Chapter 6
The Great Pacific Garbage Patch is Full of Plastic and is Twice the Size of Texas

The Great Pacific Garbage Patch is Fabricated (and Invisible)

There seems to be no end to the absurdity spread by the "green" movement and the media. For many years the story of the Great Pacific Garbage Patch has been publicized as a great environmental tragedy. It is described as three times the size of France and twice the size of Texas. The web is full of images that give the impression that the central Pacific Ocean is completely covered in floating garbage, most of which is plastic (see Fig. 49). Here is a quote from the CNN story that covered this narrative, the footnote is below:

> *A huge, swirling pile of trash in the Pacific Ocean is growing faster than expected and is now three times the size of France. According to a three-year study published in Scientific Reports Friday, the mass known as the Great Pacific Garbage Patch is about 1.6 million square kilometers in size – up to 16 times bigger than previous estimates. That makes it more than double the size of Texas.*[150]

Figure 49. *Images like this one are often used to depict the Great Pacific Garbage Patch.*[151] *But this image is from the aftermath of the Japanese earthquake and tsunami in 2011 that killed nearly 20,000 people, caused the Fukushima nuclear accident, and swept entire towns and villages into the sea. This photo was clearly not taken in the middle of the Pacific Ocean as there is land a short distance away in the background.*

There are also multiple photoshopped depictions of the Great Pacific Garbage Patch that claim to depict its size and location (see Figs. 50 and 51). Many people believe these represent the truth as they are not able to go to the middle of the Pacific Ocean to check for themselves. But these images are 100 percent fabricated.

Figure 50. *This illustration of the Great Pacific Garbage Patch indicates that it is nearly as large as the entire lower 48 US states. The website it appears on claims this is the result of "new aerial surveys" yet it also states, "the patch is not truly visible with the naked eye."*[152]

Figure 51. *This depiction of the Great Pacific Garbage Patch shows it to be about half the size of South America. This is actually a composite of many satellite images which were stitched together so it could exhibit nearly the entire planet without cloud cover. The Garbage Patch was simply painted or photoshopped onto the photograph. The website this appears on says the garbage patch is a "satellite image."*[153]

Fortunately, there is a very clear image of the entire Pacific Ocean which is also a composite taken over a year-long period in order to create a clear and

perfectly cloudless image. It does not show any visible garbage patch because there isn't one. The Great Pacific Garbage Patch, famed to be twice the size of Texas is fabricated, as it does not actually exist (see Fig. 52).[154]

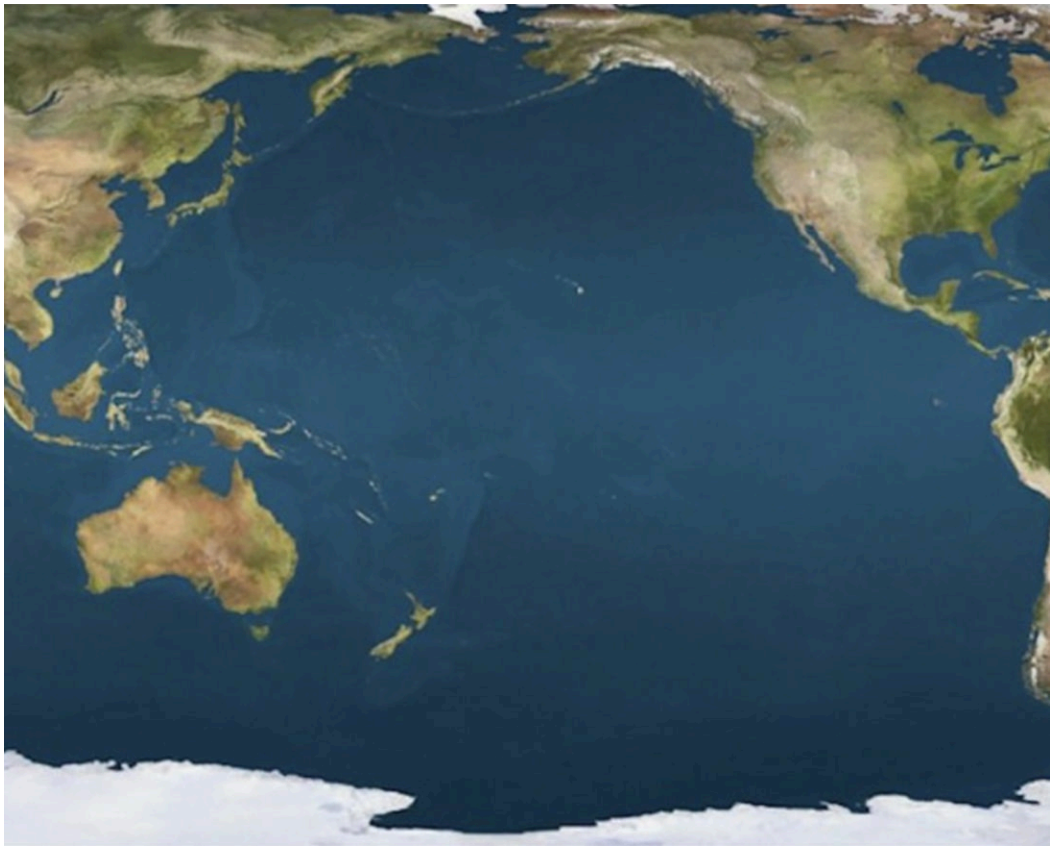

Figure 52. *This is a composite of satellite photos taken over a period of one year in order to catch the entire area with no cloud coverage. The Hawaiian Islands can be easily seen, and they are definitely not twice the size of Texas.*

I have been confronted with some hostility among members of my audiences when I point out the fact that the garbage patch is a hoax. The most common rebuttal is that the garbage patch is just below the surface and that is why it can't be seen from a satellite or an aircraft. In my experience, and I have spent a lot of time scuba diving and snorkeling, most objects either float or sink and only rarely do they hover at a particular depth below the surface. Plastic articles do not have buoyancy-compensation devices, they are mostly either less dense or more dense than the water they are in. One person even stated that the reason you can't see the Great Pacific Garbage Patch is because it's only the clear plastic.

