

## The Ocean Cleanup

Wageningen Marine Research is committed to long-term research of plastic litter and its impacts on marine wildlife [www.wur.eu/plastics-fulmars](http://www.wur.eu/plastics-fulmars). From that background, the media and public often ask us about our opinion of The Ocean Cleanup project by Boyan Slat <https://www.theoceancleanup.com/>.

### **New test phase of The Ocean Cleanup in September 2018**

Now that The Ocean Cleanup project has started towing its first boom-system to the 'garbage patch' in the north Pacific Ocean, we again receive a lot of questions. The current system is a test model consisting of a 600m long floating synthetic curtain that will form a trap for floating litter. If this test model proves to be satisfactory, it is the intention of the project to scale up to about 60 of such units. In that full set-up, the Ocean Cleanup estimates that it will be able to reduce the garbage patch by about half in five years.

### **What will actually be cleaned up?**

The Ocean Cleanup has estimated that the north Pacific Gyre encircles a garbage patch containing about 80,000 tons of plastic litter ([Lebreton et al 2018](#)). That estimate compares reasonably well with some of the earlier estimates from much smaller datasets ([Van Sebille et al. 2015](#)). The floating litter in terms of plastic mass mainly consists of larger objects, and almost half is fishing net material. The mass of 80.000 ton accumulated floating plastics approximately equals 1% of the quantity of plastics lost to sea ANNUALLY from land-based sources, estimated at between 5 to 13 million tonnes of plastic ([Jambeck et al. 2015](#)), a range often simplified to about 8 million tonnes.

In combination with debris from marine sources (fisheries, aquaculture, shipping, offshore industry) the 'fishable' quantity of plastics from the Pacific Garbage Patch will thus be well below 1% of the plastics that we ANNUALLY lose to our oceans. When the Ocean Cleanup works according to plan at its full scale of about 60 units of the current 600m model, it expects over a period of five years to be able to remove about half of the plastics from the garbage patch, so roughly 40,000 tonnes. That quantity thus certainly represents less than 0.5% of our annual plastic input, or less than 0.1% per operational year of the Ocean Cleanup. Of course, each bit of plastic taken out of the ocean may help, but it is far away from an efficient clean-up of the plastics that we continuously lose to our environment.

### **Why then an Ocean Cleanup?**

With the 0.1% figure in the back of one's mind, it becomes a personal decision on how to balance costs and benefits of the Ocean Cleanup. Personally, we tend to think that the smart engineer Boyan Slat and his team had better focus their skills and creativity on technical solutions that tackle the plastic problem at its roots. One might think of technical solutions to reduce losses of nets or other objects from fisheries, or to facilitate their recovery. Or think about designing smarter, reusable and truly recyclable plastic packaging. Or design clever waste storage systems to be used onboard ships. Or work on technological improvements to filter plastics out of sewage discharges or rivers. And finally if you think of 'cleaning up of the ocean', to work on designs that could operate close to river outflows or along the coastline. Even when success of these things is moderate, they offer a better perspective than the 0.1% removal of annual input in the current planning. When responding to this type of comments, the Ocean Cleanup does confirm that source reduction is also important, but nevertheless, as far as can be seen, spends all of its funds in end-of-the-pipeline solutions. Of course, we are well aware that the Ocean Cleanup, without its spectacular aura of cleaning up the historic debt of our misbehaviour in distant oceans, would not be able to generate its current level of funds and support from public, big companies and governments. In that sense, our enumeration of alternatives is rather theoretical small-talk. But maybe we can challenge the Ocean Cleanup to also spend a substantial part of its funds to other solutions than cleaning up in distant gyres. We think that such would

represent a business plan that could also successfully convince big funding companies and the crowd-funding public to make The Ocean Cleanup an even bigger success than it already is.

