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Round-the-World Sailing Competition Uses Technology To Measure Ocean Plastic

Green, Trending April 2, 2018 Jay Devineni

AUCKLAND, NEW ZEALAND - MARCH 18: Turn the Tide on Plastic and Team Brunel during the start of leg seven of the Volvo Ocean Race on March 18, 2018 in Auckland, New Zealand. (Photo by Hannah Peters/Getty Images)

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In the current Volvo Ocean Race, seven teams are sailing around the world, racing 45,000 nautical miles in one of the most grueling sporting events on Earth. But the eight-month race — which traverses four oceans and stops in 12 cities — isn't just about spanning the globe. It's about protecting it.

United in a quest for environmental sustainability, athletes, researchers, and activists arrive from every corner of the planet to participate in the triennial race. Through conferences, educational programs, and scientific data collection, their goal is to increase knowledge and awareness of sustainability issues, while persuading governments and businesses to reduce their ecological footprint.

The event has been a hotbed for ocean research and education for years, but this edition of the race has a special focus: the prevalence and danger of plastic. The combination of several factors — a rapidly growing plastics industry, a centuries-long decomposition period for the material, toxic chemicals that are present in some plastics — has created a legitimate environmental crisis that raises questions about society's plastic usage.

"We're not saying 'ban plastics,'" said Anne-Cécile Turner, the Sustainability Programme leader for the Volvo Ocean Race. "Plastic has had a tremendous impact on human beings. But it has grown so fast that I think we have forgotten a little sense of responsibility."

According to a 2015 study in *Science*, an estimated eight million metric tons of plastic entered the ocean in 2010, with the numbers increasing every year. Whether it's due to plastic litter, poor waste management, or industrial leakage, a lot of plastic is finding its way into the ocean and damaging marine ecosystems.

Mapfre and Dongfeng Race Team during the start of leg seven of the Volvo Ocean Race on March 18, 2018 in Auckland, New Zealand. (Photo by Hannah Peters/Getty Images)

"We want people to understand that if we don't do anything, there will be more plastic than fish in the ocean by 2050," Turner said. "That's the research. So, we're just giving the scale and the impact of the issue and saying that everybody has a role to play."

So how can everyday people prevent plastic pollution? Recycling plastic is one good option, although in today's plastic-happy society, it isn't quite enough. Experts say the true solution is to reduce plastic consumption, particularly single-use plastics like grocery bags, straws, coffee lids, sauce packets, and disposable bottles.

"It's not that hard to start," said Liz Wardley, a Papa New Guinean boat captain for one of the race's teams. "Just having a general awareness of it makes you quite conscious. I think our message is that things can be done. It's not too late. Things like not using straws, carrying a bag with you when you go to the supermarket instead of taking a million plastic bags home, picking up a piece of rubbish instead of walking over it — all those little things make an impact."

While preventing future pollution is crucial to cleaning up the oceans, it obviously won't change the megatons of plastic that are already there. Making matters worse, some of those ocean plastics break apart into microplastics, tiny particles that can be ingested by marine life and are often invisible to the naked eye.

That's why Wardley's team, named "Turn the Tide on Plastic," is gathering data on microplastic as part of the race's Science Programme. The team, which is skippered by British sailor Dee Caffari and gets its name from the slogan of UN Environment's "Clean Seas" campaign, is working with German ocean research institute GEOMAR to determine exactly how much microplastic is in the ocean.

"The issue with that, in particular, is that we have little knowledge of where the plastic goes," said Toste Tanhua, a Swedish scientist and chemical oceanographer who works for GEOMAR. "If you do the calculation of all the measurements that we have done so far, and you do the calculation of how much plastic actually ends up in the ocean, it turns out we only know where 1 percent of all the plastic is. The rest, we don't know."

So, where could the other 99 percent be? Since microplastic sampling is a relatively new field, measurements thus far have mostly been restricted to the ocean surface, leading Tanhua to believe that the answer lies deeper down the water column, perhaps even at the bottom of the ocean. He also says that microplastic gets washed up on beaches, while other missing plastic could simply be situated at latitudes and longitudes that haven't been tested yet. That's where Turn the Tide on Plastic can help, since the race takes the team through some remote locations.

"The way that the boats are sailing, they are not following the shipping lanes," Tanhua said. "Even though they go between major ports, they have taken very different routes because they are looking at the winds, the currents, the fastest way to get there."

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@TurnTidePlastic

Looking ahead after rounding Cape Horn, @deecaffari said "We have 2000 miles of lots of mixed up weather to negotiate and lots of opportunities to be had before any boat crosses the finish line in Itajai. So now the hard work starts."
@wolfiesanchez / #VolvoOceanRace

7:20 PM - Mar 30, 2018

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Unlike the other boats in the race, Turn the Tide on Plastic has been carrying a microplastic sampling unit on board since the competition kicked off in October. The unit, which was developed by German marine technology company SubCtech, uses filters to capture microplastic particles from the water. Because the sampling unit uses the boat's battery power, the crew members preserve fuel by only turning it on for 45 minutes every 16 hours, which is when they recharge the batteries with the boat's engine.

"Ideally, we'd be running it 24 hours a day to maximize data collection," Wardley said. "But in order to run the machine 24 hours a day, we would have to take three more liters of diesel per day, so that's all weight which none of the other boats would have."

To save power, the crew members also run the sampling unit at the same time that they run the boat's desalinator, a device that every boat in the race is using to make the ocean water drinkable. Since the desalinator uses the same water intake as the sampling unit, Turn the Tide on Plastic's power consumption isn't any worse than that of the other boats.

