Scientists Expose The Truth Behind the Plastic 'Crisis' - Greenpeace Co-Founder: The 'sea of plastic is a fiction. The ultimate in Fake News'

New report by team of scientists debunks the media and Greenpeace hyped 'plastics crisis'

An independent report by Dr. Michael Connolly, Dr. Ronan Connolly, Dr. Willie Soon, Dr. Patrick Moore and Dr. Imelda Connolly

Excerpted from new report: 'Greenpeace wants a piece of your green'

Released During the UN Climate Summit in Katowice Poland (COP 24)

December 14, 2018

"One Word: Plastics." Yes, just 51 years after the 1967 film "The Graduate", "plastics" just may be the future of environmental scares, eclipsing the man-made climate scare. But this "plastics crisis" attempts to make people "feel guilty and worried about a 'crisis' which isn't actually real," according to a blockbuster new report by a team of international scientists.

There is evidence that some climate activists are seeking to elevate the plastic 'crisis' above the climate 'crisis.' Former Vice President Al Gore's producer of his 2006 film "An Inconvenient Truth," — Hollywood eco-activist Laurie David — has been test-marketing the plastic eco-scare.

David has touted the plastic crisis over man-made climate fears. "Plastic waste is in some ways

more alarming for us humans than global warming," David wrote in 2009.

"The rapid rise in global plastic production is leading to a rise in plastic pollution and its devastating effects on our oceans and our lives.," Laurie David wrote.

"This insidious invasion of the biosphere by our plastic waste is in some ways more alarming for us humans than global warming. Our bodies have evolved to handle carbon dioxide, the nemesis of global warming, indeed, we exhale it with every breath. Plastic, though present in the biosphere from the nano scale on up, is too stable a molecule for any organism to fully assimilate or biodegrade. So we have a situation in which a vector for a suite of devastating chemicals, chemicals implicated in many modern diseases, is now invading the ocean, our bodies and indeed, the entire biosphere. The prognosis for improvement in this situation is grim."

In recent years, the plastic 'crisis' reached a new level of hysteria, reaching a crescendo in 2018.

See: Plastic over concern prompts 'Single-use' to be the 2018 Word of the Year (2017 Word of the Year was 'fake news')

Starbucks Bans Plastic Straws, Winds Up Using More Plastic in New Cup Lids

Plastic shopping bags may be going the way of lead paint and other banned products

Stossel: False claim of '500 million straws used daily' came from a 10-year-old's elementary school project – But media uncritically repeats

But Greenpeace founding member and Ecologist Dr. Patrick Moore -- who has turned against the organization -- responds to the plastics scare:

"What I don't get is why it is assumed that a bit of plastic in your digestive tract is probably 'harmful.' This is the same plastic nearly all our food is packaged, transported, stored, and often served in. It is essentially inert and with the main exception of PVC, which contains chlorine, is made of 100% carbon and hydrogen. And because it is so inert it goes right through us like a small pebble or the cellulose in a kernel of corn.

Now the 'sea of plastic garbage' is the 'size of Alaska.' Last month it was 'the size of Texas' yet no satellite photo has been presented because the sea of plastic is a fiction. The ultimate in Fake News."

The new report finds that "Greenpeace is deliberately misleading the public by fabricating a fictional 'crisis.' and "the infamous 'oceanic garbage patches' are not nearly as dramatic as people think."

"It is making people feel guilty and worried about a 'crisis' which isn't actually real," the new report notes.

> *The report finds: "The Greenpeace narrative is largely fabricated, and is based on cherry-picked distortions of the scientific literature."*

"Some scientists are genuinely concerned about the fact that concentrations of 'microplastics' in some parts of the oceans are relatively high. However, the concentrations that they are talking about are relatively modest, e.g., a few hundred fragments per square mile in the worst regions," the report concludes. "Also, the average sizes of these plastic fragments are very small, e.g., less than 1/16 inches in diameter...Despite this, Greenpeace has been actively misleading the public to create the perception that there are massive floating 'islands' filled with plastic bottles, plastic bags and other plastic debris," the report notes. "They are deliberately misleading the public by fabricating a fictional 'crisis' and trying to turn it into an excuse to abandon 'single use plastics."

Greenpeace has been hyping the alleged plastci "crisis" and are using it as "an excellent excuse to blame the western world for their 'overconsumption,'" according to the new report. "They decided to start campaigning for 'Zero Waste' and insisting that we needed to completely stop using 'single use plastics' to protect the oceans."

"Where exactly the plastic is coming from. Greenpeace and others are implying that the developed world is to blame (particularly Europe and North America), but several studies have now confirmed that the problem lies almost entirely with certain developing nations – chiefly in Asia."

Greenpeace, some media channels, and other environmental activist groups (and to be fair, some scientists too) have used these alarming-sounding names to ridiculously exaggerate the phenomenon, and create the completely false impression that there are these horrendous floating "islands" of our plastic waste somewhere "out there"...

Greenpeace's latest campaign on "the plastics crisis" is having the following effects:

It is making people feel guilty and worried about a "crisis" which isn't actually real.

It is prompting people, governments and businesses to implement radical reforms without thinking through the consequences.

It is hampering efforts to evaluate and deal with the genuine "ocean plastic pollution" concern.

In addition, "despite Greenpeace's repeated claims, we now know that the ingestion of plastic particles by seabirds doesn't seem to be having any ill effects on the birds," the

report notes.

This new report examines whether or not the Earth is experiencing a plastic “crisis” and the scientific finding is a resounding ‘No’.

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Excerpted from a larger report: “Analysis of Greenpeace’s business model & philosophy”

An independent report by Dr. Michael Connolly, Dr. Ronan Connolly,
Dr. Willie Soon, Dr. Patrick Moore and Dr. Imelda Connolly (December 2018)

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Excerpt:

> In 2015, they announced that they were going to start prioritising a new sub-campaign of the "Oceans" campaign – campaigning against "Single Use Plastics", which they claimed were responsible for a new crisis: "ocean plastic pollution". This relatively new campaign seems to have been remarkably popular for them, and other like-minded groups have joined in with them to help create a widespread public concern that the Western world's usage of "single use plastics" is causing a catastrophic "ocean pollution crisis".

In Section 5, we will show how this "ocean pollution crisis" has been invented by Greenpeace through the deliberate distortion of the work of well-meaning environmentalists looking at a similar- sounding, but very different, issue which Greenpeace are intentionally misrepresenting.

5. Case study of their latest big campaign: the "plastics crisis"

The existence of floating and sunken human-generated debris in the oceans has been talked about for centuries or even millennia, and it has often featured as a key component of our stories, e.g., with stories of castaways sending "messages in bottles", and underwater explorers hunting for "sunken treasure". However, in the last few years, there has been a new and widespread, rapidly growing, public concern that our everyday use of plastics is leading to a major environmental threat to our oceans and the creatures that live in or near the oceans.

This "plastics crisis" has become a major news story. For instance, in June 2018, National Geographic dedicated a special issue to it, entitled "Planet or Plastic?", while a recent BBC documentary series, "Blue Planet II" which dedicated its final episode to "the plastics crisis" was the most-watched TV programme in the UK in 2017. It was estimated that at least 20% of households in the UK watched the series.

As we will discuss in this section, there are two very distinct "ocean plastic pollution" narratives – one is a genuine environmental concern that is based on on-going scientific research, the other one is the narrative promoted by Greenpeace. The Greenpeace narrative is largely fabricated, and is based on cherry-picked distortions of the scientific literature. The "solutions" that Greenpeace are promoting for their "crisis" have very little relevance for the genuine "ocean plastic pollution" concern. Moreover, in several cases, Greenpeace have actually been fighting against the efforts of those trying to address the genuine concern. Yet, Greenpeace's narrative is the one which the public are concerned about.

As a result, Greenpeace's latest campaign on "the plastics crisis" is having the following effects:

- It is making people feel guilty and worried about a "crisis" which isn't actually real.

- It is prompting people, governments and businesses to implement radical reforms without thinking through the consequences.
- It is hampering efforts to evaluate and deal with the genuine "ocean plastic pollution" concern.
- It is generating increased annual turnover for Greenpeace.

For these reasons, it is worth looking in detail at the two competing narratives on "ocean plastic pollution".

5.1. The actual "ocean plastic pollution" issue

Over the last decade or so, several research groups have begun to realize that tiny fragments of plastic ("microplastics") are present in non-zero concentrations in most of the ocean basins. Since plastics are a human invention, we can directly attribute the existence of these microplastics in the oceans to human activity. For this reason, several scientists have been actively trying to answer the following questions:

1. Exactly how high are the concentrations of these "microplastics" (as well as larger "macroplastic" fragments)? Are the concentrations evenly distributed, and are they increasing over time?
2. Are they having any biological effects (positive **or** negative) on ocean life, and what are those effects?
3. Where exactly are these microplastics coming from?
4. If they are a problem or even a potential problem, how could we prevent their concentrations from increasing, and ultimately reduce their concentrations?

In this section, we will provide a brief review of the current scientific opinion on several of these issues, but broadly we can summarise the current answers to those questions as follows,

1. For most of the oceans, the concentrations of "microplastics" are basically negligible. But, in some regions (particularly the "North Pacific Gyre"), you can find a few hundred tiny fragments per square mile. Despite Greenpeace's claims, large "macroplastics" from land, e.g., plastic bottles, plastic bags, etc., are exceedingly rare.
2. So far, nobody has found any evidence that these microplastics are having negative impacts on ocean wildlife. But, "absence of evidence is not the same as evidence of absence". So, research into answering this is still ongoing.
3. Much of the plastic seems to come from marine debris such as lost or abandoned fishing nets, tackle, etc. However, the rest seems to come from mismanaged land waste. Current estimates suggest that about 85% is coming from developing nations in Asia (China, Indonesia, etc.), but about 7-8% seems to be coming from developing nations in Africa, and most of the rest seems to be coming from regions in South America and Central America.

4. The concentrations of ocean plastics are far too small – even in the so-called "oceanic garbage patches" – to make it feasible to collect it with current methods, although the Ocean Cleanup Project are investigating possible technological solutions which they believe could make it possible in the future. However, the most straightforward solution to stop or slow down the increase in ocean plastic pollution would be to improve the waste management systems of the coastal developing nations. Despite Greenpeace's insistence that the developed nations are somehow to blame, the combined contribution of all the countries in Europe and North America is estimated to be less than 1-2%. So, if the developing nations along the coasts of Asia (and to a lesser extent, Africa and South America) were to reduce their mismanaged waste to the levels of European and North American countries, then this would probably resolve most of the issue.

5.1.1. The infamous "oceanic garbage patches" are not nearly as dramatic as people think

When researchers first began seriously considering the possibility that plastic debris could be accumulating in the oceans, it was quickly realised that the ocean currents tend to push floating debris towards certain parts of the oceans ("gyres") over time. These gyres cover quite a large part of each ocean basin, e.g., 5-10% of the ocean, but within them the concentration of plastic debris seems to be at least 10 times the concentrations in the rest of the ocean. Because of this aggregating effect, some (sensationalist) people began to refer to these large oceanic regions with dramatic-sounding names, such as the "Great North Pacific Garbage Patch".

