

WESTERN SCIENCE SPEAKS PODCAST SEASON 5, EPISODE 4

EPISODE TITLE

Microplastics Are Everywhere (Including Your Food!)

PODCAST SUMMARY

When Western Earth Sciences professor Patricia Corcoran takes time off from discovering a new plastic forms on the shorelines of our beaches and lakes, she chooses to educate and explain why the plastic epidemic is worse than our eyes tell us. On this episode of Western Science Speaks, we discuss how toxic plastic-nature hybrids are formed, the invisible killers on our beaches, and how we can be better plastic citizens. Hope isn't lost in winning the fight against debris and plastic and listening to Patricia is the perfect place to start.

INTERVIEW

Henry Standage 0:00

Hey, welcome to the podcast. Today we're talking about microplastics. Microplastics are tiny, borderline invisible plastic pollutants that are increasingly being found on our beaches. Patricia Corcoran surveys the shorelines of freshwater in Canada and studies the effects microplastics have on our environment. Patricia was kind enough to come on the show and explain why this miniscule debris is so toxic to our wildlife and our climate. Here's our conversation.

A micro plastic is defined as a piece of plastic less than five millimeters in length. First of all, how does a piece of plastic this miniscule come to fruition?

Patricia Corcoran 1:10

So microplastic particles are either primary or secondary. A primary microplastic particle is produced to be less than five millimeters at its longest diameter. And examples of these would be microbeads, litter and most plastic pellets. So, pellets which are also known as nurdles are the raw resin products that are about the size of a lentil that are melted down and molded to form and use - items like bottles. But secondary microplastics result from the degradation of larger plastic products. So, for example, the plastic bottle breaks down through ultraviolet radiation and abrasion over time and crumbles into thousands of tiny pieces.

Henry Standage 1:55

Yeah, so explain the process to us, of how a microplastics spreads from our rivers to our lakes.

Patricia Corcoran 2:02

So both types of microplastics, the secondary and the primary, enter rivers and lakes during high wind or storm events, or through littering and also through processed wastewater.

Henry Standage 2:15

Do you generally look at lakes or rivers more?

Patricia Corcoran 2:18

Thus far we've concentrated mostly on lakes, we've studied Lake Ontario, Lake Huron Lake St. Clair and Lake Erie. But we are also starting to work more with rivers. So, we have a long term monitoring project with the Thames River. And we also work on ocean microplastics. So, in the Arctic Ocean, we have a project looking at microplastics in benthic sediment.

Henry Standage 2:44

And speaking of microplastics, we're talking about an object so small that I would imagine it would be hard to get a sense for the number of them that are in a certain area, how are you able to detect these plastics and get a general sense for their prominence in an area?

Patricia Corcoran 3:01

Okay, so most microplastics you can't see with the naked eye. So, the very largest types of microplastics, like pellets, you could actually identify on a beach, most people couldn't because they don't really know what they're looking for. But when we go to beaches, we can obviously see these but most of the microplastics are very tiny. So we sample water and sediment from streams, lakes and oceans. And then we bring the samples back to the lab, and they undergo a rigorous drying, sieving and density separation procedure. Then what remains in a glass petri dish is examined under a microscope, and the number of particles we identify are reported in number per amount of sediment or water. So for example, we may identify 400 microplastic particles per kilogram of dry weight sediment or per liter of water.

Henry Standage 3:55

A common theme across your work is the damage that we're inflicting on our beaches with plastic waste. Why are we finding so many plastic objects among our beaches?

Patricia Corcoran 4:07

So, depending on whether the beach is in a remote or in an urban area, large plastic debris, so we call that macro plastic as opposed to micro plastic, it can vary in abundance. Plastic debris found on beaches can be considered throwaways, meaning litter, but the debris can also be found on remote beaches once it enters the lake. The circulating water currents can deposit it anywhere so it can pick it up from one shoreline or one beach and actually transport it to a totally different one. We currently have a study investigating the number and distribution of plastic pellets across all five Great Lakes and in this study, we've looked at 67 beaches, and we've noticed that they're plastic pellets that are found on beaches that are even in remote locations, say in the Lake Superior area.

Henry Standage 5:01

How does that come to be?

Patricia Corcoran 5:02

So again, it has a lot to do with the source. Pellets are normally transported by rail car or by truck. And so, if there is a rail car spill, which is what happened on Lake Superior in 2008, pellets are spilled into the lake. But once they get into the lake, they're floating at the surface, and you have circulating water currents at the surface of the lake, and it can actually transport those pellets to the totally opposite side of the lake. And that's what we're finding in Lake Superior.

