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5GYRES

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PLASTIC SOUP

Microplastics in consumer products and in the marine environment

Position Paper - 2013

5 Gyres Institute
Plastic Soup Foundation
Surfrider Foundation
Plastic Free Seas
Clean Seas Coalition

Many consumer products sold in the United States and around the world contain microplastic particles as abrasives and exfoliants. In most cases, these microplastic particles are intended to be washed down the drain after use, where many sewage treatment facilities are incapable of capturing them. They are polluting our waterways. Microplastic particles are found in all oceanic gyres, bays, gulfs and seas worldwide, and recent evidence has found microplastics, including polyethylene microbeads, in the Great Lakes of North America.

The 5 Gyres Institute, Plastic Soup Foundation, Surfrider Foundation, Clean Seas Coalition and the Plastic Free Seas are campaigning to end the use of plastic microbeads in consumer products.

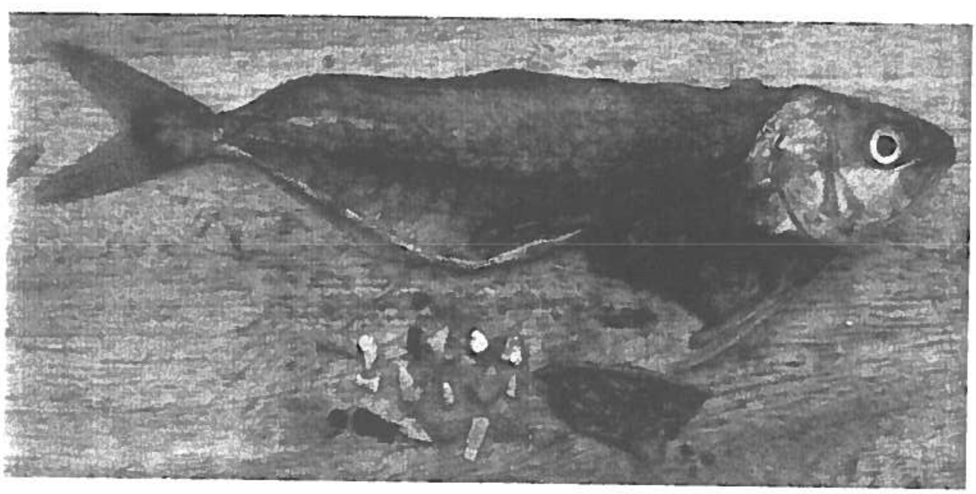
We know microplastics are pervasive in the environment, that they absorb persistent organic pollutants, and are consumed by a variety of marine life, including fish we harvest to feed the world. We also know that other natural alternatives, like apricot shells and cocoa beans, are being used successfully by other companies. We are confident that the scientific evidence of microplastics and microbeads in the environment, and the known and suspected harm to marine life, will convince companies to end the use of microplastics in consumer products worldwide and switch to available alternatives.

Microplastics impact the marine environment

Microplastics are pervasive throughout the marine environment, absorb pollutants, are ingested by many marine organisms, and enter a food chain that includes humans.

Microplastics in the world's oceans. Plastic pollution is the dominant type of anthropogenic debris ubiquitous throughout the marine environment (Barnes, et al, 2009; Derraik, 2002; Gregory and Ryan, 1997). Microplastics are estimated to reside in all of the subtropical gyres (Maximenko et al., 2012; Lebreton et al., 2012). Floating plastic fragments have been reported in the Northern Hemisphere subtropical gyres since the early 1970's in the North Atlantic (Carpenter and Smith, 1972; Colton et al., 1974; Law et al., 2010), and North Pacific (Day et al.,1990; Moore et al., 2001; Hidalgo-Ruz et al., 2012). Recently, a new garbage patch in the South Pacific Subtropical Gyre has been identified (Eriksen, 2013).