Greenpeace, some media channels, and other environmental activist groups (and to be fair, **some** scientists too) have used these alarming-sounding names to ridiculously exaggerate the phenomenon, and create the completely false impression that there are these horrendous floating "islands" of our plastic waste somewhere "out there".

Admittedly, there are **some** scientists – particularly those who have worked with Greenpeace - that are happy to leave this false impression uncorrected, as it creates more attention for their field. However, most of the scientists actively studying the issue are frustrated about the grossly-exaggerated claims that are being made about it. For instance, one of the researchers studying the "North Pacific Garbage Patch" is Prof. Angelicque (Angel) White, who is based in the College of Earth, Ocean and Atmospheric Sciences at Oregon State University. She is researching the phenomenon, because she is concerned about it and thinks that it is something we should be investigating. However, she has repeatedly tried to let the public know that this "crisis" is nowhere near as dramatic as the media (and Greenpeace) have made it out to be. E.g.,

> "There is no doubt that the amount of plastic in the world's oceans is troubling, but this kind of exaggeration undermines the credibility of scientists. [...] We have data that allow us to make reasonable estimates; we don't need the hyperbole. Given the observed concentration of plastic in the North Pacific, it is simply inaccurate to state that plastic

> outweighs plankton, or that we have observed an exponential increase in plastic. [...] The amount of plastic out there isn't trivial. But using the highest concentrations ever reported by scientists produces a patch that is a small fraction of the state of Texas, not twice the size. [...] If we were to filter the surface area of the ocean equivalent [of the amount of plastic found to the amount of water in which it was found] to a football field in waters having the highest concentration (of plastic) ever recorded, the amount of plastic recovered would not even extend to the 1-inch line." – Oceanic "garbage patch" not nearly as big as portrayed in media, Prof. Angelicque White, January 4, 2011.

Or,

> "The use of the phrase 'garbage patch' is misleading. I'd go as far as to say that it is a myth and a misconception. [...] It is not visible from space; there are no islands of trash; it is more akin to a diffuse soup of plastic floating in our oceans. [...] Yes, there is plastic in the ocean. Peer-reviewed papers suggest that the highest concentration of microplastic is around three pieces of plastic the size of a pencil eraser in a cubic meter. [...] The continued use of verbage such as 'plastic islands', 'twice the size of Texas', is pure hyperbole that I personally believe undermines the credibility of those that should be focused on helping reduce the source stream of marine debris to our oceans." – Prof. Angelicque ("Angel") White, interviewed by The Telegraph, October 5, 2016

Similarly, NOAA stress on their website that these "garbage patches" are nowhere near as dramatic as they sound:

> "The name "Pacific Garbage Patch" has led many to believe that this area is a large and continuous patch of easily visible marine debris items such as bottles and other litter—akin to a literal island of trash that should be visible with satellite or aerial photographs. This is not the case. While higher concentrations of litter items can be found in this area, much of the debris is actually small pieces of floating plastic that are not immediately evident to the naked eye." – What is the Great Pacific Garbage Patch?, NOAA National Ocean Service

5.1.2. How much plastic is really there, and how big are these plastic pieces?

At this stage, a number of different studies have been carried out in each of the oceans, where research vessels voyaging along a particular route will drop a trawling net for a period of time (say 10-15 minutes, half-an-hour, or longer) and continue on the journey (but at a slower rate). Then, once the time is up, the net is lifted and the contents of the net are categorised. This is typically repeated at fixed intervals along the voyage. All of these surveys have confirmed that the concentration of plastic fragments is at least 10 times higher in the "gyres" than in the rest of the ocean. Separately, computer models of ocean circulation patterns that have been fed with

experimental observations predict that the gyres should occur roughly where we are finding them.

The figure below is taken from a paper by Prof. Andrés Cózar from the Universidad de Cádiz in Spain and colleagues, Cózar et al. (2014). The areas shown in gray and dark gray are the locations of the five gyres predicted by one of the computer models, i.e., Maximenko, Hafner & Niiler (2012). The dots show the locations of the various trawls in the study. In the Cózar et al. (2014) study, some of the dots are taken from other studies, but they have all being converted into the same units (grams of plastic per km^2). We can see that the red, yellow and green dots are almost all in or near the dark gray parts, i.e., the gyres. These are the so-called "ocean garbage patches". The blue dots are regions where no (or very few) plastic fragments were found. We can see that this corresponds to the rest of the ocean.

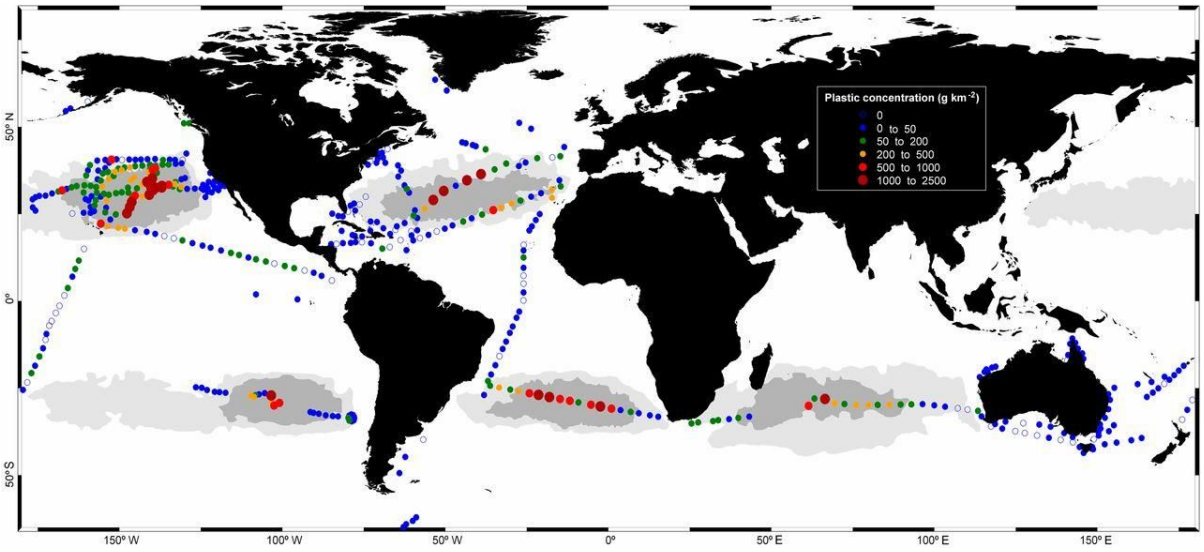


Figure taken from Cózar et al., 2014, PNAS 111 (28) 10239-10244; https://doi.org/10.1073/pnas.1314705111

So, the existence of these gyres is a real phenomenon, and we can see why scientists are actively studying them. We can also see why environmentalists might be concerned about the fact that these relatively high density regions exist. But, it is important to put into context exactly how much plastic we're talking about.

Below is a **magnified** photograph showing every single one of the plastic fragments taken from one of the "red circle" trawls on the Cózar et al. (2014) study. The actual size of the black sheet in the photograph is about 1.6 inches long by 0.8 inches tall. That is, the entire collection *when spread out* like below only occupied 1.3 square inches. If the plastic was all collected into a small pile, it wouldn't even fill a thimble.

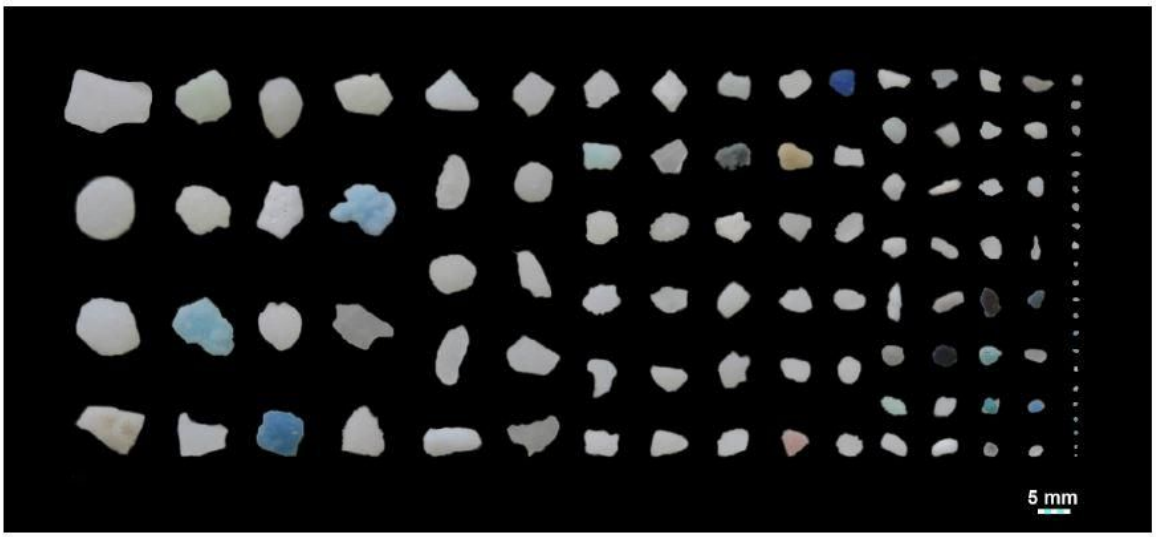


Fig. S11. Plastic fragments sampled on the ocean surface. This photography corresponds to the plastic items collected in a net tow in the South Atlantic Gyre.

Figure taken from Cózar et al., 2014, PNAS 111 (28) 10239-10244; https://doi.org/10.1073/pnas.1314705111

This trawl was one of the highest density trawls – right in the heart of one of the so-called "Oceanic Garbage Patches". They found 106 pieces. Each trawl in this study lasted 10-15 minutes, and covered between 0.4 and 0.9 miles. The largest fragment they found on that particular trawl was less than 1/16 of an inch in diameter. The claims being promoted by Greenpeace and others that these "Garbage Patches" consist of high densities of actual plastic bottles, plastic bags, etc. are completely false!

The next point to note is that the concentration of plastic in most of these gyres doesn't seem to be significantly increasing over time. This is an ongoing scientific puzzle, but it suggests that for most ocean basins, the issue is not a particularly urgent "crisis". However, the largest of the "Garbage Patches" is the one in the North Pacific, and the concentrations *there* do seem to be significantly increasing over time. This brings us to the question of where exactly the plastic is coming from. Greenpeace and others are implying that the developed world is to blame (particularly Europe and North America), but several studies have now confirmed that the problem lies almost entirely with certain developing nations – chiefly in Asia

5.1.3. Where is this plastic coming from? Mostly Asian and African countries

A lot of the plastic in the oceans (particularly the larger "macroplastics") seems to be fishing-related marine debris from fishing vessels, trawlers, etc. That is, lost or abandoned fishing nets, ropes, etc. Estimates vary from 20-80% of the plastics. However, chemical analysis

of the microplastics suggests that most of the rest of the plastic comes from mismanaged land waste that somehow got washed into the oceans.

