

Eric Moody:

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Eric Moody:

This is Eric Moody with this Making Waves podcast for the Society for Freshwater Science. This month I'm being joined by Dr. Sherri Mason, professor of chemistry at the State University of New York at Fredonia. Her research focuses on a topic that's received some attention recently, which is microplastic pollution. Thanks for joining me.

Sherri Mason:

Thank you for having me.

Eric Moody:

My first question is what exactly is a microplastic? Is there a standard definition for this, and where do they come from?

Sherri Mason:

Yeah, so the standard definition of microplastic, any piece of plastic that is smaller than five millimeters, which is actually pretty big, right?

Eric Moody:

Yeah.

Sherri Mason:

That's the definition. They come from basically the plethora of plastic products that we use in our daily life, from bags and bottles to straws to flip-flops, and plastic pails when we go to the beach. But all of these plastic materials, whether intentionally or unintentionally, they make their way into the environment, aren't properly disposed of, get run over by cars, and they break into these smaller and smaller pieces, right?

Sherri Mason:

That's really something very unique about plastic is that as a material, it doesn't biodegrade. So it'll undergo photodegradation and it'll get smaller and smaller, but it maintains basically its same molecular integrity. So even as it gets smaller and smaller and smaller, it's still plastic.

Eric Moody:

How long can these pieces of plastic stay around in the environment?

Sherri Mason:

Yeah, it's a good question. From decades to centuries. It depends upon which plastic you're talking about, because there's thousands of different types of plastics out there.

Sherri Mason:

Part of that too is that we don't really have a whole lot of data on how plastics degrade, and so the estimates are pretty wide-ranging. But generally, it's stated that you're looking at over a hundred years for an individual piece of plastic. But that can be quite variable. Cigarette butts, which are semi-synthetic, will actually decompose on the order of a decade. But then your more elaborate polyethylene, that doesn't really have any kind of functional groups that would make it attractive in terms degrading, that will tend to be around for a lot longer. Sorry, got a little too chemistry there for you.

Eric Moody:

No, I think that's good. It's good to compare it with something else. One source of microplastics, that at least I've heard about as a recent source of controversy, are these small plastic beads in cosmetics. Is this an important source of microplastics in the environment? Why did it receive so much attention?

Sherri Mason:

I'm somewhat biased here. I just don't think that plastic belongs in the environment, so I think any piece of plastic is significant.

Sherri Mason:

Our studies in the Great Lakes and tributaries to the Great Lakes kind of indicate that at least within the United States that these microbeads currently represent about 15% of the plastics that are out in the environment. So it's not the biggest piece of the plastic pollution problem, but it's definitely a significant piece of the plastic pollution problem.

Sherri Mason:

I think one of the reasons it's gotten so much attention... I mean, I can give a few different kind of things, synergies that kind of work together. One is that this was a piece of plastic that we pulled out of these aquatic environments and we could directly link them to a particular product. We could say, "This is coming from these face washes and these body washes."

Sherri Mason:

Frequently, with the microplastics, because they're so small, being able to create that direct causal link is extremely difficult. That's really helpful to people to understand. When they can say, "These beads are in my face wash, that's what you're finding in the water?" and you can make that direct connection, I think that really helps people to understand.

Sherri Mason:

I think the other aspect is that people didn't realize that it was plastic. As we had news stories about us and as we would go around talking about what we were finding and basically making people aware that there was plastic in their face wash, and their body wash, and their toothpaste, I think that really got under people's skin. That basically, "I don't want to wash my face. I don't want to brush my teeth with plastic. This isn't something I want." Then it was done kind of without people being aware that it was happening.

Sherri Mason:

So I think that that feeds into it too, where there was a direct consumer awareness that got raised, and people being very open about the fact that this isn't what they wanted and being very open and somewhat dramatically sending products back to manufacturers. Dental hygienists posting pictures online of X-rays and you can still see the plastic underneath people's gums. I think all of these things kind of worked together. The media attention was circling things like this, the podcasts. Getting at people I think also was pieces of it to help raise the awareness. And kind of everybody moving in one direction that we don't need plastic in our face wash, let's get this out. It's completely unnecessary.

