Shore Stewards
Washington State University Extension

SPOTLIGHT ON… MICROPLASTICS

The Problem with Microplastics

We are all aware of the problems associated with larger plastic items that float around in our oceans and Puget Sound. Fishing nets trapping and killing fish and marine mammals, plastic bags ingested by turtles who mistake them for jellyfish, and six-pack holders strangling wildlife are just a few examples of the threats presented by the plastic debris that enters our marine waters from land, boats and recreational activities. Something that was not of concern until recently, however, are the tiny plastic particles that are now called *microplastics*. Microplastics are described as synthetic polymers measuring 5 millimeters or less in size, or smaller than a ladybug. They can be "new" plastic pellets used in manufacturing, called nurdles, which get spilled by trucks onto our highways and factory parking lots and swept into our storm drains and out into the Sound and ocean. These are often mistaken by fish as being edible fish eggs. Or they can be the result of larger plastic pieces that break down and weather into smaller bits over time, also ingested by marine life.

A lot of research about microplastics is being done in the Puget Sound region. Researchers from the National Oceanic and Atmospheric Administration (NOAA) are leading efforts through the Marine Debris Program. They are working on standardizing the methods used to collect sand, sediment and surface water that may contain samples of microplastics, and are testing those methods in Puget Sound and Chesapeake Bay, partnering with Dr. Joel Baker, the Port of Tacoma Chair in Environmental Science at University of Washington Tacoma. They are seeking to develop a simple and cost-effective method of estimating the quantity of three common plastics in samples they've taken, and eventually these protocols will make global comparisons of the amount of microplastics released in the environment possible.

Research on the problem of microplastics is relatively new, and scientists from around the world are beginning to meet to discuss the topic. The NOAA Marine Debris Program and the University of Washington Tacoma have held two workshops in Tacoma, bringing together scientific experts from around the world to discuss the different topics relating to microplastics. These were held in September of 2008 and November of 2010. In June of 2010, a three day workshop was held in Paris to address the problem, titled "GESAMP International Workshop on micro-plastic particles as a vector in transporting persistent, bio-accumulating and toxic substances in the oceans". (GESAMP is the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection.) Links to the proceedings of these workshops can be found in the References section of this newsletter.

Tiny plastic particles collected on a beach in Hawaii

Microplastics and Organic Contaminants

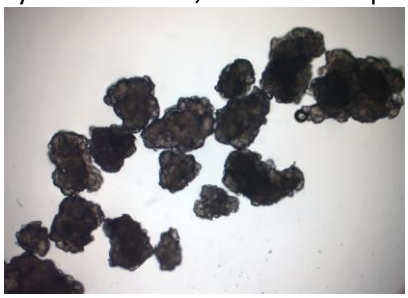
One of the main concerns is the possibility that organic contaminants like dioxins and polychlorinated biphenyls may be absorbed and concentrated in the microplastics, potentially harming organisms that ingest the particles. According to Anthony Andrady, a materials scientist and polymers specialist with North Carolina State University in Raleigh, "In the ocean, plastics act like a sponge", absorbing and concentrating fat-soluble pollutants. In a study reported in the November 2010 issue of *Marine Pollution Bulletin*, it was reported that researchers in Portugal found microplastic pellets tainted with toxic pollutants.

The Portuguese team filtered out sand-size pellets of polystyrene and polypropylene from sand collected from two coastal beaches. Persistent organic pollutants found in the plastic bits included polychlorinated biphenyls, polycyclic aromatic hydrocarbons, and DDT, some of which are found in crude oil. João Frias, the lead author of the article and an ecological engineer at the Institute of Marine Research at the New University of Lisbon (in Caparica, Portugal), reported that "Every sample was contaminated." Marine ecologist Henry Carson (University of Hawaii, Hilo) was alarmed by these findings. According to Carson, "These tiny pieces have the potential not only to get inside tissues of mussels and other animals, but to actually move into their cells. That's pretty frightening."

Due to their tiny size, some microplastic particles appear to be eaten by Pacific krill, who cannot differentiate the particles from algae. Krill are tiny organisms at the base of the marine food web, eaten by fish, birds, and whales. Andrady feels that plastic of this size is not inherently toxic to animals and humans, as we have no enzymes capable of digesting the plastics. Plastics tainted with the toxins, however, will be available to animals that eat them, as well as their predators, as their large surface-to-volume ratio allows microplastics to rapidly absorb these toxic pollutants. They can then quickly release these pollutants to fatty tissues inside of the animals, which is what Andrady finds so worrisome.