As a final resort, the garbage-patch defenders claimed that the plastic is in

the form of micro-plastics in the water column, or in other words, they're invisible. Just another garden-variety invisible, fake catastrophe like so many others. At this point one can only shake their head and call it off. If the plastic consists of invisible micro-plastic, how can it be labeled the Great Pacific Garbage Patch twice the size of Texas?

Of course, there is plastic debris floating in the oceans, but it is not in a giant patch. It is very spread out and most of it is discarded fishing gear (see Fig. 53).

Figure 53. *This ship spent 48 days combing the "Pacific Garbage Patch" between California and Hawaii and salvaged 103 tons of plastic. One can see that nearly all of it is discarded fishing gear, mostly nets and ropes. Fishnets are a serious problem, not because they are plastic but because they are meant to catch fish and other marine life. They are referred to as "ghost nets" because they can entangle marine life. A program focused on educating fishers would go a long way to reducing this problem.*[155]

Is Marine Plastic an Environmental Catastrophe?

A tremendous effort has been made and is still underway to make "plastic" into a negative term. This is similar to the campaigns against fossil fuels which literally refer to them as "dirty coal" and "dirty oil." Clearly there is nothing evil about dirt as dirt is where we grow most of the food we eat and the food we feed to our livestock. In the case of fossil fuels the word "dirty"

is simply being used as a pejorative, or derogatory slur, as in “dirty rotten scoundrel.” It is propaganda, one of the main features of which is associating the object of your disdain with negative words like “dirty.”

The “War on Plastic” is, in fact, a proxy for the campaigns against fossil fuels. Nearly all the synthetic plastic polymers are made from fossil fuels. Polystyrene and polypropylene are made from oil. Polyethylene can be made from oil or natural gas. Polyvinylchloride (PVC or vinyl) is made from natural gas and table salt (NaCl).

Interestingly, nature produced a plastic polymer through evolution more than three billion years ago. Unbeknown to most people, cellulose is a polymer of glucose, which in turn is the main sugar produced by combining CO_2 and H_2O in photosynthesis. Early life forms evolved the ability to join glucose molecules in a string to form the fibers for building cell walls. So cellulose was the first plastic, and, in that sense, paper is a plastic as it too is composed of cellulose. Rayon is a plastic because it is synthesized from cellulose. Wood is also technically a plastic as it is composed of cellulose and lignin, both of which are used to make synthetic polymers and plastics. Cotton is another plastic as it is almost pure cellulose. Plastic is not a dirty word. Plastic is one of the most versatile and useful groups of materials. Life without plastics like cellulose would simply not be possible.

The anti-plastic movement has been very successful at portraying plastic as extremely negative from an environmental perspective. One of the most effective tools in this portrayal are the staged and contrived images that are intended to make people cringe at the sight of them (see Fig. 54).

Figure 54. *This dead albatross chick has been staged by cutting it open and stuffing it with plastic objects. When birds swallow plastic it is directed to the gizzard. Unless this bird had a gizzard the size of its entire body this is a fake photo. But it does have the desired effect: revulsion.*

In the same article with the photo of a dead bird full of plastic, there is an account of 13 sperm whales stranded on a beach in Germany. The article claims that their stomachs were full of plastic. However, the article provides no evidence of this either with images or citations.[156] The only photo of whales in the article showed two of the 13 sperm whales stranded on a beach (see Fig. 55).

Figure 55. *Two of the 13 sperm whales that were stranded on a beach in Germany in January 2016. Whale strandings are quite common with hundreds of whales around the world stranding annually. This has been happening for millions of years, long before modern plastics were invented.*[157]

Here is another entirely staged image used to demonstrate that whales are swallowing huge amounts of plastic too. The whale is artificial, and the plastic has been shoveled into its mouth by Greenpeace members in the Philippines (see Fig. 56)

Figure 56. *A mock whale with its mouth full of plastic is the only image associated with an article about a sperm whale that washed up in Spain that allegedly had 64 pounds of plastic in its stomach. No evidence of the actual sperm whale was presented in the article.*[158]

The Many Benefits of Marine Plastic

It is true that plastic can cause harm in the oceans as with the example of discarded fishnets continuing to catch fish and entangling other marine species such as turtles and even whales. Convincing fishers to bring their damaged nets back to the dock for disposal should be the aim of a major international campaign in itself. And it is possible that whales sometimes swallow plastic. But there is no indication that this is causing the kind of mass death that is implied in these articles.

It was mentioned earlier that wood is a kind of plastic, made with hydrogen and carbon like synthetic plastic, except wood also contains oxygen. There is a lot of wood floating in the ocean. Here is a description from an environmentalist about the ecological role of wood in the sea.

> *For driftwood that leaves terra firma to begin a new life at sea, the odds of ever returning to land are pretty slim. But being lost at sea doesn't necessarily mean their travels are a lost cause. As writer Brian Payton noted recently in Hakai magazine, driftwood can stay afloat in the open ocean for about 17 months, where it offers rare amenities like food,*

shade, protection from waves, and a place to lay eggs. As such, pelagic driftwood becomes a 'floating reef' that can host a variety of marine wildlife.