Initially some researchers suggested that high GDP countries in Europe and North America might have been a big contributor to the ocean microplastics, since these countries use a lot of plastic. However, there now have been several peer-reviewed papers that have attempted to quantify the likely origins of the mismanaged land waste. The results are unanimous in showing that Europe and North America are **not** to blame! It is true that these countries use a lot of plastic, but their waste management systems and infrastructure have become good enough that almost none of the waste plastic ever reaches the oceans. Instead, the problem seems to lie with certain developing coastal nations whose waste management is not good enough to prevent plastic from entering the oceans.

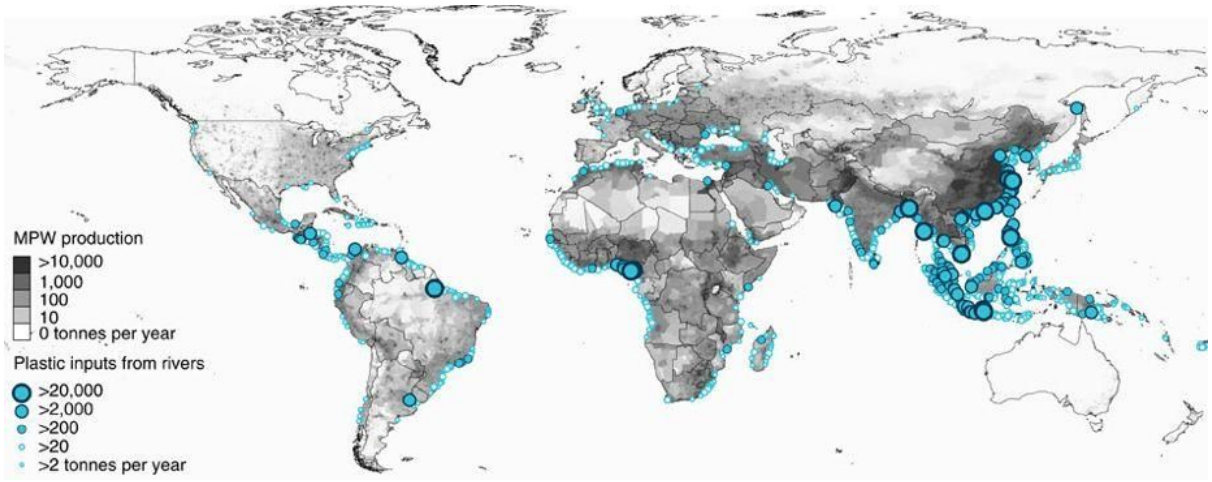
One of the first major attempts to quantify the sources was Jambeck et al. (2015) – a study which was widely covered by the media, e.g., Wall Street Journal, Feb 12, 2015. The Jambeck et al. article is paywalled, but various copies of the paper can be found online, e.g., here. Below are their estimates of the 10 biggest contributors to the ocean plastics:

Rank	Country	Region	% of world's mismanaged waste
1	China	Asia	27.7%
2	Indonesia	Asia	10.1%
3	Philippines	Asia	5.9%
4	Vietnam	Asia	5.8%
5	Sri Lanka	Asia	5.0%
6	Thailand	Asia	3.2%
7	Egypt	Africa	3.0%
8	Malaysia	Asia	2.9%
9	Nigeria	Africa	2.7%
10	Bangladesh	Asia	2.5%

In comparison, they estimate that the United States only contribute to 0.9% of the mismanaged waste, and the E.U. about 1%.

More recently, the research team of the Ocean Cleanup Project (which we mentioned earlier) have carried out a more detailed breakdown which was published in the journal Nature Communications: Lebreton et al. (2017). This study confirms that the United States and Europe are not to blame. In fact, they suggest that the North American and European contribution is **even less** than Jambeck et al. (2015) had estimated.

The Lebreton et al. (2017) estimates are shown below:



Lebreton et al. (2017)'s estimates of the mass of river plastic flowing into oceans in tonnes per year. Taken from Lebreton et al., River plastic emissions to the world's oceans, Nature Communications, Vol. 8, 15611 (2017). https://doi.org/10.1038/ncomms15611. Image is used under Creative Commons Attribution 4.0 license.

They estimate that the mismanaged plastic waste that is entering the oceans is as follows:

- Asia = 86% (of which China contributes more than half)
- Africa = 7.8%
- South America = 4.8% (mostly being discharged from the Amazon River)
- Central and North America = 0.95% (as can be seen from the map above, most of this comes from Central America, and the U.S. contribution is relatively small)
- Europe = 0.28%
- Australia/Pacific region = 0.02%

As discussed earlier, once the plastic enters the oceans, the ocean currents tend to aggregate into the various "gyres". Therefore, most of the Asian waste ends up in the North Pacific gyre, while the mismanaged waste from the eastern South American and south-western African countries tends to aggregate into the South Atlantic gyre. These are the two biggest "oceanic garbage patches" of the five.

5.2. Greenpeace's version of the "crisis"

5.2.1. Trying to turn it into an excuse to abandon "single use plastics"

In the previous section, we established that there is a genuine concern over the presence of non-trivial concentrations of microplastics in some regions of the oceans. So far, there has not been any evidence to show that these microplastics are having a net negative impact on ocean life. However, because it is a relatively new phenomenon, it is worth investigating carefully. Moreover, because leakage of mismanaged plastic waste from some developing nations (chiefly

in Asia) is leading to an increase in these concentrations (particularly in the North Pacific gyre), we should be working to help those countries to improve the waste management systems.

Now, let us consider how Greenpeace has taken this genuine concern and distorted it into a major global **panic** that the western usage of 'single use plastics' is allegedly causing a catastrophic 'ocean plastic crisis'.

Although Greenpeace are themselves a very successful business (as we saw in Section 1) that relies heavily on marketing, advertising and free market principles, they promote socialist and anti-capitalist ideals in their marketing. In particular, they argue that the world's population is too large, and that both "overconsumption" and "economic growth" are non-sustainable. They endorse anti-capitalists such as Naomi Klein, e.g., here and here. In turn, Naomi Klein has been a vocal supporter of Greenpeace (and related groups, e.g., Friends of the Earth and Sierra Club), e.g., here, or here.

With that in mind, when Greenpeace heard of the initial dramatic sounding terms such as "Giant North Pacific Garbage Patch", they thought this would be an excellent excuse to blame the western world for their "overconsumption". They decided to start campaigning for "Zero Waste" and insisting that we needed to completely stop using "single use plastics" to protect the oceans.

For instance, in their 2007 report they claim,

> "While the above measures are important at preventing or reducing the problem of marine debris, the ultimate solution to waste prevention is to implement a responsible waste strategy, namely the concept of "Zero Waste". Such a strategy encompasses waste reduction, reuse and recycling as well as producer responsibility and ecodesign. Ultimately, this would mean reduction of the use of plastics and synthetics such that they are only used where absolutely necessary and where they have been designed for ease of recycling within existing recovery infrastructure. It is possible that biodegradable plastics could be used where plastic was deemed necessary but could not be seen as an environmentally sound alternative unless they are known to break down rapidly to non-hazardous substances in natural environments." – Plastic Debris in the World's Oceans, Greenpeace, 2007.

However, they soon began to acknowledge amongst themselves that these "pacific garbage patch" terms were misleading. For instance, in a 2011 report by the Greenpeace Science Unit (which is based on the campus of the University of Exeter in the UK), they admitted that the emotionally-charged terms bear almost no resemblance to reality:

> "The term "Pacific trash vortex" suggests an entire region covered by a large, obvious and easily visible patch of floating litter, one that could be detected from satellites or through aerial photography - in extreme terms, a "literal blanket of trash" (NOAA 2010). In reality -

> despite numerous relatively large items of debris, visible to observers on vessels or even from low-flying aircraft - these conspicuous items only rarely form larger agglomerations in the open ocean." – "The Pacific Trash Vortex: one symptom of the global marine plastic debris problem", Greenpeace Science Unit, 2011.

Despite this, they felt it was still too juicy a concept not to use it to generate a new "crisis" from. So, they kept on preparing it as one of their new campaigns. By 2015, they seem to have felt they were finally ready to start promoting their narrative in a big way. Indeed, they highlighted it in the foreword of their 2015 Annual Report as one of the big issues they were going to start pushing,

> "A striking example of how threatening we humans have become for our own life-supporting systems is **plastic pollution in the ocean**. We produce over 300 million tons of plastic every year. That is equivalent to the combined weight of all the adult humans on Earth. Between 25 and 35 million tons of this plastic ends up in the ocean – **annually**. And once it is there it stays there. In 2015, the ocean contained 1 ton of plastic for every 3 tons of fish. If this rate of pollution continues, by 2050 the amount of plastic in the ocean is expected to match the amount of fish by weight. The ocean and the creatures living in it are literally choking on plastics." – Greenpeace International 2015 Annual Report. [The bold emphasis was in the original].

They then began actively promoting their narrative that this "crisis" was due to the western world's widespread usage of "single-use plastics". They are clearly aware that this is not the case, since they frequently cite studies such as the Jambeck et al. (2015) paper we discussed in Section 5.1.3 in their reports, such as their 2015 report, "Time to ban single-use plastics and protect oceans".

And on their websites, the "solutions" they propose all focus on us "reduc(ing) our plastic footprint" and campaigning to reduce our usage of specific "single-use plastic" items such as plastic straws and plastic utensils, e.g., "7 things you can do to create a plastic free future".

In 2016, Greenpeace teamed up with several other NGOs promoting this "zero waste" narrative to form a collective organization called Break Free From Plastic (BFFP). See this Greenpeace press release. Some of the other groups are Zero Waste Europe, Surfrider Foundation, Oceana, Story of Stuff, Global Alliance for Incinerator Alternatives (GAIA) and Seas at Risk. Many of these groups have further ties with Greenpeace. For instance, in 2014, Annie Leonard, the founder of the Story of Stuff group was made the Executive Director of the USA branch of Greenpeace.

5.2.2. Tie-in with BBC's Blue Planet 2 documentary series

In late 2017, the BBC launched a very emotionally powerful documentary series narrated by the well-loved wildlife presenter, Sir David Attenburgh, called Blue Planet II (a sequel to an earlier popular BBC documentary series from the 1990s). The final episode of the series was dedicated almost exclusively to promoting Greenpeace's narrative about their alleged "plastic crisis". For instance, below is an extract from the opening scene:

> "For years, we thought that the oceans were so vast, and the inhabitants so infinitely numerous that nothing we could do could have an effect upon them. But, now we know that was wrong. The oceans are under threat now – as never before in human history.
>
> [...] But is time running out? Many people believe that our oceans have reached a crisis point. So, just how fragile is our Blue Planet? [*opening theme music begins*]" – Sir David Attenborough, BBC Blue Planet II, episode 7 (of 7), Season 1.

The series was remarkably popular in the UK, and actually became the most watched TV series in the UK in 2017 (beating Strictly Come Dancing, etc.). It is estimated that 20% of the British population watched it. It so far hasn't been as widely seen internationally, but according to the New Yorker, it has had about 3 million viewers in the US, and according to the Independent, it was viewed by about 80 million in China during a streaming event.

The film-makers seem to have been totally on-board with Greenpeace's approach of using emotionally-charged, but deliberately misleading, footage (see Appendices) to make people concerned, alarmed and ultimately angry. For instance, in one scene, they describe a famous incident in 1992 when a freight trailer filled with yellow ducks and other plastic toys accidentally broke and fell into the ocean. After mentioning the incident, they show footage of a pile of yellow ducks floating in the ocean, creating the false impression that a) the "yellow ducks" are still floating there, and b) they had actually found and filmed the original ducks.