Microplastics in the bodies of marine life. A wide range of marine life, including marine mammals, reptiles and birds, is impacted by plastic pollution through ingestion (Laist, 1987; van Franeker et al., 2011). Sea cucumbers, mussels and oysters, lobsters and fish are examples of marine species in which microplastic particles have been found (Graham et al., 2009; Brown et al., 2007; Murray et al., 2011; Possatto et al., 2011). Research suggests this can have consequences for toxicological effects and the transfer to higher trophic levels (Ward et al., 2009). We know that persistent organic pollutants, like PCBs, DDT, and PBDE's (flame retardants) will be absorbed by microplastics (Mato et al., 2001; Teuten et al., 2007; Teuten et al., 2009; Rios et al., 2010). Because plastic enters our food chain it ultimately threatens our own health.



Sources of microplastic pollution. Plastic pollution enters the marine environment via rivers, beaches, maritime activities, and illegal dumping at sea (Derraik, 2002; Ryan et al., 2009). Under the effects of UV degradation and hydrolysis, plastic loses its elasticity, and powered by wind and waves, gradually breaks into smaller particles, which are called microplastic when they are less than 5mm in diameter (Andrady, 2003; Thompson et al., 2004; Cole et al., 2011).

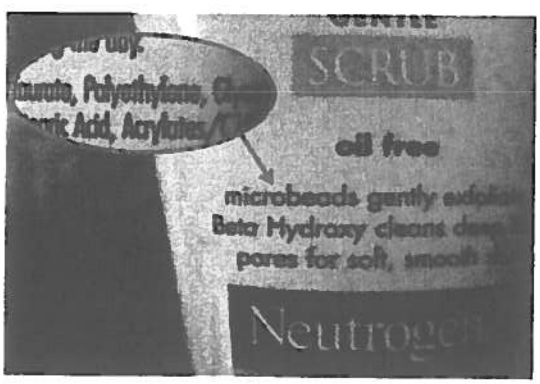
But one source of microplastics, those found in many consumer products, are already in the size range. Microplastics and microbeads that have originated from personal care products typically enter the sewer system after they have been flushed down the sink or bathtub. Many wastewater treatment plants are unable to remove all microplastics and microbeads as they are too small, do not biodegrade and float. A number of studies have shown that microplastics simply pass through wastewater treatment facilities (Vesilend, 2003; Bowne, et al., 2007; Browne, et al, 2011; Leslie, et al., 2012). Furthermore, not all sewage water goes through a sewer treatment plant on its way to the ocean, as many release wastewater overflow directly to rivers during heavy rainfall events. In all these circumstances untreated sewage, including microplastics, is released into the environment.

Microplastics in consumer products

Microplastic particles and microbeads can be found in facial scrubs, shampoos & soaps, toothpaste, eyeliners, lip gloss, deodorant and sunblock sticks. These micro particles are made of Polyethylene (PE), Polypropylene (PP), Polyethylene Terephthalate (PET), Polymethyl methacrylate (PMMA) and Nylon. PE and PP are the most common.

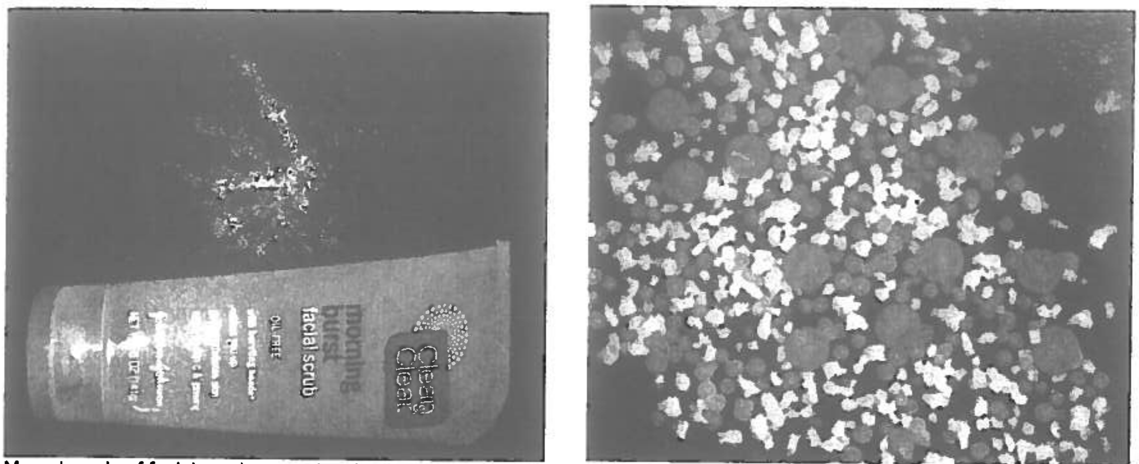
The Institute for Environmental Studies (IVM) in the Netherlands carried out research on several products for the presence of microplastics. In one example 10.6% of the product weight consisted of polyethylene (PE). This means that for every bottle of 200ml used, 21g of micro plastics would end up in the sewer system. Another product examined in the study contained very small particles - 50 µm in diameter - of polyethylene terephthalate (PET) (Leslie, 2012).