That includes wingless water striders (aka sea skaters), which lay their eggs on floating driftwood and are the only insects known to inhabit the open ocean. It also includes more than 100 other species of invertebrates, Payton adds, and some 130 species of fish.[159]

From the point of view of all these species that use driftwood as habitat, floating plastic is no different. As with driftwood, drifting plastic is a floating reef that provides a home for many marine species. In fact, plastic offers much more variety in terms of shapes such as bottles and containers, so it offers a wider range of habitats than driftwood (see Fig. 57).

Figure 57. *The following caption was written under this photo of a crab in a plastic cup. "A crab was trapped inside a discarded milktea cup in Verde Island, Philippines (© Noel Guevara / Greenpeace)."*[160] *But in fact, the crab is not "trapped." It is using the cup as shelter, in other words, its habitat. Hundreds of marine species benefit from plastic objects whether they are floating, drifting in the water column, or lying on the seafloor.*

Plastic is no more toxic than driftwood, which is not toxic at all. Yet website after website claims that plastic "leaches toxics" and "chemicals" into the oceans.[161,162] This is untrue. There is a good reason why we package

and wrap much of our food in plastic containers and plastic wrap. It is because the plastic protects it from contamination and spoilage, and because the plastic is sterile and does not contain anything toxic. But wait a minute, the plastic polyvinylchloride contains chlorine which is an elemental gas and is very toxic. What about that? The fact is that the most common salt in seawater is sodium chloride, otherwise known as table salt. Sodium chloride is an essential nutrient for all animal life including marine life.[163] Isn't chemistry fascinating?

One of the most important benefits of plastic in the sea is that, like driftwood, it provides a habitat for many of the species such as barnacles that attach themselves to floating objects (see Fig. 58). Other species lay their eggs on driftwood and floating plastic. This in turn provides food for fish and birds. There is no doubt that the benefit of additional food provided by floating plastic far outweighs the rather rare occurrence of damage or death from being tangled in plastic.

Figure 58. *Pelagic gooseneck barnacles have engulfed a small plastic fishing float before it was turned from flotsam into jetsam. If a piece of plastic is floating in the sea it will not be long before it becomes habitat for a potential host of species (Photo – Patrick Moore).*

While on this subject it is important to note that the vast majority of animals are in the shape of a tube. This is true for all vertebrates, worms, clams, insects, shrimp, sea cucumbers, and so many more, including humans. Food is ingested through one end of the tube and waste is emitted from the other end. Evolution has been intelligent enough to make the in-hole smaller than the out-hole. Therefore, nearly anything you can swallow – without choking to death – will be able to pass through the rest of you. Regarding humans, the Harvard Medical School's website on bowel obstructions lists numerous causes but there is no mention of large objects that were swallowed.[164]

During my numerous deep-sea voyages on Greenpeace campaigns, I witnessed many occurrences of plastic with sea-life growing on them. There is no doubt that one of the reasons fish and birds sometimes ingest bits of plastic is to get to the food growing on it. They would do the same thing if the food was growing on a small piece of wood.

One of the most contrived "narratives" about plastic in the ocean is that adult albatrosses are feeding plastic bags to their chicks and that in some cases this is killing the chicks. In his series *Blue Planet* for the BBC, Sir David Attenborough displays plastic bags and other bits of plastic film which he claims was fed to albatross chicks by their parents.[165] There is no video or photos of the parent albatross actually feeding plastic bags to their chicks.

Unlike mammals, birds have no teeth and therefore cannot chew their food. Birds of prey such as eagles, ospreys, and hawks are able to rip large prey into pieces small enough to swallow. But most birds swallow their food whole. Unlike most mammals, birds have two stomachs: one like ours with gastric acids to begin digestion and then there's the muscular gizzard where the food is broken down with the aid of indigestible solid objects. Birds that live on or close to land use pebbles for this. However, there are not a lot of pebbles out at sea. For sea birds the first choice is pumice from undersea volcanos which are basically rocks that float. When pumice is scarce seabirds will use pieces of hard wood, floating nuts from trees, and anything else that is the right size and relatively hard. In addition, the hard beaks of squids

eaten by seabirds are retained in the gizzard to help with digestion. Since plastic was introduced to the ocean, seabirds are perfectly content to use it as one of the hard objects for their gizzard. They are not giving bits of plastic to their chicks because they mistake it for food, birds are not that stupid. They are giving it to them so they can digest their food.166

Sir David Attenborough is the author of The Life of Birds, which he published in 1998 based on the 10-part PBS series.167 Is it possible that he does not know about gizzards in birds? Not to mention the fact that chicks need hard objects fed to them in order to digest their food properly; and that they continue to ingest hard objects through their entire adult lives for the very same purpose? Why doesn't Attenborough even mention the word "gizzard" during his claim that albatross parents are feeding plastics to their chicks?