The scriptwriters were careful not to explicitly state that these were the original ducks, and argue that this was just "for effect" (The Independent, Dec 3, 2017). But, once you realise (as the Blue Planet II scientific advisors did) that the average size of the plastic debris that is been talked about is less than 1cm in diameter (see Section 5.1), then it is clear that even showing this carefully staged footage "for effect" was deliberately misleading.

However, despite being clearly misleading to anybody familiar with the actual issues which we discussed above (Section 5.1), the series seems to have been remarkably influential in making the British public panicked and angry about Greenpeace's distorted "plastics crisis". For example, here is an extract from the current Wikipedia page about the series:

"The programme has been credited with raising awareness of plastic pollution both domestically and internationally, an influence dubbed the 'Blue Planet effect'.

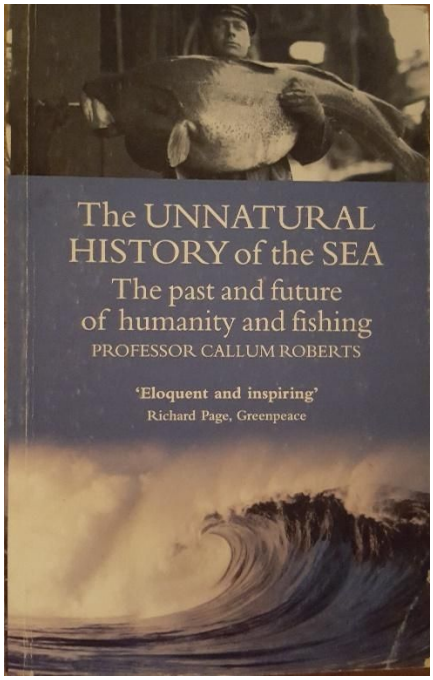
Following the programme's airing in the UK, the BBC announced its intention to completely ban single-use plastics within its organisation by 2020. In April 2018, in response to growing public support directly linked to Blue Planet II, the British government announced it is considering a national ban on single-use plastic products. It was also reported that Queen Elizabeth II's decision to ban plastic bottles and straws across the Royal estates was in part a response to the documentary." – Wikipedia https://en.wikipedia.org/wiki/Blue_Planet_II

Although the documentary series was marketed as a joint collaboration between the BBC and Open University, and Greenpeace were not **officially** involved with the series, when we look at the CVs and bios of all three of the scientific advisors that were not from the Open University group, we can see that they each have strong ties with Greenpeace. The three (non-Open University) "Academic Consultants" listed in the credits to the series were:

1. Callum Roberts
2. Alex Rogers
3. Steve Simpson

All three of these scientists seem to be closely related to Greenpeace:

1. Prof. Callum Roberts, University of York has written guest articles for Greenpeace, e.g., "Guest blogger Callum Roberts: Future oceans", 26 July 2012. He has acted as a reviewer for Greenpeace reports, e.g., https://www.greenpeace.org/international/press-release/6878/sustainable-fish-from-major-consumer-brands-linked-to-arctic-destruction/. As can be seen below, the review on the front cover of the 1st paperback edition of his 2007 book, "The unnatural history of the sea" is from a Greenpeace spokesperson:



Prof. Roberts also has promoted Greenpeace (among other similar NGOs) when asked what people should do if they are concerned about the oceans, e.g.,

"[Interviewer]: What can someone do to help the ocean, even if they don't live on the coast or interact with it directly on a regular basis?

Callum Roberts: There are many ways to help. Top of my list would be to learn more about the oceans and what we are doing to them and spread the word. Check out some of the great organisations dedicated to protecting life in the sea, like SeaWeb, Rare, WWF, Oceana, **Greenpeace**, Sea Shepherd, The Black Fish, Client Earth, Blue Ocean Institute and the Ocean Conservancy, among many others. Each has their own distinctive way of doing things, so with a little digging you can find a close match to your own interests and philosophy. **Most depend on the generosity of philanthropists for support so if you can give even a little it will help**. Alternatively, get involved by volunteering." – "Five Questions for Callum Roberts, Author and Professor", July 2012, interview with Smithsonian Institute [Emphasis added in bold]

2. Prof. Alex Rogers is a Professor of Conservation Biology at the University of Oxford. But, as he explains on his faculty website, he has "...also worked for other NGOs including the WWF, Greenpeace and the Deep-Sea Conservation Coalition" and on his research website, "My work has applied aspects and I have undertaken projects for [...] and for non-governmental organisations (NGOs) including Greenpeace, the Pew Foundation, The World Wildlife Fund for Nature and The Deep-Sea Conservation Coalition.". He has also contributed to Greenpeace press

releases, e.g., "Greenpeace launches campaign to create 'largest protected area on Earth' – as Antarctic nations fall short on marine protection" – Greenpeace UK, 27th October 2017

3. Prof. Steve Simpson in the Biosciences Department in the University of Exeter does not appear to have worked **directly** for Greenpeace. However, he has been very vocal in promoting the claims in the documentary about the "microplastics crisis", e.g., here and here. Several of his colleagues in the Bioscience Department (Dr. Ceri Lewis; Prof. Tamara Galloway; and Dr. Matthew Cole) have this as one of their main research projects: see here. The University of Exeter has also recently announced plans "to become 'plastic free' by 2020".

We do not know **exactly** how much direct contact Prof. Simpson has with Greenpeace. However, we note that the Greenpeace Scientific Unit is also based on the University of Exeter campus. Also, it is clear that Greenpeace has considerable influence in the Biosciences Department where Prof. Simpson is based. For instance, Dr. David Santillo, one of Greenpeace's senior scientists who has been a co-author on all of their publications on the "plastics crisis" and "microplastics crisis" since at least 2011, is also an Honorary Research Fellow in the Biosciences Department.

5.3. What is wrong with Greenpeace's narrative on plastics?

5.3.1. They are deliberately misleading the public by fabricating a fictional "crisis"

As we discussed in Section 5.1, some scientists are genuinely concerned about the fact that concentrations of "microplastics" in some parts of the oceans are relatively high. However, the concentrations that they are talking about are relatively modest, e.g., a few hundred fragments per square mile in the worst regions. Also, the average sizes of these plastic fragments are very small, e.g., less than 1/16 inches in diameter.

Despite this, Greenpeace has been actively misleading the public to create the perception that there are massive floating "islands" filled with plastic bottles, plastic bags and other plastic debris. For instance, we saw how they influenced the BBC documentary makers of the Blue Planet II to promote this false narrative.

As another example, in April 2018, Greenpeace worked with Ogilvy & Mather advertising agency to create a new ad to promote their narrative on "the plastics crisis". See here for a summary. For the ad, they replaced one of the displays in Dingle Oceanworld Aquarium in Ireland with a display containing large plastic bottles, beer can holders, plastic bags etc. They then filmed a group of school children visiting "the exhibit" and watched their upset reactions. The text for the ad then consists of the following captions:

- UK supermarkets generate 800,000 tonnes of plastic each year.
- A truck load of plastic ends up in our oceans every minute.
- Let's make sure the ocean of the future is filled with fish not plastic.
- Demand your supermarket uses less plastic.

- Sign our Petition now. Greenpeace.
- Greenpeace.org.uk/oceanofthefuture

– "Welcome to the Ocean of the Future", https://www.youtube.com/watch?v=sjU5i98nx74

The ad can be viewed on YouTube here: https://www.youtube.com/watch?v=sjU5i98nx74

The goals of this Greenpeace ad were **not** about raising public concern over the genuine environmental issues discussed in Section 5.1, or support for the genuine attempts to deal with these issues. Instead, Greenpeace chose to deliberately promote misinformation by creating the perception that:

a) The "plastic fragments" that scientists are concerned about are full plastic items such as plastic bottles, beer can holders and plastic bags. (In reality, most of the "plastic fragments" are a few millimetres in diameter)
b) UK plastic use is a significant part of the problem (it's not!)
c) Supermarket plastic use is a significant part of the problem (it's not!)
d) Greenpeace are actively fighting to fix "the problem" (they're not!)

When you visit the Greenpeace website you find several invites to donate $25 or more to "help" them to fight "the problem". However, "the problem" which they are scaring people about is non-existent, and "the solutions" they are proposing would have zero effect on the genuine environmental concerns which we discussed in Section 5.1.

5.3.2. Unnecessary guilt doesn't help the actual issue

Despite the widespread public perception promoted by Greenpeace that the western world is to blame, as we discussed in Section 5.1.3, the actual sources of the mismanaged waste are predominantly developing nations. As Prof. Ramani Narayan (a co-author of Jambeck et al., 2015) describes in the recent National Geographic "Planet of Plastic" special issue,

> "Let's say you recycle 100 percent in all of North America and Europe, [...] you still would not make a dent on the plastics released into the oceans. If you want to do something about this, you have to go there, to these countries, and deal with the mismanaged waste." – Prof. Ramani Narayan, interviewed in National Geographic, June 2018.

And, the most straightforward way to deal with the mismanaged waste in those countries is to improve their waste collection systems. As Ted Siegler (another co-author of Jambeck et al., 2015) explains later in the same issue,

> "Everyone wants a sexy answer [...]. The reality is, we need to just collect the trash. Most countries that I work in, you can't even get it off the street. We need garbage trucks and help institutionalizing the fact that this waste needs to be collected on a regular basis and

> landfilled, recycled, or burned so that it doesn't end up going all over the place." – Ted Siegler interviewed in National Geographic, June 2018

Through their campaigning, Greenpeace and the various other "Zero Waste" groups they have aligned with have created a widespread panic that North American and European countries are causing alarming-sounding "ocean pollution" through their "single-use plastic". They have developed campaigns targeting specific items, e.g., the use of plastic straws, and these campaigns have gained a lot of attention. For instance, Starbucks recently announced that they will stop "using disposable plastic straws by 2020" and replacing their straw and lid combination for their cold drinks with new "strawless lids". (NY Times, July 9, 2018).

These campaigns are problematic because the "solutions" often cause more harm than good. For instance, as Reason's assistant editor, Christian Britschgi, points out in his Reason blog post on July 12, Starbucks' new "strawless lids" actually use slightly more plastic than the original "straw plus lid" combination.

