

## Is This a New Silent Spring?

September 25, 2015

By Jay Sinha

In 1962, Rachel Carson published her seminal book and call to action, *Silent Spring*, which documented in chilling detail the toxic effects on wildlife of a widely used and seemingly harmless pesticide commonly known as DDT (dichlorodiphenyltrichloroethane). The American marine biologist and conservationist explained how the chemical weakened the egg shells of raptors and other birds, thus leading to the death of their young. Scientists call this "reproductive failure."

With *Silent Spring*, Carson put a powerful public spotlight on the dangerous effects of synthetic chemicals in the environment. She explained in a manner accessible to all how such human-made toxins directly harm wildlife and have the potential to harm humans. When it was published, she was dying of advanced breast cancer. Practically single-handedly, she ignited a global environmental movement and influenced the eventual banning of DDT.

A couple of weeks ago, a stunning research paper, "Threat of plastic pollution to seabirds is global, pervasive, and increasing," was published in the U.S. Proceedings of the National Academy of Science by scientists from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Imperial College London.

Here are few of their key findings based on an extensive global risk analysis of plastic exposure and ingestion by 186 seabird species:

- Nearly 60 percent of all sea bird species have plastic in their gut.
- They estimate 90 percent of all seabirds alive today have eaten plastic of some kind.
- Based on current rates of plastic ingestion by birds and exponentially increasing global plastic production, they predict that plastic will be found in the guts of 99 percent of all seabird species by 2050.

There is now a significant amount of research and information available about plastic pollution and the toxic effects of various plastics. So why should this study be different?

Because it highlights what might be the "canary in the coal mine," pointing to a new *Silent Spring*.

One leading marine biologist seems to think this is the case, especially when considered alongside the steadily increasing body of scientific research highlighting the

endocrine-disrupting effects of plastic chemicals ranging from bisphenol A (BPA) to phthalates.

Dr. Boris Worm, a professor at Dalhousie University in Canada and a specialist in global marine biodiversity and conservation, penned a comment to the above research paper where he suggested exactly that:

"Carson specifically highlighted how DDT was a persistent pollutant that accumulated in the environment and threatened the survival of many bird species by interfering with their breeding cycle. In PNAS, an analogous argument is made for plastic pollution, only this time a 'silent spring' may be looming in the oceans."

Dr. Worm was recently interviewed on the Canadian Broadcasting Corporation radio show Quirks & Quarks, where he explained his rationale for such a conclusion, noting the following ominous parallels with the DDT silent spring documented by Rachel Carson 53 years ago:

Plastic, like DDT, is a global phenomenon and can be found everywhere, as the above research is one indication. DDT is still used in some countries and is widely found throughout the global environment, including in the Arctic where it is consumed by fish and seals, and then humans further up the food chain. It is still found in the Great Lakes despite being banned in North America well over 40 years ago.

The problem is not going away on its own. Both plastics and DDT are persistent pollutants that remain for centuries. The plastic really never disappears. It just gets broken down into smaller and smaller pieces.

Global production is massive. Approximately 1.8 million tons of DDT have been produced—a huge amount by any measure. That same amount of plastic is produced every two days now. This leads to an enormous amount of badly managed waste plastic ending up in the environment and being ingested by wildlife.

Both plastic and DDT affect reproductive development. DDT has been shown to adversely affect reproduction in wildlife, especially birds and aquatic wildlife.

Plastic-derived endocrine-disrupting chemicals ranging from bisphenol A to phthalates have been shown to promote reproductive disease.

Both plastic and DDT may not appear directly poisonous on their own, but their toxic effects can manifest through impacts on hormonal systems. DDT was sprayed directly on skin and added to paint for children's rooms to control mosquitoes; it is still used in

some parts of the world as a pesticide. Plastics are ubiquitous in children's toys—including even the highly toxic polyvinyl chloride (PVC) plastic resin.

Plastic toxins and DDT both bioaccumulate and become increasingly concentrated as they move up the food chain. Miniscule amounts of DDT in water can increase in concentration up to 10 million times as they are continually ingested by plankton, then small fish, larger fish, and finally fish-eating birds. Apart from the toxins inherent to plastics, plastic in aquatic environments act like little sponges, adsorbing other chemicals in the surrounding water, and can concentrate them up to a million times more than the surrounding water.

As if all that is not enough, just days ago, a new international study, by some of the same researchers as the seabird study, revealed global hotspots for plastic marine debris ingestion by sea turtles. They estimate up to 52 percent of all sea turtles have ingested plastic.

It is estimated that approximately 500 million plastic straws are used daily in the U.S. alone—500 million every single day. And that does not even include all of the little plastic bag-enclosed straws attached to juice and milk cartons handed out in school lunchrooms and put into lunch boxes daily.