The average amount of micro plastic used by consumers is about 2.4 mg of micro plastic/person/day (Gouin, 2011). Some products contain as much as 10% PE, the equivalent of one teaspoon or 500 mg.



Product reads "Microbeads" listing "polyethylene" as an ingredient

Competing products contain sustainable alternatives



Many brands of facial scrubs contain microbeads and angular microplastic fragments as seen here at 10X magnification

The 5 Gyres Institute examined three brands of facial scrubs containing microbeads. They were analysed for microbead weight and percentage in product. The percentage ranged from .94-4.2%

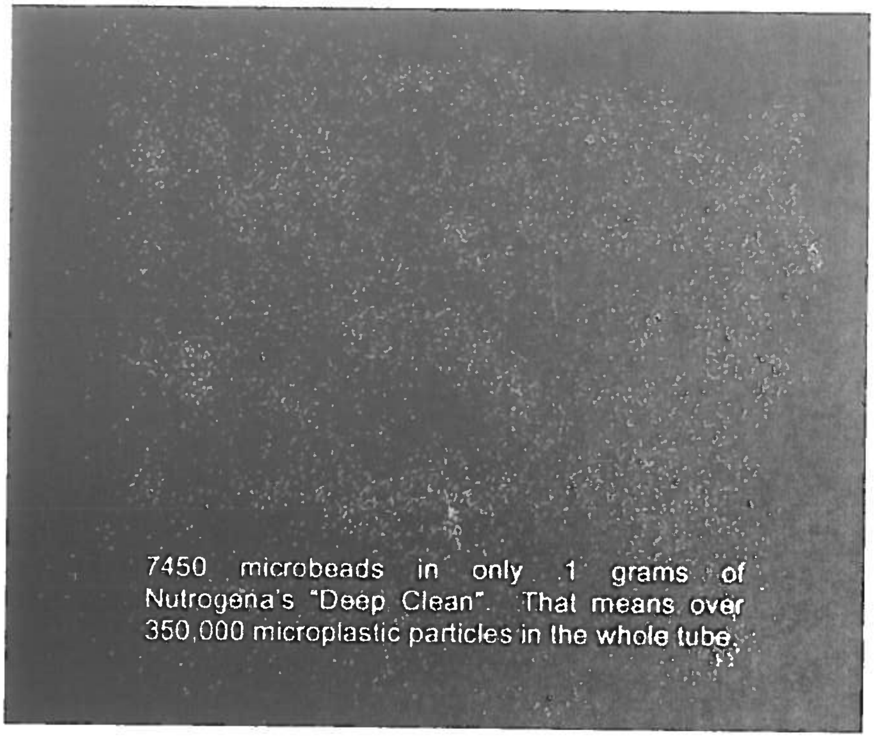
PERCENTAGE OF MICROBEADS IN THREE FACIAL SCRUB PRODUCTS

Brand	Parent Company	Volume or weight of product	Weight of plastic in product PE density = .91g/ml	Percentage of product that is plastic
Deep Clean	Neutrogena	125ml	4.78 g or 5.25ml	4.2%
Clean & Clear	Johnson & Johnson	156g	1.47 g	.94%
Aveeno	Johnson & Johnson	140g	1.49 g	1.06%

One product was selected to be counted. Nutrogena's "Deep Clean" was selected, and .1 grams of the product's total of 4.78 grams was separated, photographed and counted. The photograph contained 7450 microbeads. If we multiply this by 47.8 to scale up the to total weight in the product, we then estimate that the total number of microbeads would be 356,110. That's a million microbeads in every three tubes!