Wardley and the Turn the Tide on Plastic crew also use filters with three different mesh sizes in the sampling unit, allowing them to capture different-sized microplastics. They change the filter every 48 hours, and at the end of each leg of the race, someone takes the filters to Kiel, Germany, where the scientists at GEOMAR analyze the samples.

To prepare the samples for analysis, Tanhua and his scientists first wash everything off the filters and mix those things in water to create a slurry. After pumping that slurry through a continuous flow system, they use instruments developed by German environmental technology manufacturer bbe Moldaenke to identify the plastic particles.

"That's where RAMAN spectroscopy comes into play," Tanhua said. "Basically, RAMAN is a common analytical instrumentation used to characterize a material."

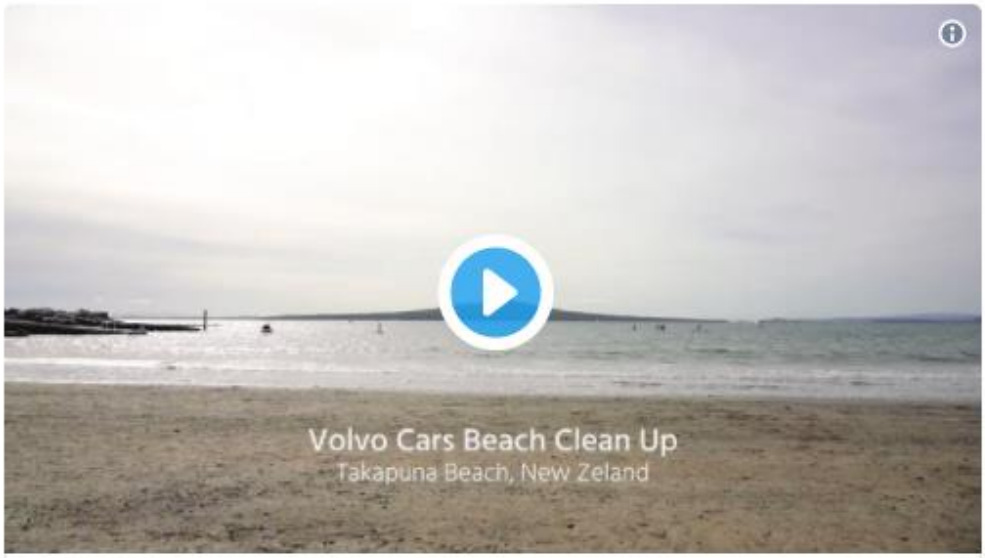
In RAMAN spectroscopy, a ray of light is shot through the sample. When that light hits a particle, it interacts with the molecular vibrations of that particle, which results in an energy shift of the light's photons. By measuring that energy shift, scientists can determine the identity of the particle. It's a complicated technique, but it effectively allows GEOMAR's researchers to accurately detect the amount of microplastic in the samples. So, how much microplastic did they actually find?

In the earliest samples from the Mediterranean Sea, GEOMAR's scientists discovered up to 307 microplastic particles per cubic meter of water, a staggering number that was significantly higher than expected. The race's press releases also indicate that 89 particles per cubic meter were found in the southern Atlantic Ocean, 152 particles per cubic meter were found in the Indian Ocean just east of South Africa, 115 particles per cubic meter were found near Melbourne, Australia, and 75 particles per cubic meter were found near Hong Kong. The researchers even found four microplastic particles per cubic meter in the Antarctic waters of the Southern Ocean, a shocking finding for such a remote area.

"That means that plastic is everywhere," Tanhua said. "It really means that we have microplastic everywhere in the ocean."

It also means that seafood, regardless of where it is caught, could contain microplastic as well.

"This is alarming as the microplastic not only harms a wide range of marine life, but, through entering the food chain, in species such as tuna and mackerel, can cause harm to humans, too," Tanhua said in his presentation of the early findings.



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"You think it's a beach full of sand, it's actually a beach full of plastic" Dave Rouse @theseacleaners • On Sunday our sailors and shore team participated in the #VolvoCarsBeachCleanUp#TurnTheTideOnPlastic #CleanSeas @beauoutteridge

5:32 AM - Mar 12, 2018 · Auckland, New Zealand

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Of course, it's easy to forget that the Volvo Ocean Race is, at its heart, a competition — a demanding and sometimes dangerous one at that. Damian Foxall, an Irish sailor who has competed in five previous editions of the race, knows that better than anyone.

"It takes everything," he said. "It takes 100 percent and more of your effort and involvement."

Ultimately, the race organizers are hoping to use the seemingly impossible sporting event to inspire people to tackle greater, seemingly impossible environmental challenges.

"That really is the ethos behind the sustainability strategy — to use sport and a sporting event like the Volvo Ocean Race to transmit a larger message," Foxall said.

Changing the culture around plastic is, admittedly, a difficult message to transmit. Still, the race's outreach continues to grow, so perhaps this edition can be a watershed event.

"I've seen a complete transformation in people's attitudes," Turner said. "Three years ago, it was not even a subject. People were not interested. There was no money and no resources behind the issue. Now, people understand that it's at stake at every level, that there's an environmental risk and a human risk."

If the message of that risk can reach enough people, then maybe, in 2050, there won't be more plastic than fish in the ocean. Maybe, instead, 2018 will be known as the year when society finally turned the tide on the plastic pollution crisis.