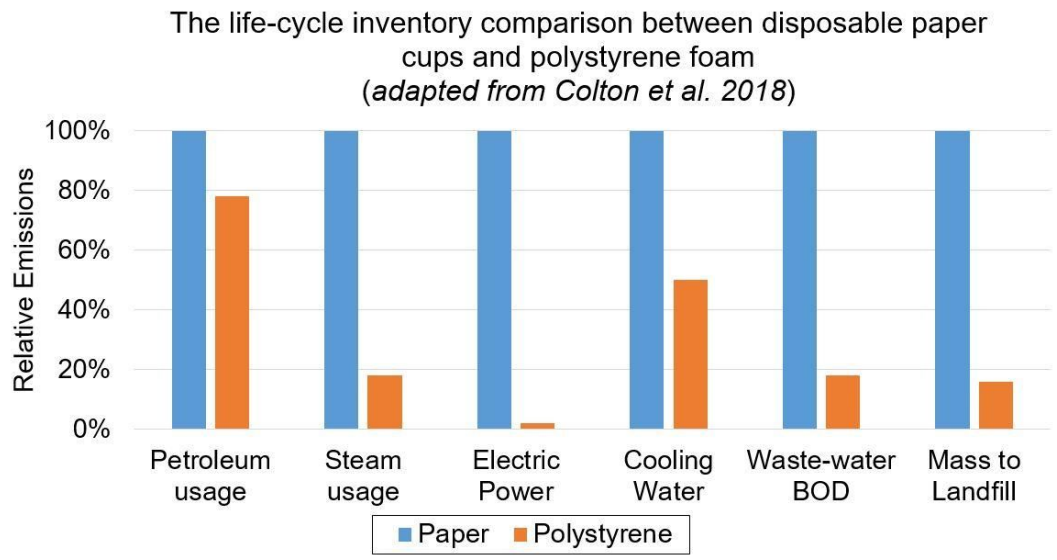
Moreover, specific campaigns to reduce or abolish, e.g., plastic straws, disposable plastic coffee cups, plastic bags, in the western world will have zero impact on the "ocean plastic pollution". This is a specific problem for developing nations that are not properly managing their waste, and some plastic is being "leaked" into the oceans. North American and European countries are already managing their waste well enough to prevent any substantial "plastic leakage".

5.3.3. Losing sight of the reasons why we are using plastic

By scaring people into thinking that plastics are inherently "bad", Greenpeace are making the public lose sight of the reasons why we are using plastic in the first place. There are many reasons why plastic products have become more popular than alternatives such as paper-based products, e.g.,

- They are usually more affordable and cost-effective
- They are often sturdier and can be custom designed with tailor-made properties
- They often are more environmentally friendly to produce, e.g., require less energy and water

A good review of the advantages of plastics is given in a recent white paper by the Independent Institute led by Katie Colton and colleagues. In the paper, they point out that the negative environmental impacts involved in producing a paper cup are much greater than for an equivalent plastic polystyrene foam (i.e., "Styrofoam") cup. See below:



Comparison of the life-cycle environmental impacts of a plastic (polystyrene foam) cup and an equivalent paper cup. Adapted from Colton et al. (2018). Independent Review. http://www.independent.org/publications/article.asp?id=9378

Additionally, as a rule of thumb, if a product (such as a disposable coffee cup) is in wide usage, there are probably reasons why – it is generally meeting consumers' demands in some manner. So, before vilifying the product and saying it needs to be completely abandoned and replaced with something else (such as a non-plastic reusable mug), it is important to figure out what values the original product had, and checking whether your proposed replacement product meets those demands.

Before vilifying the common disposable coffee cup as being intrinsically bad (as Greenpeace are implying), it is worth reading this interesting article on the BonAppetit website about why people invented the disposable coffee cup in the first place:
https://www.bonappetit.com/entertaining-style/trends-news/article/disposable-coffee-cup-history

5.4. Comparing Greenpeace's approach to those of honest environmentalists

The hypocrisy of Greenpeace's "ocean plastic crisis" campaigning is particularly evident when we compare their activities to those of honest environmentalist groups that are genuinely trying to reduce plastic pollution in the oceans.

We should stress that we do not entirely agree with everything that these groups are doing, and we find that – like Greenpeace - they often oversell and simplify the issue to make it sound more dramatic and alarming than it is.

Nonetheless, unlike Greenpeace, they seem to take care to remain factual and stick to the real issues. They are **not** taking Greenpeace's "anti-education" approach (see Appendix 3) to campaigning. Instead, they seem to be making an honest effort to inform the public of an issue they are genuinely concerned about. They are also offering plausible solutions which they genuinely believe could help resolve the issue.

More importantly, unlike Greenpeace, these other groups seem to be making significant progress in achieving their stated goals. In this section, we will compare Greenpeace's approach to some of these other groups.

5.4.1. The Ellen MacArthur Foundation and their proposed "circular economy"

The Ellen MacArthur Foundation was set up by Dame Ellen MacArthur, a retired English sailor who in 2005 (at the age of 28) broke the world record for the fastest solo circumnavigation of the globe. From her sailing career, she became interested in sustainability, and so when she retired from professional sailing in 2010, she set up the Foundation to try and promote better sustainability practices in the economy. In particular, the Foundation has been very successful in starting conversations about the concept of switching to what they call a "circular economy" for plastics.

They are concerned about the fact that most of the plastic we produce is "single use", i.e., very little of it gets reused or recycled. They also are concerned about the fact that a lot of it seems to be ending up into the oceans via "leakage" from mismanaged waste. So, from this, you might *initially* assume that they are natural allies of Greenpeace, and that they share common goals. But, as they say, the devil is in the detail, and when you compare and contrast Greenpeace's campaigning and canvassing to the Ellen MacArthur Foundation's campaigning and canvassing, you can see that their approaches are in many ways diametrically opposed!

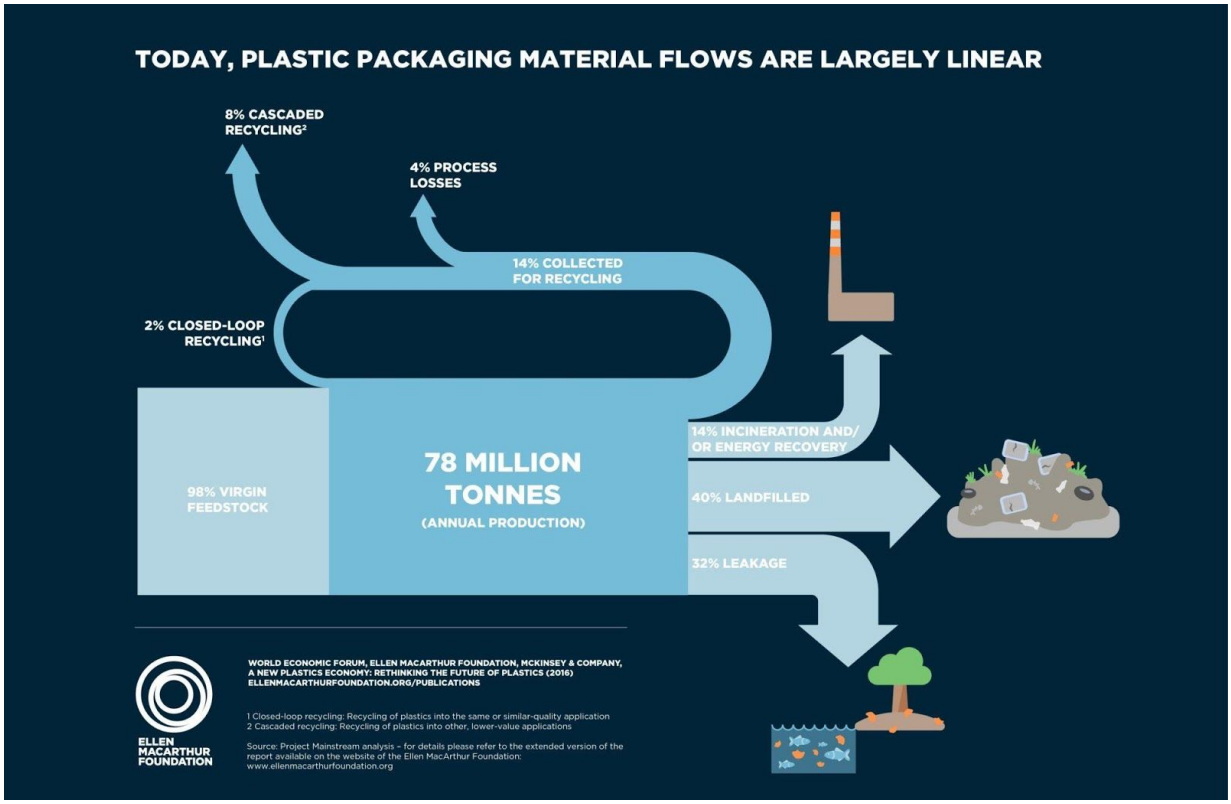
A good summary of the Ellen MacArthur Foundation's views on reducing plastic waste is provided in their 2016 report, "The new plastics economy: Rethinking the future of plastics". We do not personally agree with all of their analysis, e.g., the large focus they place on greenhouse gas emissions. We also find some of their claims to be somewhat hyperbolic and sensationalist. However, it is striking how different their approach is to Greenpeace's. Unlike Greenpeace, they genuinely seem to be interested in trying to reduce the world's overall plastic waste, without causing undue economic hardship or abandoning the immense benefits of plastics for society:

- The Ellen MacArthur Foundation are trying to promote an open-minded discussion on how to overcome the considerable challenges involved in changing the way we use plastics. Greenpeace are trying to shut down discussion and insisting that "zero waste" is the **only** answer, and that it would be easy to implement, with no negative consequences.
- The Ellen MacArthur Foundation are willing to talk about the pros and cons of plastics, and have a nuanced discussion about how we can manage to maintain the benefits of

current plastic usage – but just improving our recycling and reusing rates. Greenpeace deliberately overlook the real reasons why we're using so much plastic, and insist that plastics are inherently "bad" for the environment. Greenpeace actually oppose efforts to increase recycling and reusing of plastic! Instead, they instead that we should be abandoning plastic and refusing to settle for anything other than "zero waste".