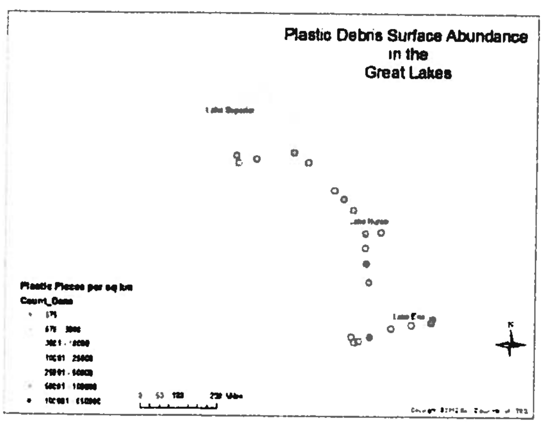
NUMBER OF MICROBEADS ESTIMATED IN ONE PRODUCT

Product	Start weight	# of microplastic particles counted	Estimated # of microplastic particles in 4.78 grams of entire product
Neutrogena's Deep Clean	.1g	7450	356,110



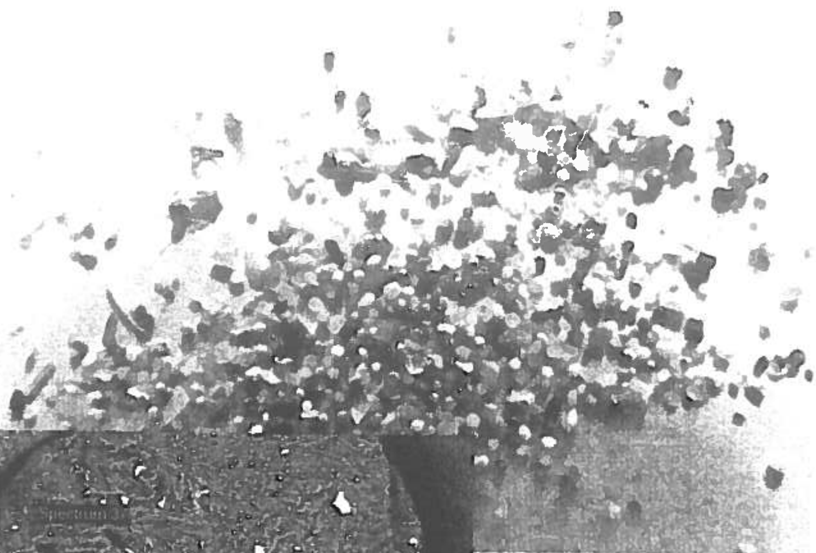
Microbeads in the Great Lakes

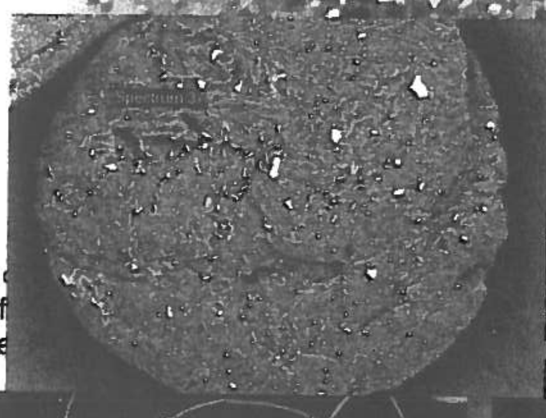
During the summer of 2012 the 5 Gyres Institute, in collaboration with SUNY Fredonia, collected 21 samples of the lake surface in three of the Great Lakes: Huron, Superior and Erie. We used a .35mm net to sieve the top layer of the lakes, which is the same method and equipment used for ocean sampling. We tow the 60cm wide net for two nautical miles, approximately equaling one football field of surface area. We were surprised to find 1237 microplastic particles in sample #20. These downstream samples contained more plastic particles than any of the over 400 ocean samples we've collected in all five ocean subtropical gyres around the world. But the particles are tiny.



21 samples were collected in 3 lakes Microplastic particles from sample 20

The microbeads look like little perfect spheres, multi-colored beads, the size of the period at the end of this sentence. These micro-beads are difficult to find. They are dirty, look just like fish eggs, so you need a microscope to tell the difference between microplastic particles and natural organic material. We separated the non-natural particles from all samples.