The only image I was able to find in a thorough internet search shows an albatross transferring bits of hard plastic to its chick, suitable for its function in the gizzard, not plastic bags (see Fig. 59).168

Figure 59. *An albatross parent transfers suitable bits of hard plastic to its chick. These will be used to aid digestion in the gizzard. For seabirds it is more difficult to find suitable hard objects than for birds on land which use pebbles. The addition of floating plastic bits of marine flotsam has been a benefit to seabirds when other suitable objects are hard to find.*

On the website hosted by the Ocean Portal of the Smithsonian and the National Museum of Natural History, this claim is made:

> *Many birds accidentally eat plastic and other marine debris floating in the ocean, mistaking it for food. But the problem is intensified in Laysan albatrosses because of the way they catch fish, squid, and other seafood: by skimming the surface of the water with their beak. Along the way, they accidentally pick up a lot of floating plastic, which they then feed to their chicks. Adults can regurgitate plastic they've swallowed, but chicks are unable to, so it fills up their stomachs.*
>
> *The effects of plastic on the chicks hasn't been scientifically proven. It's probable that it injures or kills the birds by cutting their stomachs.*[169]

The Smithsonian should be ashamed of itself for spouting these false claims. As pointed out above, one of the reasons birds and fish swallow bits of plastic is to get to the food that is growing on them. Birds are not so stupid as to "mistake" plastic for food, or to feed plastic bags to their chicks thinking it is food. But most seabirds, including albatross, do purposefully provide hard bits of plastic to their chicks, and as adults they ingest plastic bits themselves, for the same reason that birds on the land feed pebbles to their chicks and ingest pebbles themselves for their entire lives.

The Smithsonian statement is not credible in that it states: "Adults can regurgitate plastic they've swallowed, but chicks are unable to, so it fills up their stomachs."

This is a false statement. While albatross chicks are in the nest, they are given as much as a kilo of hard objects to assist with digestion in their gizzard. Before they fledge and take flight, they regurgitate most of the hard objects in their gizzard, otherwise they would be too heavy to fly. The material they cough up is called a "bolus." Take note that the Smithsonian does not mention the words "gizzard" or "bolus." Like Sir David Attenborough, they intentionally neglect to divulge this information regarding the existence of the gizzard, even though they are most certainly aware of its existence. They and their colleagues are lying to us, knowing that the average citizen cannot go to remote ocean islands to observe the truth for themselves. This is a crime against the public. Scientists should be held to a high moral standard, and this sort of propaganda does not even qualify for a low moral standard. On the same websites there is a collection of images

exhibiting dead albatross chicks cut open to reveal what the Smithsonian alleges are the contents of the bird's "stomachs." I believe these images are staged (see Fig. 60). I stand to be corrected but I do not find these images to be credible as the amount of plastic shown is at least ten times as much as has been documented in the gizzards of albatross chicks.

Figure 60. *This is one of the images on the Smithsonian's website which does not make mention of the fact that albatrosses do, in fact, use hard bits of plastic for aiding in the digestion of their food. It is not because they are mistaking the plastic for food, it is because all birds have a gizzard where they use suitable hard objects to help their digestion. These images are widely distributed throughout the internet and are used to give plastic a bad name, when in fact the bits of plastic are serving a very useful purpose. These images are almost certainly staged as no albatross chick has this much plastic in its gizzard. All the studies researched for this chapter indicate that plastic objects are a minority of the objects in albatross chicks' gizzards.*

Greenpeace is right in the center of this disinformation campaign. Below is an excerpt from a paper describing Greenpeace's campaign policy and fundraising strategy that I co-authored with Dr. Willie Soon, as well as with Drs. Michael, Ronan, and Imelda Connolly.[170]

(Begin Excerpt)

Greenpeace claim that the Laysan albatross is in danger of extinction and they are blaming plastics. Here is an excerpt from Greenpeace USA's

webpage on the albatross:

> *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 five tons of plastic a year at Midway Atoll.*

And:

> *This species is in real danger of extinction because they are unable to breed fast enough to keep up with population declines (see Fig. 61).*[171]

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.

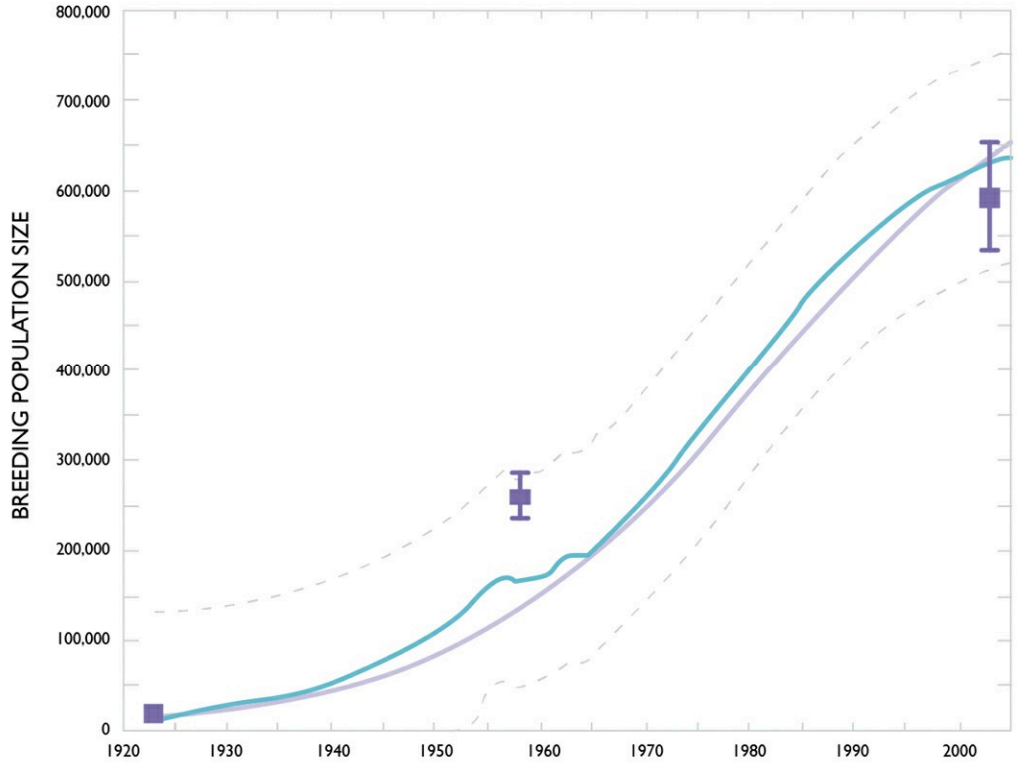

Figure 61. *A graph of the population of Laysan Albatross.[172] Their population was decimated by feather hunters,[173] but they have recovered steadily and may eventually reach their carrying capacity where the population will level off. Clearly, the great "menace" of marine plastic has not slowed them down. Greenpeace claims that the species is "in real danger of extinction because they are unable to breed fast enough to keep up with population declines."[174] Perhaps they have not seen this graph.*