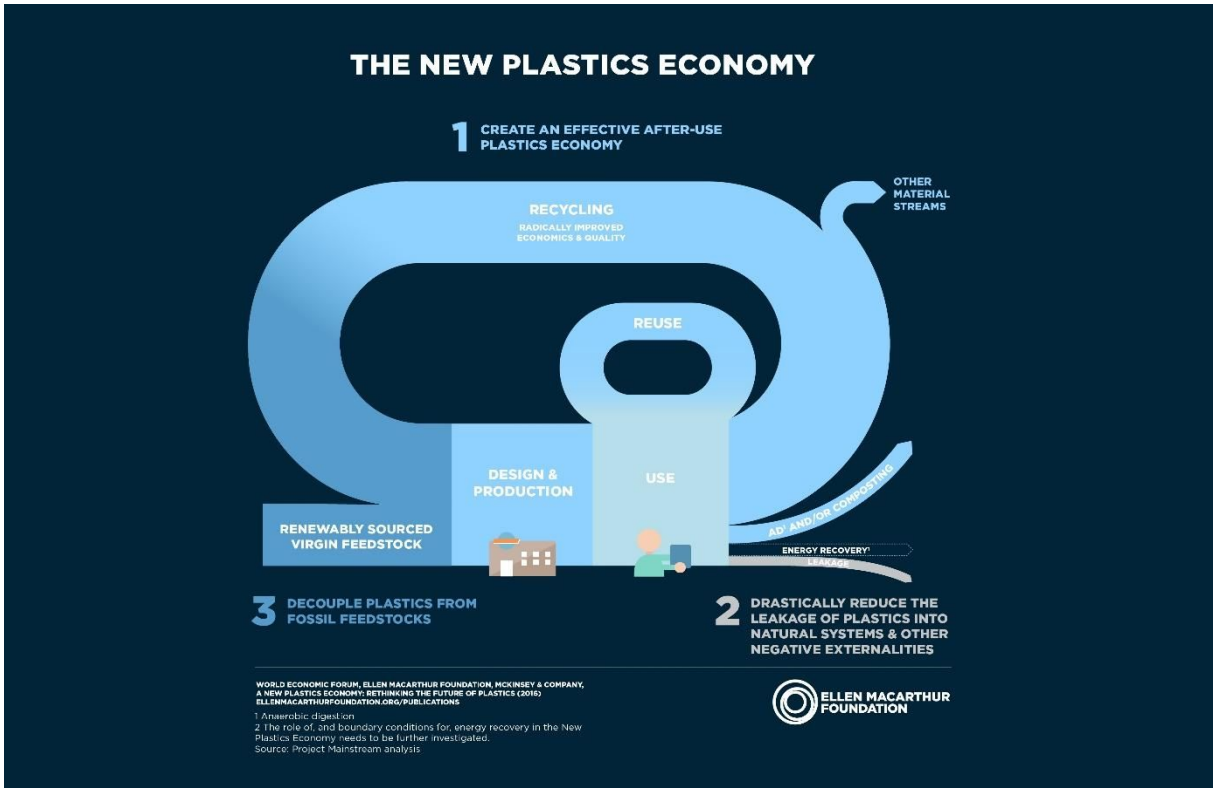
- The Ellen MacArthur Foundation are trying to encourage informed debate and discussion. So, they take care to stress that the plastic leakage into the oceans is almost entirely coming from developing nations (**not** Europe or North America). They tell concerned citizens from the developed nations that they could still help with the leakage problem by canvassing the plastic producing companies (that mostly have their headquarters in Europe/North America). But, they stress that the latest scientific studies show that the general public in these developed nations are **not** to blame for the ocean leakage. Greenpeace are deliberately ignoring this - we can say "deliberately", because Greenpeace repeatedly **reference** the papers like Jambeck et al., 2015, but neglect to mention their key findings! Instead, Greenpeace insist (against the scientific evidence) that the users of "single use plastic" in developed nations are to blame. They also deliberately foster the (completely inaccurate) notion that the "Oceanic Garbage Patches" are floating islands of plastic bags, bottles, and other large plastic items.
- The Ellen MacArthur Foundation is trying to genuinely improve our global plastic usage. They have put forward practical (though challenging) suggestions and ideas, and are actively working with major international companies (e.g., Coca Cola, Evian, etc.) to discuss realistic and practical solutions – that are financially viable. Greenpeace refuse to endorse any genuine attempts other than their hypothetical "zero waste" outcome. They pick major international companies like Coca Cola as "enemies" and insist that they should implement financially disastrous "solutions". Moreover, when companies like Coca Cola work with groups like the Ellen MacArthur Foundation to try and develop realistic reforms, Greenpeace dismiss their efforts as "inadequate".

The Ellen MacArthur Foundation's goal is to help society to dramatically reduce plastic waste in several different ways, chiefly by substantially increasing the fraction of plastic that is reused or recycled. At the moment, only about 14% of the world's plastic packaging is recycled. This is far below the recycling rates for e.g., paper (58%), or iron and steel (70-90%). Instead most of the plastic packaging is either incinerated (14%), landfilled (40%) or else "lost" through mismanaged waste (32%). They illustrate the problem with the following schematic:



Infographic illustrating the current life-cycles of plastics taken from the Ellen MacArthur Foundation website.

Their goal is to try and drastically improve the situation through what they call a “circular economy”, which they illustrate with the following schematic:



Infographic illustrating their proposed "circular economy" life cycles for plastics taken from the Ellen MacArthur Foundation website.

They also believe that we should separately try to reduce the "leakage" from those countries that have been specifically identified as having major mismanaged waste problems, i.e., those developing nations in Asia, Africa, and South America which were discussed in Section 5.1.3.

Since their goal is to drastically reduce both the total waste plastic and the leakage of waste plastic into the oceans, you might expect Greenpeace to support their efforts. But, Greenpeace have actually been remarkably dismissive of the "circular economy" concept. They argue that the concept of "economic growth" should be abandoned, and the world should only settle for "zero waste", e.g.,

> ""A 'circular economy' is the latest meme being used across the EU and worldwide, but behind this nice phrase lies the industry's fantasy that circularity can fix a material-intensive system; selling the promises of 100% recyclability which is unlikely to come true," said Chiara Campione, Greenpeace Italy Senior Corporate Strategist." – New report breaks the myth of fast fashion's so-called 'circular economy' – Greenpeace, Greenpeace International, September 18, 2017

> "Sharing and circular economies were attempts in this direction. They started in response to the economic crisis as people were pushed to utilize excess capacity, time and goods and

> companies started to suffer from the impacts of climate change and resource scarcity. Unfortunately, as with many other ideas, they've been hijacked by the private sector and its main driver; growth. The idea of a circular economy [*the article then links to the Ellen MacArthur Foundation's website*] carries a rebound effect; meaning we could end up *increasing* overall production, which would offset any benefits." – What a green and peaceful future could look like, Greenpeace International, July 19, 2018.

Meanwhile, it is worth noting that – unlike Greenpeace – the Ellen MacArthur Foundation have been working with some of the largest producers of plastic products to try and reduce their waste, e.g., Coca-Cola, Evian and global packaging company Amcor. A particularly relevant example is Coca-Cola, since this is one of the "enemies" which Greenpeace chose to vilify for their "ocean plastics crisis".

Coca-Cola obviously produce a lot of plastic bottles and up until recently the recycling rates of their bottles were very low. Greenpeace have developed a series of vilification campaigns against them to make the public outraged at Coca-Cola. These campaigns have used a lot of slick marketing (see here for a summary), and gained quite a bit of attention – and crucially for Greenpeace, generated a lot of support for Greenpeace – e.g., see here and here.

However, while Greenpeace were focusing their efforts on vilifying Coca-Cola, the Ellen MacArthur Foundation had gone directly to Coca-Cola and worked with them to see how they could try to improve the recycling of their plastic, and start reusing plastic. After these discussions, Coca-Cola announced several new efforts to help with the circular economy: https://www.coca-colacompany.com/stories/world-without-waste

Greenpeace, of course, took the credit for this move by Coca-Cola (even though Coca-Cola had specifically acknowledged that they had made their decision after consultation with the Ellen MacArthur Foundation). However, rather than praising Coca-Cola for making a big step, Greenpeace ridiculed the efforts as inadequate, and have continued to vilify them, e.g., see here.

5.4.2. The Plastic Bank's attempts to reduce "ocean leakage" from developing nations

As we discussed in Section 5.1.3, almost all of the "leakage" of plastic waste into the ocean is coming from a handful of developing nations that don't have adequate waste management resources. For that reason, a number of entrepreneurs concerned about the build-up of plastic in the oceans have tried to improve the waste management resources in those countries.

For example, David Katz and Shaun Frankson decided to set up a venture which they call, "The Plastic Bank". In collaboration with the Ellen MacArthur Foundation, they have teamed up with several of the larger plastic producing companies, such as Henkel, who have agreed to recycle plastic waste collected by the Plastic Bank for their products. Katz and Frankson then pay locals in these developing nations to collect plastic waste for them. This plastic waste is then sold to Henkel and others, who recycle it, thereby reducing "ocean leakage" and boosting the "circular economy".

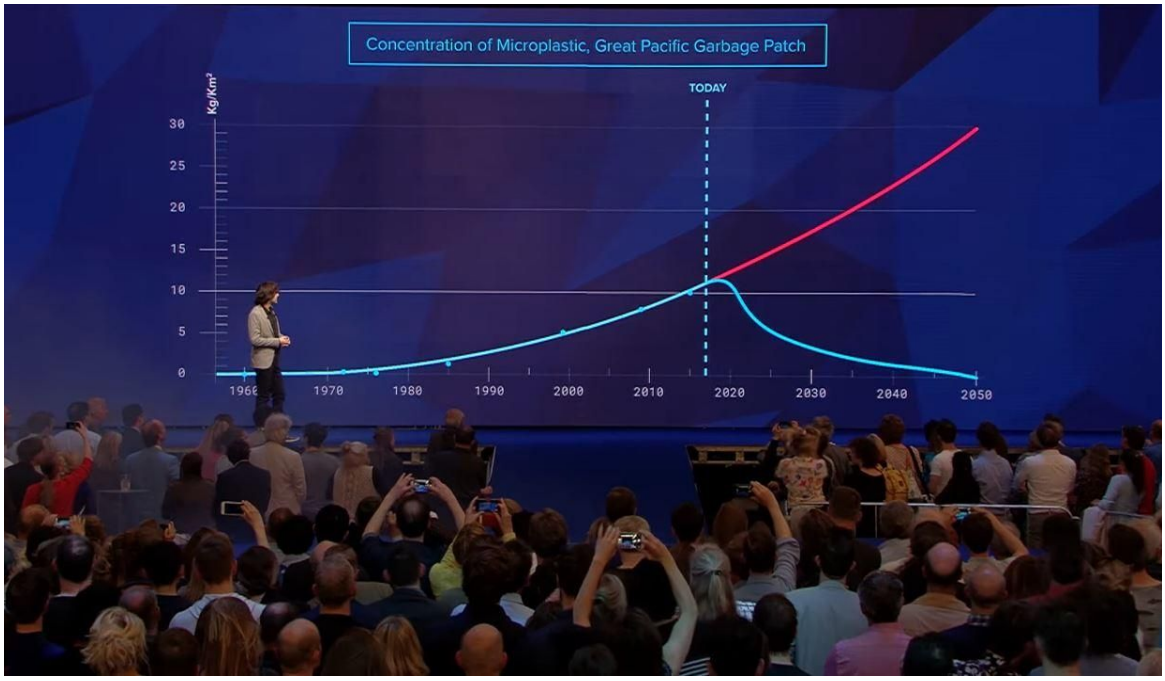
David Katz recently gave a 10 minute TED talk (Feb 2018) summarising what they're doing: https://www.youtube.com/watch?v=mT4Qbp89nIQ. If different groups like the Plastic Bank were collectively able to substantially reduce the mismanaged plastic waste from these developing nations, then the problem of "ocean leakage" would be largely resolved. However, Greenpeace keep insisting –against all the evidence - that the problem has something to do with the use in Europe and North America of plastic straws, disposable coffee cups, etc.

5.4.3. The Ocean CleanUp Project

If groups like the Ellen MacArthur Foundation and the Plastic Bank are successful in drastically reducing the amount of mismanaged plastic waste "leakage" into the oceans, then this should mostly stop the concentrations of microplastics from continuing to increase. However, it wouldn't do anything about the microplastics which are already there.

As we discussed in Section 5.1, there is still no evidence that these microplastics are having a net negative environmental effect. But, if we were to try to remove them, it could be a very costly and inefficient process – precisely because the actual concentrations of microplastics are so low, i.e., only a few hundred "fragments" per square mile in the peak areas. However, a young Dutch inventor (currently 23 years old) and engineer called Boyan Slat has been working on using technology to try and meet that challenge in a cost-effective way. In 2013, he discontinued his university studies to found The Ocean Cleanup, and this group (which we mentioned in Section 5.1) has now become a major non-profit organization with a staff of more than 70. They believe that they are close to having technology that could halve the concentration of microplastics in the North Pacific gyre within a decade (or less).