Eric Moody:

Some states have in fact passed laws to restrict at least the use of these beads in cosmetic products, right?

Sherri Mason:

Yeah, there was a total of eight states that had passed bans on the microbeads. Some of them were better than others. Then in New York state where I live, we were having trouble getting it to happen at the state level, so then it was happening county by county. We're putting in moratoriums on the sale of products that had these microbeads.

Sherri Mason:

But then the national legislation passed, so now it doesn't matter. It's across the entire nation. We don't have to worry about county by county or state by state. The national bill is a good bill.

Eric Moody:

You mentioned that these cosmetic microbeads account for about 15% of the microplastics you find in the Great Lakes, for example. How do we reduce the remaining 85% of our plastic pollution?

Sherri Mason:

I mean, ultimately, it comes down to being aware of how plastic enters our life, and finding ways to reduce. Especially the single-use disposable plastic. Most of our cars nowadays are pretty much all plastic except for the engine, right? The whole outside of the car is all plastic. So I'm not telling you you have to get rid of your car. Sounds silly to say.

Sherri Mason:

Well, just refuse a straw when you go out to eat and they bring you water. Just say, "I don't need a straw." That sounds silly, but there's 350 million people in the United States. Think about just one day how many straws that we probably use here, and the numbers really increase quite dramatically. If everybody just stops using plastic straws, well that's one source of plastic that's no longer going to be making its way out into the environment. So be aware of these single-use plastic items that enter your life, and find ways to reduce those.

Sherri Mason:

When I go out to dinner, I bring containers with me so that if I have something to take to go, I'm not taking it home in plastic. I've made a commitment to myself that I will never take a plastic bag, which means I either remember to bring my reusable bags with me or I carry stuff out of stores without bags at all. I made a similar kind of commitment to myself that I would never buy bottled water. For multiple

reasons, aside from just the plastic, but it's not clean. So you find these ways to eliminate these single-use plastic items from your life, and that dramatically affects then what we see in the water.

Sherri Mason:

For Christmas this year, I gave out bamboo utensils, travel utensils to all my girlfriends.

Eric Moody:

Nice. Spread the word.

Sherri Mason:

They slip into our purse, and so that way you always have utensils with you when, say, you're at a picnic. You don't have to use the plastic ones.

Eric Moody:

Yeah, that's a good idea. Let's talk more about the actual plastic out in the environment. You've measured microplastic pollution levels in all of the Great Lakes, right?

Sherri Mason:

Correct.

Eric Moody:

What have you found? How does the microplastic pollution in the Great Lakes compare to other places in the world?

Sherri Mason:

Yeah, so as an issue that's really started with the world's oceans, the first documented in the scientific literature was 1972 is a study that was in the North Atlantic ocean and the Sargasso Sea. But it really didn't capture attention and become an area of rigorous scientific study until about 1999 when Captain Moore's publications on what's been termed the Great Pacific Garbage Patch came out. In 2004, the United Nations put out a study that 80% of what we find in the world's oceans is coming from land.

Sherri Mason:

The story that we had been telling since 2004 is that that plastic bag you see blowing in the wind, well it makes its way into a river, which flows into a lake, and eventually into the ocean. But while we've been kind of telling that story, all of the research still had been focused or was still focused on the oceans. We were one of the first groups to actually then go and look in a freshwater system. I'm fortunate that I live on the shores of the largest freshwater ecosystem in the entire world. So we surveyed all five of the Great Lakes.

Sherri Mason:

Basically what we see is that the counts of plastic increase as we follow the flow of water. Lake Superior is the start of the Great Lakes chain, and tends to have the lowest counts of plastic. Then we move into Lake Huron. Some of the water that flows into Lake Huron will go into Lake Michigan. Lake Superior, Lake Huron, we found about 7,000 pieces of plastic per square kilometer across that lake's surface. Lake

Michigan, the counts went up to 17,000 plastic particles per square kilometer. That water then flows into Lake Erie.