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*.[175]

When researchers first started noticing, in the 1960s through the 1980s, that seabirds were ingesting plastic particles, 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 most worried about the following:

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

These were all reasonable concerns that led to a lot of research. As we will discuss later, after all of this research was concluded, the answers to all of the above now seem to be a simple "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. The plastic seems to be a beneficial alternative to the naturally occurring pumice, squid beaks, and other hard indigestible objects that seabirds have been using as digestive aids for millions of years.

Partly because they are a relatively large bird, the albatrosses are the seabirds which seem to ingest the largest 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 to 1989. In total, they analyzed 1,033 seabirds, making up 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.[176]

So, it is true that many seabirds are ingesting plastic particles along with many other types of naturally occurring indigestible materials. The average size of these plastic particles is very small (less than one gram). 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[177] and Gray, et al.,[178] there doesn't seem to have been an increase in the amount of plastic being ingested since then.

However, Greenpeace has chosen to ignore all of this research, and instead

(falsely) insists that the answer to all of the above concerns is “yes.” Further, they basely 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.*[179]
>
> *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.*[180]

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 actually investigating the claims have concluded.

One of the first systematic efforts to investigate these claims was through the graduate work of Peter Ryan in the late 1980s and early 1990s. 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 Hawaii:

> *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.*[181]

Other researchers’ findings were the same. For example, here is the main conclusion from the Moser & Lee 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).”*[182]

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 analyzed in this study. Stomach fullness was not correlated with the amount of plastic in the gut.*[183]

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.*[184]

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.*[185]

Another potential concern was that the plastic particles were gradually building up in the seabirds’ stomachs, and that over time their stomachs would 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 (six months to a year or even longer) were too long. They found:

> *An overall 90 percent 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.*[186]

It appears that rather than the plastic particles "building up" in the seabirds' stomachs, the seabirds actually have to collect replacement particles every year.

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.

(End of Excerpt).

It is clear that Sir David Attenborough, the BBC, the Smithsonian, and Greenpeace are knowingly lying through their teeth in hopes no one will call them out. Very few people know the truth about seabirds, gizzards, and the hard objects used for digestive aids. Virtually no one except scientists do field research in the breeding grounds of seabird species. And activists, the media, and some scientists are happy to play along with the "birds mistaking plastic for food" narrative. This is a clear example of an unobservable, remote situation where the general public cannot verify the truth of the matter for themselves.

Surely the concern about plastic in the oceans should be narrowed to focus on discarded fishnets and other articles that can trap or injure marine species. In the final analysis, the multi-faceted benefits of plastic far outweigh the negatives.

Henderson Island – "The Most Plastic-Polluted Place on Earth"

Not many people know where Henderson Island is situated because it is one of the most remote bits of land in the world. To get to it one must first fly to Tahiti, and then fly another four-five hours to Mangareva Island in the Gambier Islands, and then a three-day boat trip to Pitcairn Island, and then you must find someone with a boat who will take you the final 168

kilometers (104 miles) to Henderson Island which is uninhabited, and has no dock. It is just south of the Tropic of Capricorn.

On June 6, 2017, the journal *Proceedings of the National Academy of Sciences of the United States of America* published a paper that claimed "The density of (plastic) debris was the highest recorded anywhere in the world," on Henderson Island.[187] This was followed by a large number of media reports with photos claimed to be taken at Henderson Island (see Figs. 62 and 63).[188,189]

It takes weeks and tens of thousands of dollars at the best of times to visit Henderson Island. With the COVID-19 restrictions it may be impossible. So, I zoomed in on it with Google Earth Pro (see Figs. 64, 65, and 66). Here is the entire island, 37.3 square kilometers (14.4 square miles).