Henry Standage 5:35

Having gone to the beach, particularly with other young people over the years, it can be disappointing to see the litter and debris that's left behind, but in your opinion, is the main aggregator of this problem, civilians who are being irresponsible with how they use the beach recreationally, or is it the corporations?

Patricia Corcoran 5:55

This is probably not the answer you want. But it's a combination of both. Yeah, and we've also found that it depends on the leak as well. So, it depends on the culture of the consumer. And, even the type of plastic depends on the culture of the consumer. So, some beaches, for example, we would find an abundance of cigarette butts, which have plastic matter in them. But some beaches, not at all. And it just depends on you know where you're located. Industry absolutely plays a role. We have a lot of industry that produce plastic pellets in Ontario. And we have found that most of the plastic pellets on Lake Ontario and Lake Huron are found in close proximity to those production plants. So, it's a sort of a combination of both, I would say that for macroplastic debris, things like pieces of plastic bags, and parts of toys and things like that. That's the consumer. But pellets are pre-production.

So, they're actually representing what's being spilled into the lakes from either at the factory itself or during transport, or once they arrive at a facility where they're going to melt those pellets down to mold them into the new products.

Henry Standage 7:17

Something people might not expect is that you've also done some research in the Arctic, and you found microplastics are present there as well. Can you touch on that?

Patricia Corcoran 7:28

I guess it's difficult for people to understand how there could be microplastic debris in Arctic regions. So, my research group has focused on benthic sediment in the ocean in Arctic regions. But I also work with researchers who study the amount of microplastics in plankton, the amount of microplastics in surface waters, and the amount of microplastics in snow in Arctic regions. So basically, we find microplastics in all of those depositional matrices, we call them. And those microplastics are actually we think, and most other researchers who work in northern regions believe, that they're mostly transported as airborne contaminants. So, if you think about it, microplastics are everywhere. Even in your own home, when you see dust floating in the air, most of that dust is composed of microplastics. And microplastics can be so tiny that you're actually breathing them in, or you ingest them when they land on your food. So airborne microplastics are pretty much everywhere.

Henry Standage 8:43

I think when people picture humans negative impact on marine wildlife, we picture very visceral images of large plastic objects wrapped around creatures. But do you believe there's a lack of awareness for the damage that you know, you mentioned that they're invisible, this invisible killer will do over these animals lifespans. And furthermore, my own lifespan, you just told me that I probably ingest them in my own home.

Patricia Corcoran 9:08

That's right. So absolutely an answer to your first question. I think that most people have an impression of the dangers of plastic debris from images that they see in the media. And those images obviously are of macroplastic debris, like you say entangling different types of animals that we find so playful and cute.

Henry Standage 9:32

I'm a sucker for macroplastic propaganda.

Patricia Corcoran 9:37

So oftentimes, we see turtles and seals entangled in plastic debris or turtles eating plastic bags because they mistake them for jellyfish. But the microplastics are really important. And it's because even the smallest organisms have been shown to ingest microplastics. And if the very small organisms on the food chain are being harmed by microplastics, then it's going to disrupt everything in the food chain above it. So, there have been studies that have shown that things like earthworms are eating microplastics. So, plankton in oceans are eating microplastics. And what happens once the microplastics are ingested, these can affect things like feeding behavior, or reproductive capability, or even how an organism moves. So, if we are actually harming the smallest members of the food chain, were really harming ourselves eventually.

Henry Standage 10:42

Yeah, we're messing up the whole ecosystem. What about me? What about humans? Is it known what the effects are? Does it affect my lifespan?

Patricia Corcoran 10:52

So, research thus far hasn't shown the effects of microplastics pollution on humans. It has shown that microplastics have been found in in food that we eat. However, there has been a study of microplastics in drinking water that comes out of your tap and also that you get in bottled water and both contained microplastics. So, we know that it's there, we know we're ingesting it, we know we're breathing it in, but we don't really know how it's affecting how our systems work. What we also don't know is if the plastic that is ingested by say a fish would travel

up the food chain. So normally, we don't eat the intestines of a fish, the gut contents of the fish, we remove that. But few studies have shown that some microplastics can be translocated from within the gut, to the tissue itself, and the tissue is what we eat. So, the short answer to your question is, unfortunately, no, we don't have enough research done that shows us the implications of us ingesting microplastics.

Henry Standage 12:06

Is the solution in the future for us to just move away from plastics?