Here is a May 2017 presentation (30 minutes) which he gave describing their progress so far: https://www.youtube.com/watch?v=du5d5PUrH0I. Below is a screenshot showing what they think their technology could achieve (blue curve) as opposed to the red "business-as-usual" curve.



If his team is correct, then they would have developed a technological solution to essentially remove the "oceanic garbage patches" without us changing our everyday use of plastic in any way.

Yet, Greenpeace are opposed to his project as they claim it could interfere with marine life, e.g.,

'"To filter the plastic out of the water could affect very small marine life which is very important for the food chain," said Elvira Jimenez, a coordinator for Greenpeace's ocean campaign.' – Dutchman wants to deploy barriers to gather, recycle Pacific plastic, Reuters, May 16, 2017.

6. Greenpeace's claims about seabirds

6.1. The albatross

This month, Wisdom, a Laysan albatross was the subject of some media attention (e.g., The Guardian; Sky News; NPR), as she came back to the Battle of Midway National Memorial on Midway Atoll (one of the Hawaiian islands) to lay an egg. She was first tagged as an adult by a

biologist (Chandler Robbins) in 1956, who estimated that she was at least 5 years old at the time, meaning she is at least 68 years old.

Figure 1. Photograph of Wisdom, the 68-year-old Laysan albatross, incubating her egg in December 2018. Photo credit: Madalyn Riley/USFWS Volunteer. (CC BY-NC 2.0)

However, Greenpeace claim that the Laysan albatross is in danger of extinction and they are blaming plastics. Here is an extract from Greenpeace USA's webpage on the albatross (apparently first posted in 2015):

"The second most common seabird in the Hawaiian Islands, the Laysan albatross, has a population of about 874,000 and its numbers are decreasing.

According to the 2006 IUCN Red List, the Laysan albatross is categorized as Vulnerable. 19 of the 21 albatross species are threatened with extinction.

[…]

An even more tragic cause for albatross mortality is consumption of marine debris, mainly plastic, that they mistake for food. Birds are found with bellies full of trash, including cigarette lighters, toothbrushes, syringes, toys, clothespins and every other type of plastic material. On Midway Atoll, 40 percent of albatross chicks die due to dehydration and

> starvation from trash filling their bellies providing no nutrition. It has been estimated that albatross feed their chicks about 5 tons of plastic a year at Midway Atoll. The marine debris collects through a system of currents called the North Pacific subtropical gyre, located half way between Hawaii and San Francisco. Greenpeace refers to this region as the Trash Vortex, and it is also known as the Eastern Garbage Patch. Slack winds and low currents in the center of the vortex enable trash from all around the Pacific to collect causing high concentrations of plastic debris.

[…]

> This species is in real danger of extinction because they are unable to breed fast enough to keep up with population declines." – Greenpeace USA on their Oceans/Wildlife Facts/Albatross page

Let us first consider their claim that the Laysan albatross population is "decreasing" and that the "species is in real danger of extinction". They state that "According to the 2006 IUCN Red List, the Laysan albatross is categorized as Vulnerable". This is technically true, but it is rather disingenuous to single out the 2006 category since the IUCN Red List recategorized the species in 2010 because "This species has rebounded from declines in the late 1990s and early 2000s" (2018 IUCN Red List). Indeed, the IUCN Red List only listed the Laysan Albatross as "Vulnerable" from 2003-2008.

Still, is its population "decreasing"? No.

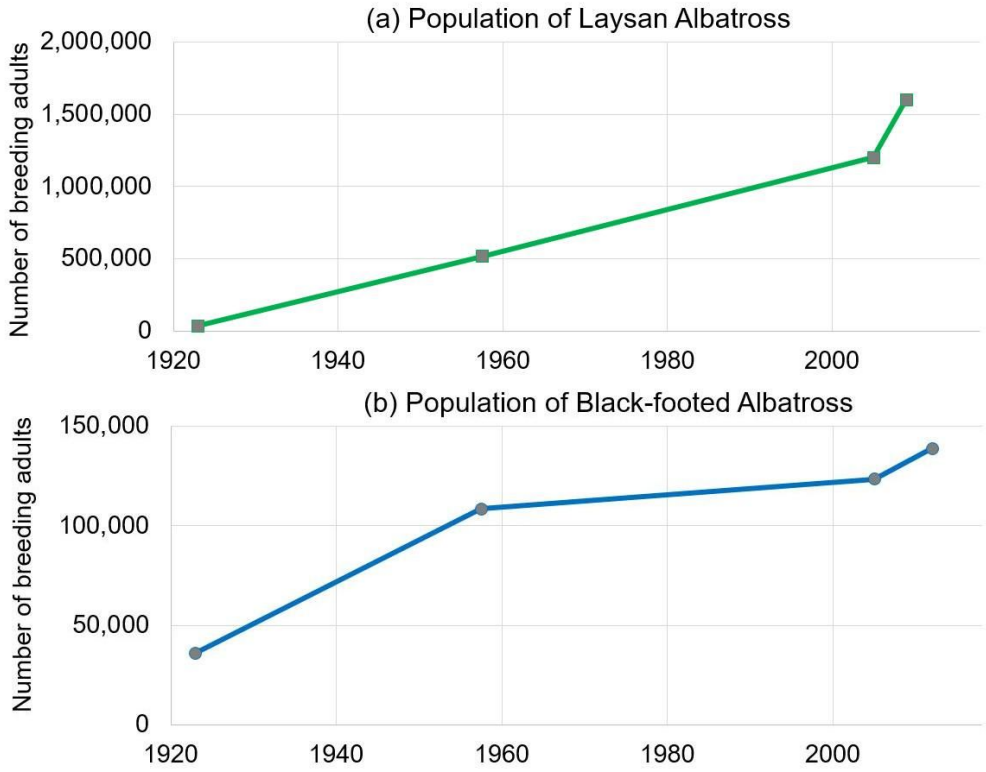


Figure 2. Population of (a) Laysan Albatross and (b) Black-footed Albatross. Estimates for the 1923-2005 period taken from U.S. Geological Survey (2009). Most recent estimates are taken from the IUCN Red List (2018) entries for Laysan Albatross and Black-footed Albatross.

In the figure above, we plot the estimated population of breeding adults for both the Laysan Albatross and the related Black-footed Albatross. The population of both species has been increasing since the early 20th century (when they were being hunted for their plumage), and neither species seems to be in any danger of extinction.

But, what about Greenpeace's claim that these birds are under threat from the use of plastic?

6.2. Seabirds and plastic

It has been known since the 1960s that many seabird species routinely ingest pieces of plastic as well as other indigestible objects such as squid beaks, pumice stones (a type of floating volcanic rock), nuts, wood and other floating objects. For instance, below is a photograph taken in 1966 of the remains of a Laysan Albatross. The plastic items are probably among the first items you notice when you look at the photograph, but after a closer inspection you can see that the darker pumice rocks and pebbles actually make up the bulk of the mass.

Figure 1. Contents of the body cavity of a young Laysan Albatross similar to many found on Southeast Island, Pearl and Hermes Reef, 24 September 1966. Plastic container caps and toys, pumice stones, and squid beaks were revealed, cradled in the sternum, after the back (feathers and skeletal material) was lifted off. Beetle larvae had consumed all soft parts in the 2 to 3 months following death.

Figure 3. Photograph from 1966 of the remains of a decomposed Laysan Albatross. Taken from Kenyon & Kridler (1969); The Auk, Volume 86, Issue 2.

Kenyon and Kridler (1969) who presented the photograph, also carried out an analysis of the indigestible material of 100 Laysan Albatross carcasses:

Type of item	Average weight	Average number	% of birds
Pumice	10.63g	5.46	85%
Plastic	1.83g	2.41	74%
Nuts	0.63g	0.12	12%
Squid beaks	Unknown	Unknown	89%
Charcoal and wood	0.89g	0.17	14%
Other floating items	0.05g	0.06	4%

Non-floating items (pebbles, bones, etc)	0.05g	0.05	5%

More than 40 years later, Gray et al. (2012) carried out a similar analysis of a sample of 18 Laysan albatrosses and 29 Black-footed albatrosses, except focusing specifically on the plastic material. Their study was published in the journal Marine Pollution Bulletin, but a copy of their paper can be found here.

In their sample, taken from the period 2006-2008, the Laysan albatrosses had an average weight of 0.998g of plastic, and the Black-footed albatrosses had an average weight of 0.463g. This was actually less than the average of 1.83g which Kenyon & Kridler found in their 1966 survey. However, it shows that the albatrosses are still ingesting small plastic pieces as part of their indigestible material.

Gray et al. (2012) also pointed out that other studies of Laysan albatross chicks suggest that chicks (that are still in the nest) have an average weight of 15.7g of plastic in their stomachs. In other words, albatross parents are giving their chicks plastic when they are feeding them.

Partly because they are a relatively large bird, the albatrosses are the seabirds which seem to ingest the most amount of plastic. But, many other seabird species also ingest small quantities of plastic particles along with other indigestible material (squid beaks, sand, insects, etc.). Moser & Lee (1992) carried out one of the most comprehensive long-term surveys over the period 1975-1989. In total, they analysed 1033 seabirds, including 38 species. They found that 21 of the 38 species had ingested at least some plastic, and some species (Northern Fulmars, Red Phalaropes and Greater Shearwaters) frequently ingested plastic particles.

So, it is true that many seabirds are ingesting plastic particles along with many other types of naturally-occurring indigestible material. The average size of these plastic particles is very small (less than 1g). The plastic only comprises a small fraction of the indigestible material the seabirds ingest - naturally-occurring pumice and squid beaks seem to be more popular. Also, seabirds seem to have been doing this since the 1960s, and if we compare the results of Kenyon & Kridler (1969) and Gray et al. (2012), there doesn't seem to have been an increase in the amount of plastic being ingested since then.

Nonetheless, it does raise some important questions:

1. Why are seabirds ingesting plastic particles?
2. Is it causing them any harm?

6.2.1. Greenpeace's claims about seabirds and plastic

When researchers first started noticing the seabirds were ingesting plastic particles in the 1960s, 1970s and 1980s, they were shocked and alarmed. The first thought was that the seabirds were "eating" the plastic by mistake. Maybe the seabirds thought the plastic was "food"? Or maybe they were accidentally swallowing the plastic along with food?

More alarmingly, seabird chicks seemed to have more than 10 times as much plastic in their stomachs as the adults. It seemed that the seabird mothers were feeding their chicks even more plastic particles than the adults were ingesting!

Researchers became worried that all of this plastic might be harming the seabirds. In particular, they were worried about the following:

1. Could sharp plastic fragments cut the stomach lining of the birds, causing them to starve and die?
2. Could the build-up of this undigested plastic in their stomachs give them a false sense of being "full" and cause them to starve?
3. Could the "extra" plastic in their stomachs make it harder for the chicks and adults to fly?

