

De-plasticizing the Ocean

Summary: Solutions for Shorelines and Open Waters - February 2017

Decades of plastic pollution which is ubiquitous in the oceans, in Arctic ice, and concentrated in several ocean gyres is visually repugnant and invokes a visceral reaction. Countless scientific studies enumerate the harm to the environment, sea flora and fauna, and on up the food chain including humans. A recent study indicates that seafood eaters ingest up to 11,000 pieces of plastic in year.¹ It is an epic 'tragedy of the commons' tale, and another testament to the short-sightedness of humans regarding even our own well-being.

Visceral responses have resulted in a range of proposed solutions over the decades. None have been effectively implemented beyond cosmetic effect though dozens of organizations are focused solely or significantly on the issue. The challenges are multiple and significant. Despite misleading media images of waste plastic floating in water, plastic in the oceans is not particularly concentrated, and averages much less than one piece of visible material per square metre, and appreciably less than 10 pieces in a square mile of ocean, overall. The ocean is big, and at times hostile. In the open ocean, 10 metre waves and gale force winds are a fact of life. Plastic pollution in the ocean ranges in size from particles not visible to the unaided human eye to pieces which measure a metre or more in all 3 dimensions. Organic mass, living and dead, is frequently attached to the weathered garbage at issue; removing the plastic without fatal consequences for the encountered biota has not yet been solved. The recovered plastic has no market value; that's why it is called garbage.

This document describes a viable path toward cleaning up a significant amount of the plastic now on our oceans and on our shorelines via three solutions utilizing innovative technologies. What remains is to find the vision and will to concretely address the issue and secure funding.

For more information on our solutions for removing plastic pollution from wild waters, to obtain our technical document, or to arrange a demonstration, please contact Darryl McMahon of RESTCo via the RESTCo.ca website or by e-mail at darryl@restco.ca

¹ <http://www.telegraph.co.uk/science/2017/01/24/seafood-eaters-ingest-11000-tiny-pieces-plastic-every-year-study/>

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The Solutions in Summary

Plastic pollution is pervasive and persistent in our waters and on shorelines.

Microplastics are not captured by conventional waste water treatment systems. We need new, effective approaches to remove plastic pollution from open water, shorelines, beaches and municipal waste water system outlets. These specific solutions are based on novel applications of technology originally designed for oil spill response. After all, plastics are essentially refined oil products.

Municipal Waste Water Systems

Municipal waste water treatment systems are essentially a combination of coarse filters, chemical treatments to reduce bacteria, settling tanks and aeration. For items which are lighter than water, flocculents are used to sink the material. However, flocculents don't adhere to inorganic plastic, and the plastic can float out of the treatment systems into natural waters.

Our solution for removing floating plastic pollution from waste-water treatment systems is to use a filtration fabric which allows water to pass through, but can capture oil at the molecular level. As even microplastic and 'grey goo' plastic molecules are bigger than oil molecules, they will be captured on or in the fabric. The fabric can be cleaned and re-used.

Open Water (big rivers, lakes and oceans)

Most people do not appreciate how big the ocean is. Even while there are massive amounts of plastic pollution in the ocean, the ocean is so big (360,000,000 sq. km surface area), that the visible plastic pollution density - on average - is actually pretty low: less than one piece per square kilometre or square mile of ocean. However, there are a couple of things which concentrate this plastic more closely together. The first is the marine food chain, which is not so good for us being at the top of the marine food chain. The second is ocean currents and resulting gyres. There is an innovative and highly effective oil skimmer technology which can operate on the ocean, even in inclement weather conditions. This gravity-based system separates spilled oil from water based on the lower density of the oil, which is why the oil floats on the surface of the water. The same principle will allow it to remove floating plastic from the ocean, augmented by a bow-mounted trash-gate / conveyor system to collect larger items. Based on physical tests with small vessels (12 metres) and computer simulations, recovery efficiency for floating oil can exceed 90%. Based on relative densities, similar recovery rates for floating plastic are expected.

There are many kinds of plastic, and the plastic recycling industry does not like mixed plastic waste. However, as the main kinds of plastics have different densities, it is

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feasible to separate them via flotation on a succession of liquids of different densities (e.g., water with varying salt content). Thus, after separating the plastic from collected organic matter, it should be possible to provide separated streams of waste plastic to the recycling industry. However, this is not expected to generate enough revenue to fund the construction and operation of the vessels.

Shorelines and Beaches

Due to winds, ocean currents, tides and wave action, a significant amount of floating plastic ends up coming ashore on beaches and shorelines. Nanoplastics, microplastics and small mesoplastics can filter into sand and gravel, where they remain available to birds and shoreline creatures to ingest. Beach clean-up events can collect larger pieces (meso and macroplastics) which can be grasped by hand, but the smaller items are not collected by this approach. The plastic pollution of consequence is the material on the surface or within a few centimetres. Pieces deeper than that are essentially not available to birds or shoreline surface inhabitants.

The process for cleaning the upper layer of the beach or shoreline which is not overgrown with vegetation is based on picking up this layer (a few centimetres thick) and putting it into a settling tank with some local water in it. With stirring, the sand and gravel will sink to the bottom, and the plastic will float on the surface. The floating plastic pollution, including meso, micro and nanoplastic, can then be skimmed off the surface using a filter fabric scoop. The skimmed plastic can be removed from the area, the water drained back to its source, and the sand returned to its original location. Repeat this process until the entire area has been remediated. We can provide plans for making the settling box and skimmer at no charge.

**We can continue talking about the problem of plastic pollution in water,
*or we can actually do something about it.***

To engage in doing something positive, please get in touch (e-mail darryl@restco.ca)