Patricia Corcoran 12:10

Yes, and no. And actually, now is a good time to be thinking about this. Because with COVID-19, we see an increase in the number of plastic items that are being purchased or used. So, if you think about surgical masks, they contain plastic fibers. And more people are wearing them now. And it's a health issue, right? They're doing it for the right reasons, the same thing for going to a grocery store now. People don't want to take an orange from that stack of oranges that people have touched, they'd rather buy a bag of oranges that haven't been touched for however long. So, the chance of there being any, any of the virus on those oranges is less. So, this brings me and I always did think this way, is that plastics can be extremely useful in the right types of fields. And the medical field is one of them. So, if you think about if you're in the hospital, and you have to have an IV drip, I mean, that tube is made out of plastic. And it's a lot cleaner, right? More sterile than anything they used to use. So, I would say that you can't get away from using all plastics. But what's really important and something that every person can do is try to never use single use plastics. So single use plastics examples would be straws, plastic, cutlery, styrofoam, all of those things can't be recycled. And so people use a straw. If you put it in your blue box, forget it, it's never going to be recycled. So those things just end up in the trash, in the landfill. Plastic is so light that it can blow out of the landfill, it can make its way into a stream, which eventually causes it to make its way out into rivers and lakes and oceans. So when people ask me, what's the main takeaway from all of this? What would I recommend? I would say, try as hard as you can to stay away from single use plastics. And sometimes that's difficult. Some grocery stores have meat packaged in styrofoam. Sometimes you go to a restaurant and you want to take the food, the leftover food home with you and they give you a styrofoam container. But there's always an option, right, you can bring your own Tupperware container that can be reused when you go out to the restaurant. If you anticipate that you know you don't have a grand appetite and you're going to take some food home. You can say when you sit down and you order drinks, please don't bring me a straw or you can bring your own straws. There are now alternatives, bamboo stainless steel and they're all reusable. So there are different ways that we can avoid single use plastics. And if everybody started to do that, even just a little bit, it would make a huge difference.

Henry Standage 15:09

Yeah, I think people should take advantage of the idea that you can have flair with these objects. If you buy a \$5 straw, that's like a luxurious straw, but that's your go to straw. That's fun.

Patricia Corcoran 15:24

Do you have a reasonable straw?

Henry Standage 15:27

No, but I'm looking for one I'm in the market. I have my water bottle that I bring everywhere.

Patricia Corcoran 15:33

That's good.

Henry Standage 15:35

Can you explain some of the research you're conducting regarding anthropogenic debris?

Patricia Corcoran 15:40

Sure, we have several investigations on the go. One of the investigations I've already mentioned, it concerns the plastic pellets across the Great Lakes watershed. And we intend to re-monitor the same beaches, five years from when we first sampled, in order to get an indication of whether the amount of pellets are increasing or decreasing

over time. And what we did was we sampled 67 beaches on all five of the Great Lakes. And some of the results are pretty surprising. So, one of these results is that if we average out the total number of pellets across 67 beaches, we find that the average is 19 pellets per square meter. So that's not 19 pellets per beach, but 19 pellets per square meter on a beach, and some areas contain an abundance of pellets for example, Baxter beach in Sarnia, contained over 7000 pellets, total pellets in the area sampled, which means that it contained over 700 pellets per square meter. So, you can see how different beaches vary depending on proximity to different stressors. In the Sarnia area, there is a high number of plastic production plants, and what they actually produce there, are the pellets, so whether the pellets are spilling from the factory itself, or whether the pellets that have spilled are being removed, and then they're placed in some sort of facility. And eventually, they're affected by things like wind. This may be blowing those pellets into creeks and rivers, which eventually make their way out into the lakes. So we're also conducting long term monitoring of microplastics in bottom sediment of the Thames River, not the Thames River, England, but the Thames River, Ontario. And it shows that the greatest number of particles were in urban areas, and in particular, London, Ontario. So, one sample contained over 2000 particles per kilogram of dry weight sediment. And that's roughly the same as a bag of sugar. So, if you think about those bags of sugar that you buy and 2000 microplastic particles in that bag of sugar, so there's quite a lot that we're finding in the river. We're also studying the number and distribution of microplastics in bottom sediment of Lake Huron and Lake St. Clair. And also, as we talked about, briefly, the number and types of micro plastic particles in sediment of the Arctic Ocean but also in fish of the Thames River, and the Arctic ocean.

Henry Standage 18:42

That wraps up another episode of Western Science Speaks. If you enjoyed the show, subscribe to us on Apple, Spotify or wherever you listen to your podcast to make sure you stay up to date with the latest episodes in research from our community. For now, I'm Henry Standage, signing out. Thanks for listening.