This is plastic waste beyond belief, given that most of these straws are used for minutes before being tossed in the garbage. Yet, their effects as one ubiquitous form of environmental pollution are extremely far-reaching.

Plastic production is increasing annually and at breakneck speed. In 2013 alone, 299 million tons were produced—a 3.9 percent increase over 2012. There has been a doubling of plastic production every 11 years since commercial production began in the 1950s.

We live in a closed global ecosystem, and ocean plastic and its effect on aquatic wildlife are indicators of an explosive worldwide waste and toxicity problem. Researchers estimate there are more than 5 trillion plastic pieces weighing over 250,000 tons afloat at sea, with localized observed concentrations being in the neighborhood of 580,000 plastic pieces per square kilometer.

And this is just the floating plastic. As it breaks down through photodegradation and other weathering processes, much of it may sink to the ocean floor, and of course be consumed by aquatic wildlife.

Dr. Marcus Eriksen, research director of 5 Gyres Institute, has described marine plastic pollution as follows: "The ocean is covered in a thin layer of plastic. It's like a plastic smog."

As Dr. Worm notes, seabirds are fitting canaries in this oceanic and global coal mine. They live on the ocean and feed there, but come back to land regularly to nest, where they can be closely monitored and studied in ways that other ocean wildlife cannot. Thus, they are sentinels for monitoring the state of the oceans and, by extension, the state of the global environment.

Attempting to clean up global plastic pollution is a step in the right direction, but the extent of the pollution is far beyond a level where even the most effective cleanup methods can have a tangible long-term effect, given the constant plastic inputs. The introduction of new plastic into the global environment must be stopped at the source.

A perfect example of how this can be done is the growing number of bans on plastic microbeads as a way to reduce microplastic pollution at the source in both water and land environments. Earlier this month, a group of U.S. researchers published an important commentary explaining that scientific evidence now clearly supports a ban on microbeads.

Tiny plastic beads made of polypropylene and polyethylene, about 0.0005 mm to 1 mm in size, are included as abrasive exfoliants in numerous personal care products ranging from body scrubs to toothpaste. Neutrogena's Deep Clean facial cleanser, for example, contains an estimated 360,000 microbeads in a single tube. The manufacturers of such products realize these microplastics go directly down the drain when rinsed off. That is unethical life cycle design: plastic intended to pollute.

And microbeads contribute actively to this new *Silent Spring* and directly impact our seabird "canaries" because the beads are small enough to be ingested constantly by plankton, small fish, larger fish, small seabirds, bigger seabirds... right up the food chain.

The best municipal wastewater sewage treatment systems will capture 95 to 99.9 percent of the microbeads, but in the U.S. alone that still leaves approximately 8 trillion microbeads per day being emitted directly into aquatic environments. Furthermore, the remaining 800 trillion captured microbeads settle into wastewater sludge, which is often spread on land such that runoff and irrigation may lead these microbeads into waterways as well. Even the best waste management technology does not have the solution.

Numerous individuals and organizations in Canada, the U.S. and internationally, are working hard pushing legislators to pass and implement sub-national and national bans on microbeads. There is no shortage of ways an individual can take action against the growing silent spring of plastic pollution:

- Reduce your own plastic footprint. Numerous alternatives to plastic are available, such as those offered at the online store Life Without Plastic, but you don't have to spend any money to reduce your plastic use. Start with something as simple as a mason jar, which is enormously versatile. Beth Terry of the blog My Plastic-Free Life offers a world of suggestions and techniques for going plastic-free.
- Learn from and support the dynamic organizations on the front lines. For example, Plastic Pollution Coalition, 5 Gyres Institute, Algalita Marine Research and Education, Plastic Soup Foundation, Environmental Working Group, Environmental Defence, Surfrider Foundation, One More Generation... the list goes on.
- Spread the word. Tell your friends and family and new people you meet about the issue.
- Appreciate art. Make art. One of the positive aspects of the plastic pollution problem has been the phenomenal outpouring of powerful, plastic waste-inspired artwork by creatives all over the world. These works exude raw emotion and present the issue in ways that facts cannot. Check out the works by anti-plastic activist artists Chris Jordan and Max Liboiron.

I'll leave the final words to Rachel Carson, the fearless visionary who warned us long ago of the damage we humans are capable of inflicting on the living, breathing Earth we all share and inhabit:

*"The most alarming of all man's assaults upon the environment is the contamination of air, earth, rivers, and sea with dangerous and even lethal materials. This pollution is for the most part irrecoverable; the chain of evil it initiates not only in the world that must support life but in living tissues is for the most part irreversible. In this now universal contamination of the environment, chemicals are the sinister and little-recognized partners of radiation in changing the very nature of the world—the very nature of its life."*

— Rachel Carson, *Silent Spring* 1962