Sherri Mason:

In Lake Erie we found on average 46,000 pieces of plastic per square kilometer. Then the water from Lake Erie flows across Niagara Falls into Lake Ontario. In Lake Ontario the counts went up to on average 230,000 plastic particles per square kilometer, which is unbelievable. Basically, Lake Erie and Lake Ontario are as polluted, if not more so, than the most polluted areas in the world's oceans, is basically what we're finding.

Sherri Mason:

Then what we've been doing more recently is looking at the tributaries that flow into the Great Lakes. That's the study that we're currently working on. The counts there are even higher, because you are closer to the people, so you're closer to the sources of the pollution, and there's less water for that pollution to be diluted. So we're seeing higher counts in the rivers than we even do in the lake. Then the lakes are basically even higher than what we see in the world's oceans, is kind of the way that this story is unfolding.

Sherri Mason:

The other thing that we've done out here is one thing to find if the water and then the question of course is, "Well, if there's plastic in the water, what does that matter? What's the impact of that plastic?" So we have surveyed 25 species of fish out of the Great Lakes. Fishing is a big recreation out here. People come from all over the world. Multibillion dollar industry for the Great Lakes region.

Sherri Mason:

We studied 25 species of fish and found plastic in every single one of those species. There was no species of fish that didn't have plastic in it. Obviously, some species have more than others, but they all had plastic. Now the next question and one that we'll start to look at with our next project I think end of May, is understanding the impacts of that plastic on the fish. Plastic is in the water. We know that the plastic is in the fish. How is that plastic impacting those organisms once it's ingested?

Eric Moody:

Right. And could this potentially have any adverse effects for the humans who are eating those fish from the Great Lakes?

Sherri Mason:

Absolutely. I indicated salt water studies are way ahead of us here in the freshwater systems, because they've been doing it longer. The concern we have with plastic is not so much the plastic itself, but the fact that the plastic can absorb chemicals on the surface. Or in the manufacture of plastic, a lot of chemicals are used as additives to the plastic. So basically, the plastic becomes a way to move chemicals, these toxic chemicals from the water from the ecosystem into the food chain and ultimately into us.

Sherri Mason:

We've seen that. Pieces of plastic can have accumulations of chemicals up to a million times what you find in the surrounding water. Fish eat the plastic, and then those chemicals will transfer into the fish,

affect their mobility, their ability to reproduce, a variety of different kind of impact. Then people that then eat those fish, yeah, the chemicals would then transfer into the people as well.

Eric Moody:

One thing that impressed me is when we think of these plastic pollution as being something coming from humans maybe near urban areas, but you were involved in a study in a remote mountain lake in outer Mongolia and you still found really high levels of plastic there.

Sherri Mason:

I didn't get to actually go to Mongolia. I just got to analyze the samples. But that was actually really interesting because we had been doing the Great Lakes samples and then we switched over to these Mongolian lake samples. We see very different kinds of plastic, right? Because you have basically different cultures.

Sherri Mason:

As we started to get in some of our panels, I contacted Chris Free, the lead author on the study, who was the one who actually collected the sample. I said, "Chris, we're finding all of these plastic films." He said, "Yeah, because a lot of the food that we send to other countries is individually packaged now in plastic. But the people that live there are used to, say, go to the store and they would buy a sandwich, it would come wrapped in a banana leaf," right? So they could then unwrap, eat the sandwich, and they would just throw the banana leaf on the ground because it would decompose. But they do that same thing with the plastic, not understanding that as a material, it doesn't go away until the material ends up in body of water.