### **Awareness and the urgency of change**

An important, but hard-to-measure effect of the Ocean Cleanup lies in its extremely effective public relations. With each new phase in the project, the Ocean Cleanup is able to globally raise broad media attention to the problem of plastic pollution in our oceans. In that sense, it increases public awareness of the problem. Awareness is most certainly an extremely important element in tackling the plastic issue. But, on the downside, the message that we are able to clean our accumulated mess of the past 50 years could reduce the feeling of urgency to change our ways of dealing with plastics.

That could have a negative effect. It is impossible to know the balance between these opposite effects, but both of them require our continuous attention. Yes, the Ocean Cleanup certainly raises awareness, but the cleaning up of current debris in the gyres does not solve our more than 50-year-old debts, and does not represent an ultimate solution to the problem.

### **Ecological impacts**

Of course we get many questions about the potential negative ecological impacts from installing big litter collecting booms in the gyre. Impacts are extremely hard to predict and need to be investigated. Possibly, the impacts from entanglement and ingestion of plastics on larger organisms such as marine mammals, turtles or birds could be 'neutral'. 'Neutral' here would be that concentration of debris could increase local impacts, but maybe not more than would otherwise occur more dispersed. The Ocean Cleanup is planning some research into these issues. However, in our feeling the Ocean Cleanup falls short in awareness of potential impacts of the booms on the smaller life-forms that cannot move away from the surface of the water (e.g. floating weeds, fish eggs attached to floating materials, surface animals like ocean skaters or surface-bound jellyfish). The suggestion that all oceanic life will be able to swim away or drift out from under the curtain is not correct. At the moment no dedicated research into these issues seems planned, but can still be built into the next-phase planning.

### **Ecologically good or bad? – an example**

The Ocean Cleanup booms concentrate man-made litter and natural floating materials like seaweed in small areas. Floating materials attract fish and other small life for shelter and food, and in turn are an attractive food source to birds, turtles and mammals. Thus, the booms will create spots with increased foraging perspectives for such wildlife. For example, albatrosses eat a lot of eggs of flying fish. These fish attach their eggs as long strings to floating objects, whether synthetic rubbish or natural materials. The albatrosses often gobble up the string of fish eggs with the floating item still attached, and feed the lot to their chicks. For the Laysan Albatrosses on the northern Hawaii Islands, such as Midway Atoll, such fish eggs probably represent an important source of plastics found in the stomach contents of the chicks. When chicks are lucky, when they grow up, they are able to regurgitate a big ball of accumulated indigestible items from the stomach before they fledge (See Photo 1 A to D). But depending on form and shape of the ingested plastics, regurgitation sometimes is impossible, with detrimental effect on survival of the chick. If the Ocean Cleanup only concentrates, but not increases albatross foraging in the area, the effect may be neutral. But if more birds start feeding there, the impact on the albatrosses may be negative. That effect is in principle temporary as the Ocean Cleanup intends to reduce the quantity of plastics floating around. Unfortunately, it is almost unavoidable that when the Ocean Cleanup takes the debris out of the water, that also the fish eggs are removed, and thus that available food for albatrosses is reduced. If this happens for long periods and over large areas that will create a negative impact, certainly for the birds, but possibly also to the fish stock. There are no simple answers to ecological damage or benefit.

### **Not an opponent**

It must be emphasized that the Ocean Cleanup has invested substantial time and funds into solid research of distribution and abundance of the litter, and knowledge of the types of debris most prominent in the garbage patch problem (e.g. [Reisser et al. 2015](#); [Lebreton et al. 2018](#)). They have

done this on a scale that no one else has been able to get together, and this achievement deserves applause. Our critical side-notes to the Ocean Cleanup campaign are sometimes interpreted as if we were opposing the project. That is not the case, we only think that it could be even better.



*Photo 1 A) Laysan Albatross feeds chick on Midway Atoll, B) almost full grown chick with a recently regurgitated ball ('pellet') of stomach contents, C) close up of the regurgitated pellet, and D) a pellet taken apart showing the mix of plastic rubbish and fish eggs.*

Jan van Franeker & Suse Kühn  
Wageningen Marine Research, Den Helder, The Netherlands  
[www.wur.eu/plastics-fulmars](http://www.wur.eu/plastics-fulmars)

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