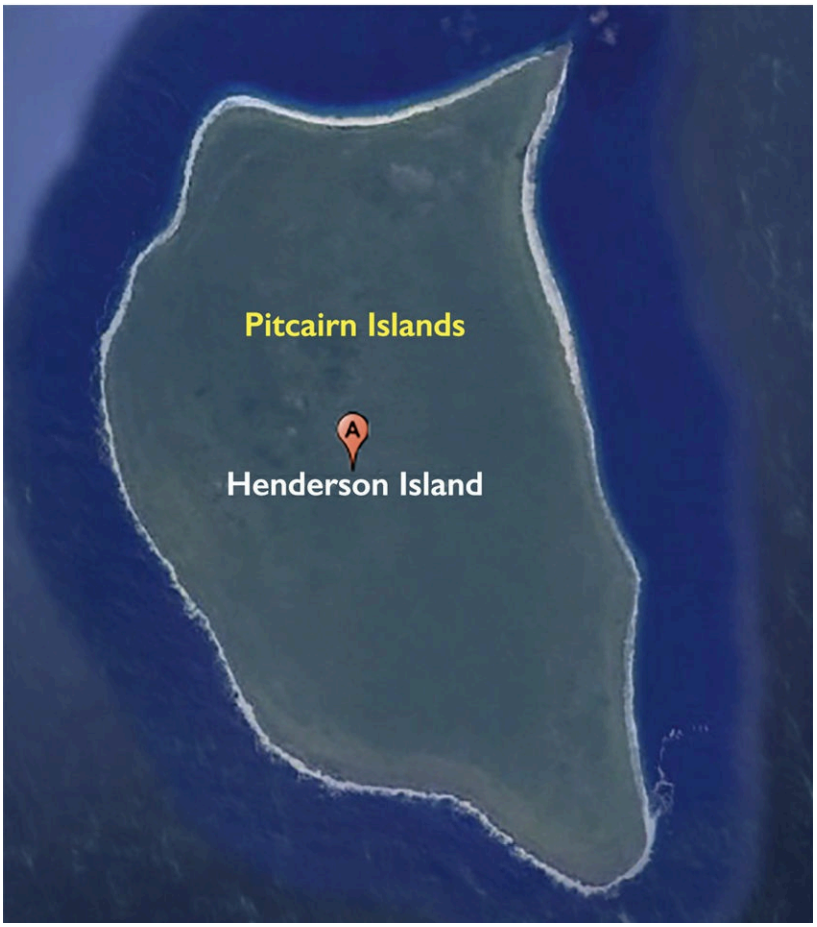

Figure 62. *Henderson Island is a raised coral reef. There is no fresh water supply as the rain soaks right though the porous coral. It is uninhabited. It was designated a World Heritage Site by the United Nations in 1988.*

Figure 63. *One of many photographs claiming to be of beaches on Henderson Island. Wherever it actually is, the plastic is mostly fishing gear.*

It is claimed, in the various reports about plastic debris, that the most polluted beaches are on the eastern shore. Here are some images of the sandy beaches on the eastern shore. I zoomed in on every beach on the island and did not see a single thing that looked like plastic debris. I believe at this resolution, if there were the amount of plastic on the beaches that their photographs display as the current extent of pollution, it should certainly be possible to see it (see Figs. 64, 65, and 66).

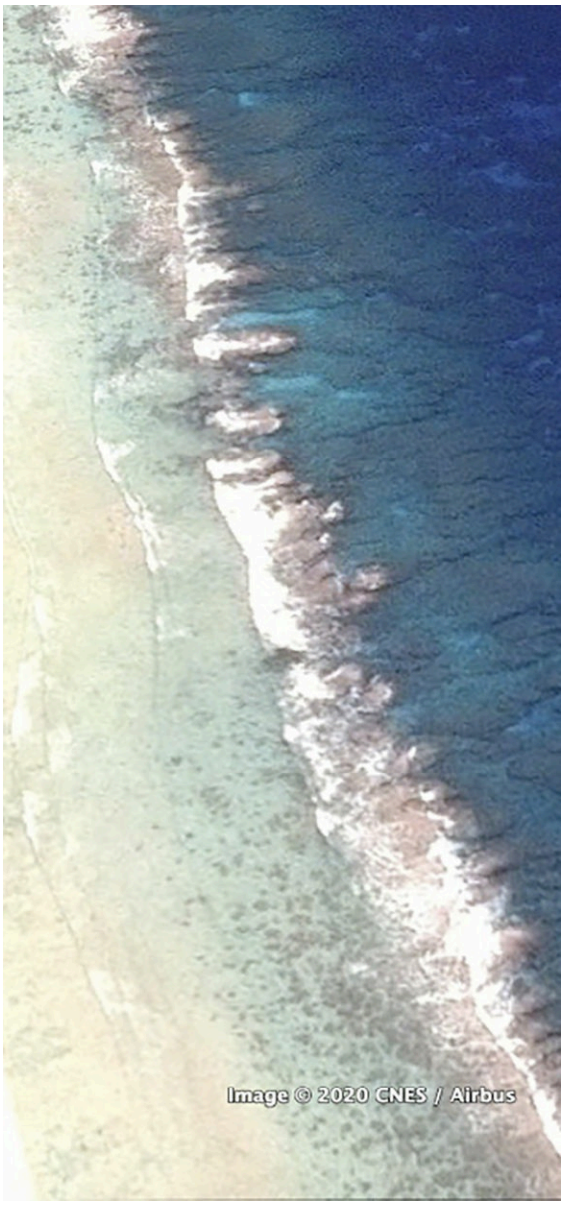
Image © 2020 CNES / Airbus


Image © 2020 CNES / Airbus
Google

Figures 64, 65, and 66. *There is no visible plastic debris on the eastern shore of Henderson Island in these images. I zoomed in on every beach on the island and they all appear similar to these stretches of beach. An independent team should go to Henderson Island to verify the claim that the Island, in fact, has the most plastic debris of anywhere else on Earth.*

Waste-to-Energy: The Solution for Unwanted Combustible Materials

While on the subject of plastic waste, let's cast a wider net and consider the subject of garbage in general, usually referred to as municipal solid waste. Waste materials can be divided into three broad categories; metals, glass, and combustibles (paper, wood, plastic, and food refuse). Metals are among the easiest and most economical materials to recycle. In the United States 86 percent of steel is recycled. Glass is also easily recycled, and any surplus or inferior product can be used as aggregate in asphalt or concrete. Most paper products are recyclable and a very high percentage of them are recycled today, however, paper that is contaminated with grease or food cannot be recycled. Wood waste, especially from the demolition of buildings, is more problematic as it is often discarded in short pieces and full of nails. A good amount of plastic can be recycled, though a large percentage of the material – plastic film and contaminated plastics – is not recycled. Food waste can either be converted into waste-to-energy fuel or it can be composted for garden soil. As a result, most waste that ends up in landfills is composed of the combustible materials that could actually be used to produce electricity and heat. This truly is a waste of valuable resources.