The Threat from Household Cleansers

There are other sources of microplastics besides nurdles used in manufacturing and larger plastics that have broken down into smaller particles. Many common products used in the home contain tiny beads of plastic, including exfoliants, toothpaste, deodorants, eyeshadow, body washes, and abrasives used in hand-washing products. Go through the personal care products in your household and look for the ingredient *polyethylene*. If the word is followed by a comma, you have found a source of microplastics in the form of tiny beads that wash down the sink, through the filters at the sewage treatment plant, and into the Sound or ocean. (Note: *polyethylene glycol* is a different product, and may not pose the same threat.) Of course, if you have a septic system at home, this does not pose a problem.



Microplastics magnified under microscope from name brand cosmetic products. (Photo: Dr. Mary Sewell/University of Auckland)

Dr. Mary Sewell, a professor at University of Auckland in New Zealand, has published a paper along with Dr. Lisa Fendall in the January 5, 2009 issue of the Marine Pollution Bulletin titled **Contributing to marine pollution by washing your face: Microplastics in facial cleansers.** An abstract of that paper states: "Plastics pollution in the

ocean is an area of growing concern, with research efforts focusing on both the macroplastic (>5mm) and microplastic (<5mm) fractions. In the 1990s it was recognized that a minor source of microplastic pollution was derived from liquid hand-cleansers that would have been rarely used by the average consumer. In 2009, however, the average consumer is likely to be using microplastic-containing products on a daily basis, as the majority of facial cleansers now contain polyethylene microplastics which are not captured by wastewater plants and will enter the oceans. Four microplastic-containing facial cleansers available in New Zealand supermarkets were used to quantify the size of the polythelene fragments. Three-quarters of the brands had a modal size of <100 microns and could be immediately ingested by planktonic organisms at the base of the food chain. Over time the microplastics will be subject to UV-degradation and absorb hydrophobic materials such as PCBs, making them smaller and more toxic in the long-term. Marine scientists need to educate the public to the dangers of using products that pose an immediate and long-term threat to the health of the oceans and the food we eat." Dr. Sewell further suggests that further investigation into the impact of these plastics on microscopic marine life is warranted.

Synthetic Lint: Your Laundry as a Source of Pollution

One of the newest recognized sources for microplastics in the ocean is your washing machine. Many of our garments are made of synthetic fabrics, often polyethylene. Polar fleece, for example, is often made from polyethylene terephthalate (PET), sometimes promoted as being made from recycled plastic soda bottles. This can be found in everything from fleece jackets to blankets and throws. Every time you put one of these garments in the washing machine, it sheds tiny plastic fibers. Thousands of these fibers can result from a single washing cycle, making their way through our sewer systems and into our Sound and ocean. (Those who have septic tanks do not have to be concerned.)

Mark Browne, an ecologist at University College Dublin, joined colleagues in collecting and testing samples of sediment from 18 shorelines on 6 continents, as reported in *Environmental Science and Technology.* They found plastic fibers in every sample, with more being found near urban centers and in densely populated countries, and made up more than 65 percent of the plastic pieces overall, by number. (The study did not include sand-sized pellets.) Earlier studies by the group found plastic fibers at land sites that were treated with sewages, so the researchers then sampled outflows from sewage-treatment plants. Wastewater from these plants was found to include plastic fibers from 1 millimeter down to 10 micrometers in diameter. Thinking that laundry might be a source of these fibers, over the following year they laundered individual blankets and garments, including several "empty" cycles between washings to clean out fibers between tests. They found that a single garment can produce greater than 1,900 fibers per wash, with fleece contributing the most.

Textile manufacturers are not presently required to test their products for durability or their potential to shed plastic. According to Browne, "We've been contacting industry representatives to try to find out that

information so that consumers can make a choice, but no one has come forward and I find that disheartening." Browne also states, "Consumers have the power when they go into a store to ask whether clothing has been tested for its impact on the environment. If more and more consumers started doing this, it would then put pressure on the people who actually produce clothes to do something about it." Until this happens, one way of making sure that your washing machine does not contribute to plastic pollution in the ocean is to use natural fabrics whenever possible.

References

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