A key aspect of increasing recycling rates is **identifying the appropriate incentives**, both at the level of consumers and at the level of industry. It is encouraging to note that quite small incentives—or disincentives—can effect **substantial behavioural change**: in Germany, where consumers are rewarded 15c for returning PET bottles, collection rates are at 90%; and in England, usage of plastic bags has dropped by 85% since the introduction of a 5p charge. Veolia’s practice of **rewarding informal collectors in developing countries** clearly incentivises the collection of pure polymers, but it has a downside: all other items will be left behind. Patrick Labat stresses that **legislative solutions** need to be applied in parallel: “Part of the solution is to ban what cannot be recycled.” In a similar fashion, Nicholas Stern foresees a possible way to **incentivise eco-design**: “If you can do it well, then you can tax the badly-designed. The more we can measure well, the better we can tax, and use quite small tax incentives.”



Towards a new plastic circular economy

Presentation by Andrew Morlet, Ellen MacArthur Foundation

The prevailing economical model is **linear**: products are created from new raw materials, which are used and then thrown away. The **Ellen MacArthur Foundation (EMF)** has a mission to transform this linear model into a **circular model**, in which products and materials are kept within the economy for longer. There are various ways to do this: recycling is one, as are reusing products, using them for longer, redistributing them, sharing and remanufacturing. It has established a **global common vision** called the **New Plastics Economy**. Working with industry, they have created **ambitious commitments**: currently, at least 16 companies have committed to the packaging of their products being 100% recyclable, compostable or reusable by 2025.

The technical details of how to reach the goal have not been worked out, but there are essentially **three strategies**. The first is to **redesign packaging** to correct troublesome design elements, such as fly-away lids or elements that hamper recycling. Approximately 30% of packaging would benefit from redesign. Another 20% of packaging should be reused, such as containers for household cleaning items. The final 50% should be recycled; again, better design will make this easier. To address the design aspects, EMF is targeting product designers around the world. They have offered prizes for innovation, and have developed a circular design guide.

Fundamentally, EMF has framed the plastics issue as an **innovation opportunity**. To communicate this positive message, they are **building relationships** with media companies and celebrities. Recently, they teamed up with Stella McCartney to launch a report on the use of plastics in fashion. This is an area with potentially catastrophic impact: 60% of the materials used in clothing are plastics, and coupled with the current trend of fast fashion, in which we buy more clothes, use them less and dispose of them faster, the volume of materials leaking into the environment is extremely high. This is a **huge challenge** for the fashion industry, because it is not a question of packaging the product—it is the product itself that is the problem.

Discussion of the committee

Innovation and cultural change

“The case of fashion highlights several key points. The first is the **need for innovation**—not just of new materials (for example, to replace the plastics that currently comprise 60% of fabrics); but also of **new technologies, new markets and new business models**. As Andrew Morlet put it, “When we talk about innovation, it is also about pre-competitive industry collaboration, to explore the ways in which we can create new markets to enable new economies to form.” The business model for fashion needs to be completely restructured, shifting to an emphasis on better clothing, and less of it. **Digital tools** may become part of the solution: just as Airbnb and Uber have transformed business models in the fields of accommodation and transport, new digital clothing companies, such as Y Closet, are starting to appear. This leads into the most important point, which was neatly summed up by Harvey Fineberg: “We are really, at heart, talking about **cultural change**. We are talking about norms that have to be really transformed, and this requires **broad public understanding, engagement and communication**, more than just conveying messages but **instilling values**.””



Main takeaways

We need scientific, political and economic cooperation to save our oceans

Coordinate research efforts on oceans to inform public policy

It is clear that more data is needed to sharpen our understanding of the impacts of plastics in the ocean, in order to inform and motivate policy decisions. Research should be prioritised towards the most “worrying” questions, such as the extent to which plastics are toxic, and the potential for plastics to spread pathogens.

To facilitate this research, the way in which science is organised should be improved—for example, by developing standardised methodologies to measure plastic pollution and its impacts, ensuring data is shared rapidly, and creating avenues for citizen science involvement.

With these aims in mind, following this meeting, the Foresight Committee has launched a call for action addressed to research institutions, including the French CNRS, to focus greater research efforts on the impacts of plastics in the oceans.

Establish an international governmental body on ocean pollution

In a similar vein, there is a need to establish an intergovernmental panel on oceans, to assess the science related to ocean pollution. Such a panel would be analogous to the Intergovernmental Panel on Climate Change (IPCC), providing policymakers with regular assessments of ocean pollution, its impacts and future risks, and strategies for reducing the amount of plastic leakage.

Accelerate deployment of a circular economy

However at the same time, immediate action is required to “stop the bleeding”; and there is certainly enough data available to make a start. For example, it is already clear that some countries have inadequate waste management systems, and that the packaging sector is a major cause of leakage. This can be addressed through eco-design of products and packaging, which would not only increase the efficiency of recycling, but also has the potential to influence behavioural leakage, such as littering.

Incentives are required to encourage better consumer behaviour and better industry practice. Although individuals are unlikely to voluntarily pay more for a more ecologically-sound product, public awareness of plastics in the ocean can effect change in industry practices. Industries are already experiencing a reputational incentive to improve product design, and to be seen to be disposing of waste and excess stock in ecologically appropriate ways, even when these actions cost more money.

The reputational incentive could and should be supported by government regulation, and by taxes on bad design. Most importantly, cultural change is required to change consumption patterns and to transform the “throwaway society”.

The Veolia Institute:
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and societal foresight

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to illuminate the future*

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