Interestingly, the most common combustible materials are of life origin.

Wood and paper are made from trees and plastics are made primarily from oil and natural gas, both of which are transformations of sediments from marine life; and of course food waste is of life origin as well. These carbon-based combustible materials are ultimately the product of solar energy and photosynthesis. We can recover that energy and turn it into electricity and heat.

The ultimate solution to preventing the dumping of unwanted combustible waste into a landfill or littering the environment is an industrial waste-to-energy plant (also called an energy-from-waste plant). This has been proven in cities and counties around the world. The technology is state-of-the-art with pollution control that meets the rigid standards adopted in most industrialized countries (see Fig. 67).

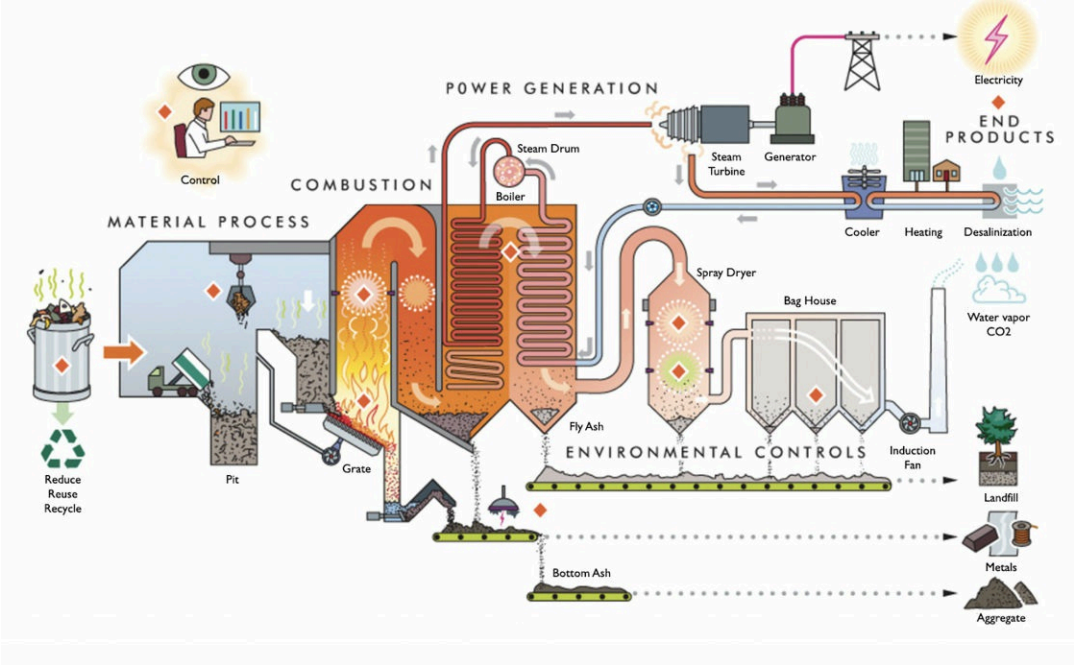

Figure 67. *A schematic of a waste-to-energy plant. It not only uses any combustible waste that is not suitable for reuse or recycling, but it can recover metals from composite products such as tires with steel belting and wood with nails in it. The bottom ash can be used as aggregate. Only the fly ash and waste from the pollution control equipment require landfilling.*

There are more than 2,450 waste-to-energy plants worldwide and there are plans to build more than 1,100 more plants in the near future.[190] The global market for these plants is expected to grow by 6.5 percent annually from 2020 to 2025. The European Union has 492 waste-to-energy plants that produce enough electricity for 18 million people, or four percent of the

population, and enough heat for 15 million people or about 3.5 percent of the population (see Fig. 68).[191] Japan has 380 waste-to-energy plants.[192]

According to a January 2019 report from the International Energy Agency (IEA), China now has the largest installed waste-to-energy capacity of any country globally with 7.3 gigawatts across 339 plants since the end of 2017. One gigawatt is the equivalent of one large nuclear reactor or two large coal powerplants. The industry has grown by one gigawatt per year on average in the past five years, and now represents the largest form of bioenergy capacity in the country, capable of managing just over 100 million tonnes of solid waste per year.[193]

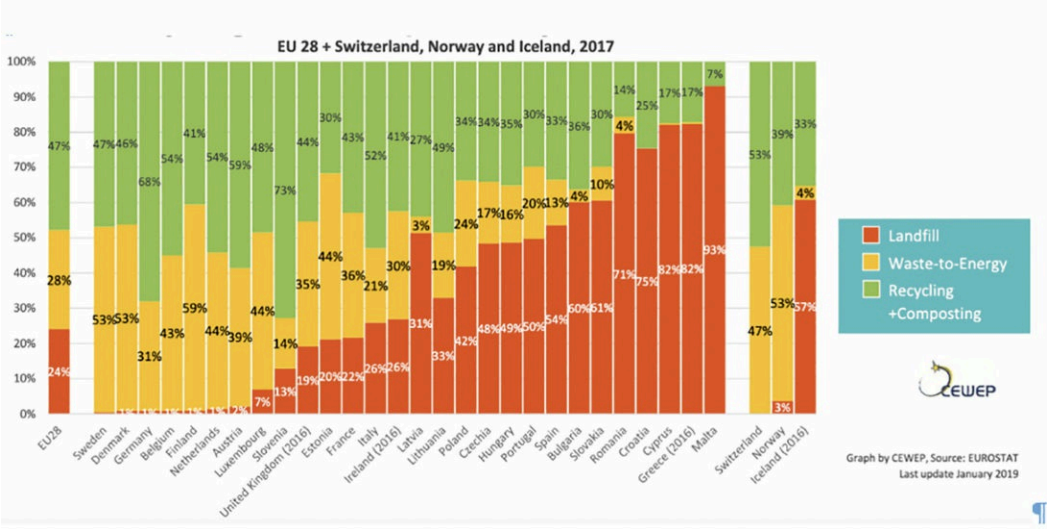

Figure 68. *A comparison of the fate of municipal solid waste in Europe shows a wide divergence among most western and eastern European countries. Germany directs 59 percent of its waste to produce energy and Slovenia recycles or composts 73 percent of its waste. Many eastern European countries send a large percentage of their waste to landfills as is the case in North America.*