These were all reasonable questions to ask, and they led to a lot of research. As we will discuss later, after all of this research, the answers to all of the above now seem to be "no"! Not only do the seabirds seem to be doing fine with these small plastic particles, but seabirds seem to be intentionally seeking them out as a useful digestive aid. They seem to be a useful complement to the naturally-occurring pumice, squid beaks and other hard indigestible objects that seabirds have been using as digestive aids for millions of years.

However, Greenpeace has chosen to ignore all of this research, and instead (falsely) insist that the answer to all of the above questions is "yes". Further, they falsely imply that this is a new and growing "crisis", and that it is somehow related to the developed world's usage of "single use plastics":

> "Our oceans are slowly turning into a plastic soup and the effects on ocean life are chilling. Big pieces of plastic are choking and entangling turtles and seabirds and tiny pieces are clogging the stomachs of creatures who mistake it for food, from tiny zooplankton to whales. Plastic is now entering every level of the ocean food chain and even ending up in the seafood on our plates." – Greenpeace UK, "Take the plastics pledge"

> '"Being surrounded by tens of thousands of gannets on the Bass Rock is a stunning spectacle – but it's seabirds like these which are acutely threatened by ocean plastic pollution," said Willie Mackenzie, oceans expert at Greenpeace UK. "We found plastic bags, packaging, bits of old fishing gear and even crisp packets strewn across the island and surrounding eggs in nests. It's no wonder that studies have shown that 90% of seabirds have eaten

plastic."' – Greenpeace UK, "Iconic seabird colony polluted with ocean plastic, Greenpeace expedition finds", May 11, 2017

"Pieces of plastic are sharp, brittle, toxic, and routinely found in the stomachs of dead fish, turtles, and marine mammals. Plastics can come with a range of hazardous additives and can act as a chemical sponge, soaking up and concentrating other pollutants. Marine species, including fish, seabirds and even marine mammals, can end up eating pieces of plastic, and at the same time get an additional dose of toxic chemicals.

Researchers have found plastic in the stomachs of 44% of all seabird species, 22% of cetacean species, and in all sea turtle species. Among seabirds, the Procellariiformes (albatross, petrels, shearwaters) are most vulnerable due to their small gizzard and inability to regurgitate the plastics. Plankton eaters – birds, fish, and mammals – often confuse plastic pellets with their food; copepods, euphausiids, and cephalopods.

The plastics obstruct the animals' intestines, block gastric enzyme secretion and there are growing fears that they might also disrupt hormone levels or cause other biological effects as a result of the chemical burden they carry. It is estimated that up to about one million seabirds and 100,000 marine mammals die each year from ingesting plastic or by getting tangled in nylon fishing line, nets, six-pack plastic can holders, and plastic rope." – Greenpeace International, "The ocean plastic crisis", October 15, 2017

And, as we discussed earlier,

"An even more tragic cause for albatross mortality is consumption of marine debris, mainly plastic, that they mistake for food. Birds are found with bellies full of trash, including cigarette lighters, toothbrushes, syringes, toys, clothes pins and every other type of plastic material. On Midway Atoll, 40 percent of albatross chicks die due to dehydration and starvation from trash filling their bellies providing no nutrition. It has been estimated that albatross feed their chicks about 5 tons of plastic a year at Midway Atoll.

The marine debris collects through a system of currents called the North Pacific subtropical gyre, located half way between Hawaii and San Francisco. Greenpeace refers to this region as the Trash Vortex, and it is also known as the Eastern Garbage Patch. Slack winds and low currents in the center of the vortex enable trash from all around the Pacific to collect causing high concentrations of plastic debris." – Greenpeace USA on their Oceans/Wildlife Facts/Albatross page

If any of Greenpeace's scary-sounding claims were true, then it would be a cause for concern. But, let us look at what the scientists who were investigating the claims have concluded.

One of the first systematic efforts to investigate the claims was the graduate work in the late-1980s and early 1990s by Peter Ryan (now a professor at the University of Cape Town in South Africa). Although he considered each of the proposed mechanisms by which the plastic particles might potentially be harming the seabirds, all of the evidence suggested that the seabirds were doing fine. A good summary of his findings is provided in a presentation he gave to the 1989 International Conference on Marine Debris in Hawai'i:

"Few statistically significant negative correlations have been found among adequately controlled samples, suggesting that the effects of ingestion are either relatively minor or that they frequently are masked by other variables." Ryan (1990), "The effects of ingested plastic and other marine debris on seabirds", NOAA Technical Memo.

Other researchers were finding the same. For example, here is the main conclusion from the Moser & Lee (1992) study which we mentioned above:

"We found no evidence that seabird health was affected by the presence of plastic, even in species containing the largest quantities: Northern Fulmars (*Fulmarus glacialis*), Red Phalaropes (*Phalaropus fulicaria*) and Greater Shearwaters (*Puffinus gravis*)" – Moser & Lee (1992), "A fourteen-year survey of plastic ingestion by western North Atlantic seabirds", Colonial Waterbirds, Volume 15, 83-94

Moser and Lee also directly addressed several of the concerns that researchers had originally raised. With regards to the claim that seabirds were starving because they were mistakenly feeling "full" from the plastic, they found the claim was wrong:

"Plastic ingestion may cause seabird starvation if the presence of plastic in the gut signals satiety and reduces bird appetites [*quoting a 1985 study suggesting this might be a problem*]. We found no evidence for this effect in the seabirds analysed in this study. Stomach fullness was not correlated with the amount of plastic in the gut, even for instances where over 90% of the gizzard volume was plastic"

They also considered the claim that the plastic might be cutting the stomach linings of the birds. Again, they found no evidence for this claim:

"Although approximately 20 Northern Fulmars and Greater Shearwaters in our collection had plastic accumulations large enough to potentially alter gizzard function, we found no evidence of digestive tract impaction or occlusion."

They agreed that plastic ingestion was widespread among seabirds, but the worries that this was harming them seem to have been unfounded:

"In conclusion, our results indicated that plastic ingestion is widespread among western North Atlantic seabirds […]. However, we found no evidence that plastic particle ingestion is detrimental to western North Atlantic seabirds. The species most likely to suffer health risks from ingestion of ocean-borne plastics, Northern Fulmars, Red Phalaropes, and Greater Shearwaters, showed no ill effects, with Northern Fulmars actually increasing their abundance and range in the western North Atlantic during the study period"

Another potential concern was that the plastic particles were gradually building up in the seabirds' stomachs, and that over time their stomachs will become filled with plastic. However, it is now becoming clear that, like the other indigestible material that seabirds ingest (squid beaks, pumice, etc.), the plastic particles only last for a few months before being worn down.

For instance, van Franeker and Law (2015) found that some of the early estimates for the length of time the plastic remained in the stomachs (6 months to a year or even longer) were too long. They found "an overall 90% decrease in the average number of plastic particles in the stomach over summer from 8.6 particles/bird in May, to 3.2 in June, 1.2 in July, and 0.8 in August". It appears that rather than the plastic particles "building up" in the seabirds' stomachs, the seabirds have to collect replacement particles every year.

Indeed, this is not too surprising since they found that the same thing seems to happen for the naturally-occurring "plastics" (e.g., squid beaks) which seabirds have presumably been ingesting for millions of years,

"A similar rapid reduction was observed for squid beaks in the stomachs of all species of fulmarine petrels in the study. Squid beaks are made of chitin, a natural equivalent of synthetic polymers, and of similar resistance [*to plastic particles*]. Squid are prevalent in winter foraging grounds but are rare near the breeding colonies […] Squid beaks disappeared at an average rate of 72% between December and January […], consistent with observations of ingested plastics." - van Franeker and Law (2015)

6.2.2. Why are seabirds ingesting plastics?

So, despite Greenpeace's repeated claims, we now know that the ingestion of plastic particles by seabirds doesn't seem to be having any ill effects on the birds. But, this still doesn't explain why the seabirds are ingesting the plastic. Is it "by mistake" as many of the researchers initially assumed (and as Greenpeace insist)?

To answer this, it is first important to understand a bit about seabird biology, and in particular about the digestive processes of seabirds.

Unlike mammals, birds have no teeth and don't chew their food. Instead, birds have two stomachs: a "glandular" stomach (the technical name is Proventriculus), and a "muscular" stomach (Ventriculus) which is commonly known as the "gizzard".

The glandular stomach is a bit like the human stomach in that it adds digestive juices and enzymes to the broken-down food. Meanwhile, the other stomach, the gizzard, grinds the food down into small particles. That is, it replaces the chewing mechanism of mammals.

To help this grinding process, birds will often ingest small stones and other indigestible hard materials. This seems to be why seabirds are ingesting plastic particles. Before plastics came onto the scene in the 1960s, seabirds were relying on naturally-occurring floating (and solid) materials like squid beaks, pumice, bits of wood, sand, etc. As we discussed earlier, they still are mostly using these materials. But, now they **also** seem to be supplementing these materials with plastic particles.

Not only are adult seabirds seeking out these small, indigestible particles as digestive aids, but in some species (such as the albatrosses), the parents also seem to be intentionally giving these particles to their chicks along with their food. In fact, as we mentioned earlier, the average mass of plastic particles in the stomachs of albatross chicks is more than ten times those of an adult.

The reason seems to be that the more indigestible material the chicks have in their stomach, the easier the digestive processes are. That is, the extra particles allow the chicks to grind up their food better. However, the extra weight also weighs the chicks down, which makes it harder for them to fly. Therefore, once the chicks have grown and are preparing to leave the nest, they regurgitate out most of their stomach contents as "a waste bolus". Then, they learn to fly and start adult life.

6. Conclusions Between the five of us, we have dedicated most of our careers to advancing scientific knowledge; raising awareness about environmental problems; trying to develop solutions to environmental problems; and generally communicating with and educating the public on science and the environment.

So, given that Greenpeace **claim** to be champions for science-driven environmentalism, you might initially think that they would be allies. However, while it is easy to claim to be something, we argue that Greenpeace's actions are the very anti-thesis of science-driven environmentalism:

About the authors

- Dr. Michael Connolly (Ireland)
- Dr. Ronan Connolly (Ireland)
- Dr. Willie Soon (USA)
- Dr. Patrick Moore (Canada)
- Dr. Imelda Connolly (Ireland)

All five of us are passionate about science, the environment and sustainability.

Patrick has been a leader in the international environmental field for more than 30 years. He was a founding member of Greenpeace and served for nine years as President of Greenpeace Canada and seven years as a Director of Greenpeace International.

In 1989, Michael and Imelda set up (and ran for seven years) the Republic of Ireland's first public aquarium ("the National Aquarium") to promote awareness and interest in both the beauty and fragility of the ocean's ecosystems. Michael and Ronan have both been actively involved in the research and development of ethical, sustainable and commercially viable methods for a) fishfarming, b) reducing water pollution and c) energy conservation for more than a decade (Michael since 1996, Ronan since 2004).

Willie has dedicated his career to scientific research and has published more than 80 peer-reviewed scientific papers in the fields of astronomy, astrophysics, climate science and environmentalism. Willie, Ronan and Michael have been working together since 2015. At the time of writing, they have published three peer-reviewed scientific papers together on the subject of climate change, and they have several further papers in preparation.

None of us received any funding or financial compensation for this report, and we carried out all of the research in our own spare time and at our own expense.

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End excerpt