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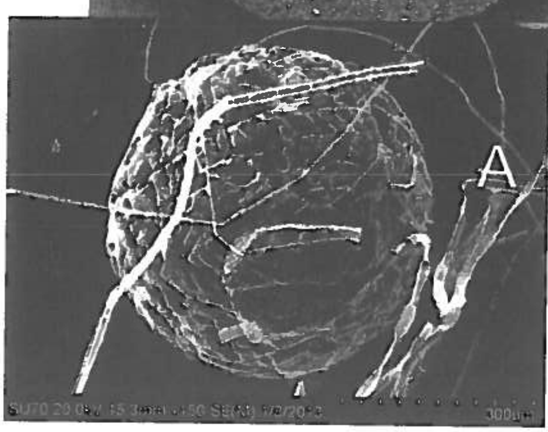
To be ... in our samples, we analyzed them at 70x magnif... cope (SEM), which confirmed that the particle... lene.



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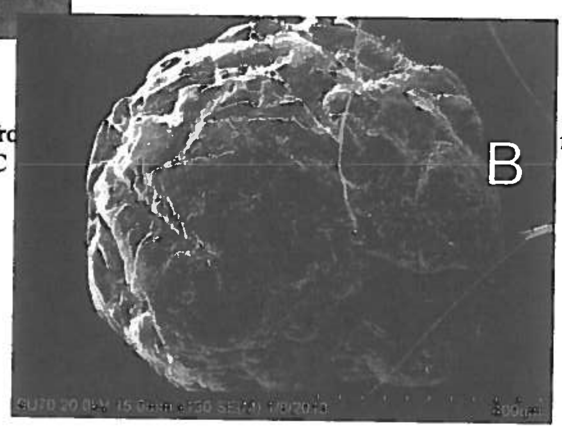

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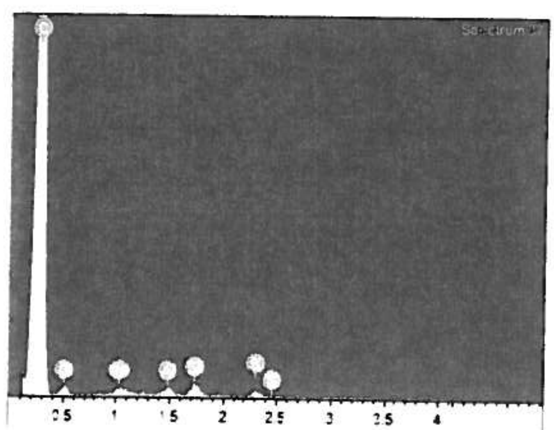

What to do?

Fixing the problem of plastic pollution in the ocean is very complex. The sources are very diverse, originating from maritime industries, waste management practices, consumer behaviour, poor design of products, and benign legislative actions with no enforcement. When you find a plastic object in the middle of the ocean, it is difficult to ask a company or country to take responsibility for several reasons. Either the plastic product is degraded beyond recognition, discovered in international waters where no legal enforcement of anti-litter regulations exist, or a single product type is not found in volumes that reflect pervasive harm. Microbeads in consumer products are different.

With microbeads we can point to specific companies in host countries and hold them accountable for their plastic waste. We know that one point of origin is from sewage treatment facilities that do not capture microbeads. We know that many consumer products that contain microbeads are designed to wash down the drain. And we know that there are benign alternatives, like apricot shells or cocoa beans, which are used by other manufactures.

We believe:

- Plastic does not belong in the marine environment, and we must prevent new sources of plastic pollution entering the seas and oceans;
- There should be a global ban on using microplastics in consumer products.
- A responsible company does not use microplastics as an ingredient in its products.

We are asking:

- *Retailers to STOP selling consumer products that contain microplastics and microbeads.*

- *Manufactures to STOP using microplastics and microbeads in consumer products worldwide and switch to natural materials that have the same properties, but do not pollute the environment with plastic pollution.*

- *Consumers to check their products for plastic content and REFUSE to purchase them.*

- *Legislators to execute a ban on microplastics and microbeads in consumer products.*

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