The United States, which in 2017 produced 268 million tons of solid waste, sent 53 percent to landfills, recycled or composted 35 percent, and 13 percent was used for waste-to-energy.[194] In 2018, Canada produced 34 million tons of municipal waste of which 27 percent was recycled or composted. Statistics for waste-to-energy are difficult to find but it appears no more than three to five percent of Canada's waste stream is used for waste-to-energy. This means at least 60 percent of their waste ends up in landfills where it emits methane and often leaches contaminated water into the soil.

There are a number of reasons for this reliance on landfills in the US and

Canada, including the fact that land in most of North America is less expensive than it is in more densely populated countries like Japan and Europe. But one of the main reasons there are so few waste-to-energy plants in the US and Canada is because of the strong opposition to them from the “green” movement. When one looks into this it becomes apparent that green activists are not only opposed to burning fossil fuels, they are also pretty much against the burning of wood; and they don’t prefer the burning of waste that is not suitable for reuse or recycling. In other words, they are generally opposed to fire, also known as combustion. This opposition has resulted in a lack of political support for waste-to-energy options, while unreliable, expensive wind and solar energy options receive massive subsidies. Waste-to-energy plants not only displace fossil fuels, they also result in much less waste, including plastic waste that is discarded into the environment.

Critics of waste-to-energy claim materials that should be recycled will end up in the furnace, but this is not the case. It can easily be seen from Figure 67 that the countries with the highest percentages of waste-to-energy recovery also have the highest rates of recycling. It is the availability of landfills, basically dumps, that reduces the recycling and waste-to-energy programs. Germany, Denmark, Sweden, and Finland have set a high bar that can be achieved in any country with the political will and technical know-how. Canada and the United States have a long way to go.

China and South Asia are now leading the movement towards more use of combustible waste for energy. Perhaps North Americans will see the wisdom of this strategy sooner than later (see Fig. 69).

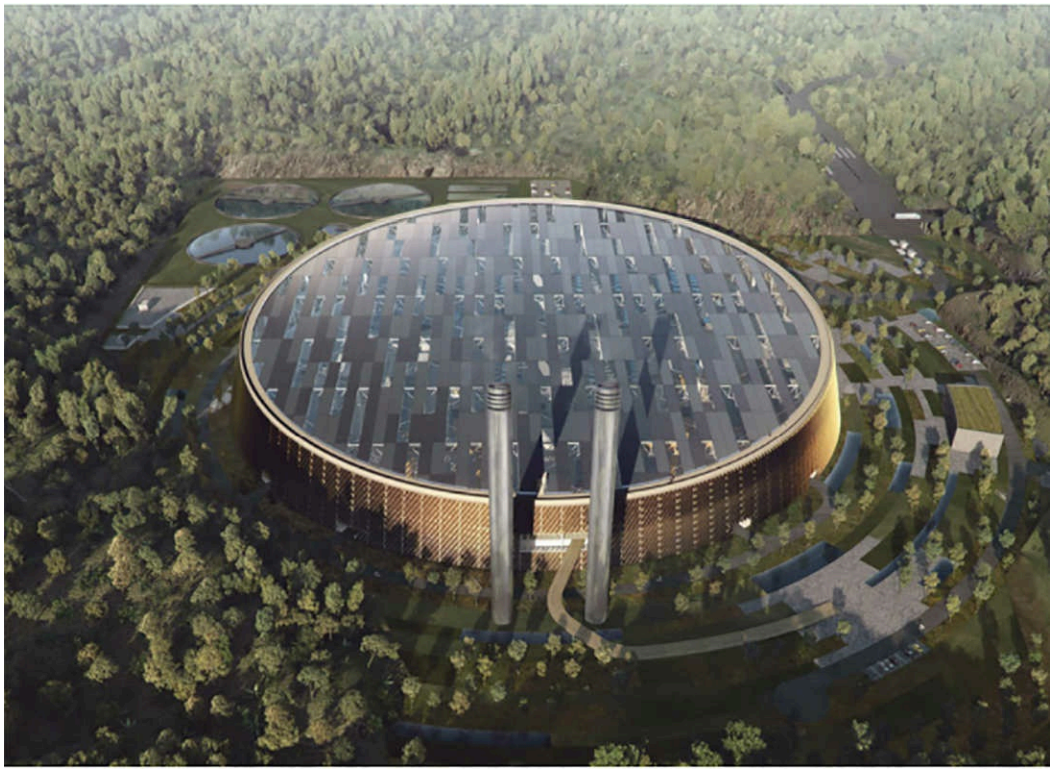

Figure 69. *China has recently built the world's largest waste-to-energy plant in Shenzhen. It will burn more than 5,000 tons of waste per day, producing 168 megawatts of electricity. The roof is covered with 44,000 square meters (474,000 square feet) of solar panels. The visitors center will focus on education in waste management and recycling.*[195]

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