Sherri Mason:

The other thing that we found a lot of were these blue foam pieces. I wasn't sure that they were real. I'm like, "Why do we keep finding all these little pieces of blue foam?" Well, how they fish, they use these blue floats to hold fishing lines in the water. When they bring in their fish, they just leave the floats there, and they shred. They basically just particulate in the water, so we just find all these little bits of blue foam from the fishing that happens there.

Sherri Mason:

What you see is connected to the people and the cultures that live around those bodies of water. The plastic has become such a part of modern society that there isn't a body of water on the planet I don't think that wouldn't have some plastic in it.

Sherri Mason:

Well, there's a study that came out as the ice caps are melting, it's releasing plastic back into the environment. I forget how many... It was a few tons of plastic. Tens of tons probably of plastic I think is what it was that was going to be released as the polar ice caps melt, because of the plastic that's basically been encapsulated in this ice and will be released as the ice melts. There's no place on the planet basically that's immune from plastic pollution.

Eric Moody:

Wow. Have you always been studying plastic pollution or what got you started with these projects?

Sherri Mason:

Actually, by training I'm an atmospheric chemist. I got interested in chemistry at a very early age. I think it was like 11. I was watching an episode of *Different Strokes*. I don't know if people will recognize that TV show, but in the episode, Kimberly washes her hair with rainwater and it turns her hair green, which is not scientifically accurate.

Eric Moody:

It doesn't sound like it.

Sherri Mason:

But it was a really interesting tool that they used in the episode to talk about acid rain. The first time I remember that awareness as a child, thinking about how my actions and how I live my life could be affecting the bigger picture of the planet. I was just thinking, "That's not right. That's not the way it should be," and wanting to fix that. So really got into chemistry.

Sherri Mason:

For my PhD I studied the influence of forest fires on the atmosphere. I think it was probably more about I was living in Montana at the time and it was more like where I was at the time as opposed to kind of a natural interest. I had a professor there who I really liked and liked working with him. This was the project that he was working on, so I just kind of naturally took it up.

Sherri Mason:

Then when I moved up to New York, once I got my PhD and to start my professorship, I continued that work. Although I won't say I had a huge passion for it. I came out to where I am because I really wanted to be a teacher, and research was secondary.

Sherri Mason:

That that kind of changed. In 2011, I took my first excursion on the Great Lakes. I've lived along the shores of Lake Erie for 10 years at that point, but had never actually been out on a boat in the lake. Not only did I get to go out on the lake, but I was on a tall ship, which was really cool. So I got to sail on a War of 1812 vessel, and was just really struck by how magnificent the Great Lakes really are. I don't think I fully grasped it, just standing on the shoreline.

Sherri Mason:

When I was out there, that's when the inspiration struck. I keep abreast on all sorts of environmental issues just because that's my passion. While I was out aboard that ship, wondered, "As much as we know about plastic pollution in the world's oceans, I wonder if there's plastic pollution in the Great Lakes."

Sherri Mason:

I came back to shore, back to land, and did a literature review and found that nobody had really looked in the open water of the Great Lakes. There were a couple of shoreline studies, but nobody had been out in the water and taken samples the way they have in the world's oceans. As a scientist, that's just immediately very intriguing. That moment, I guess, changed the course of my life.

Sherri Mason:

In 2012, we did our first excursion. It was supposed to be just kind of a fun side project for me, but I actually found that I'm way more passionate and interested in this line of research than anything I've done before. So it has taken over my life in multiple ways. I have so many questions and thoughts and things that I want to be doing, and samples that I want to be taking. That's my journey.

Eric Moody:

I don't know if there's any other major things you want to talk about that we haven't covered yet related to your work or plastic pollution in general.

Sherri Mason:

I think I'll end by saying this, that plastic pollution ultimately comes from us. That means that we're the problem, but that also means that we're the solution. If we change our habits, we change what's in the environment. That's important. Small changes that we make can have huge impacts.

Eric Moody:

Yeah, well said. Thanks a lot for joining me. Good luck with your future work on plastics in the Great Lakes.

Sherri Mason:

Thank you. Thank you for having me.

Eric Moody:

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