

Plastics in the Ocean

A call to action from Harry Bohm, co-author of *How To Build Your Own Underwater Robot and Other Wet Projects* and MATE's textbook, *Underwater Robotics: Science, Design & Fabrication* and sponsor of the Harry Bohm-Jill Zande Sharkpedo Award for Design Innovation.



*"Look beneath your lid some morning,
See those things you didn't quite consume,
The world's a can for your fresh garbage"*

-Lyrics from 'Fresh Garbage' -Composer: JAY FERGUSON of the rock band Spirit

Fresh garbage. We all have tossed a plastic wrapper. And chances are that innocuous piece of plastic ended up in a stream, lake, river, or the sea. There billions of people of the planet and if we each toss only one piece that adds up to billions every day. And most of those billions of plastic bits ends up in the ocean.

Dr. Roland Geyer an associate professor at UCSB Bren School of Environmental Science & Management estimated that between 4.8 million to 12.7 million tons of plastic waste enters the oceans from the land each year. He goes on to say that,

"Using the average density of uncompacted plastic waste, 8 million metric tons -- the midpoint of our estimate -- would cover an area 34 times the size of Manhattan ankle-deep in plastic waste. Eight million metric tons is a vast amount of material by any measure. It is how much plastic was produced worldwide in 1961."

Yet we can't argue that plastic is a substance of great benefit to our standard of living and public health. Think of all the wonderful things that utilize plastic

components. It has become essential to our technology. That is the enormous benefit of this material. And that is a good thing.

But as with all good things there is the dark side. Plastics are a Persistent Organic Pollutant or POP. Discarded plastic waste degrades into invisible micro-spherical particles when exposed to sunlight and heat. Mixing easily with water, these particles are being ingested by marine life that mistakes it for food. This in turn is introduced into our food chain and potable water supply. There are a plethora of solid scientific studies that have proven the environmental danger plastic waste is to the waters of the world. One deep-ocean study published in February 2017 dramatically illustrates this.

Dr. Alan Jamieson of Newcastle University in the United Kingdom led a team to sample the most inaccessible and remote place on Earth – the 10km deep Marianas Trench. Crustaceans collected had levels of POPs at levels 50 times greater than that of the most polluted river in China. Dr. Jamieson summarized the study's findings:

“When it gets down into the trenches, there is nowhere else for it (sic POPs) to go. The surprise was just how high the levels were – the contamination in the animals was sky high.”

Further he states in his letter to Nature: Ecology & Evolution Community, Feb 13, 2017:

“The amphipods are highly adapted to intercept and consume just about anything organic that falls from the surface – from particulates to whale carcasses, unfortunately that also includes any contamination picked up at the surface are immense in the context of the physiological adaptations organisms require for survival, and equally clever engineering solutions for human exploration, but the 11km that so easily swallows Mount Everest is still only 11km. Here is my perspective: 11km is only half the length of Manhattan Island, 11km is the width of the Mississippi River at its widest point, I could legally drive 11km in less than 6 minutes, a friend of mine could drive 11km in 4 min 6 s, and Mo Farah could run 11km in less than 30 minutes. Doesn't seem that far now does it? In reality the deep sea just isn't that remote, and the great depth and pressures perform nothing but an imaginary defence against the effects of what we do 'up here'. The bottom line is that the deep sea - most of planet earth - is anything but exempt from the consequences of what happens above it, and it is about time we recognised that: The legacy and reach of mankind's influence is most vivid by its impact on the most remote and inaccessible habitats on Earth. © Dr. Alan Jamieson, Newcastle University.”

Dr. Katherine Dafforn, a marine ecologist from the University of New South Wales commenting on the Jamison study added:

“Jamieson's team has provided clear evidence that the deep ocean, rather than being remote, is highly connected to surface waters. Their findings are crucial for future

monitoring and management of these unique environments.”

Aside from the chemical breakdown into micro and even smaller nano-particles, large, floating plastic objects pose an immediate danger to marine mammals, fish, sea birds, and reptiles. Sea turtles often ingest floating plastic bags, mistaking them for jellyfish. Birds eat fish that have ingested smaller fish infested with micro-plastic bits. Indestructible floating ‘ghost’ gill nets and broken fishing line made of near invisible nylon entangle and kill cetaceans, seals, sharks, tuna, and many other mid-water fishes. Even popular, warm polyester fleece clothing has been shown to shed micro fibers in the washing machine that gets flushed into the wastewater system. And innocuous tiny particles of plastic cuttings and fibers, easily swept out the door into a gutter, dumped into a trash bin, washed out of the clothes or inadvertently flushed down a drain, subtly contribute to the accumulation of POPs in the oceans.

It is a troubling situation.

But don’t be discouraged. The wise words of Margret Mead hold out hope:

“Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it’s the only thing that ever has.”

And you are that small group of caring and intelligent individuals.

So how does a small, technie group dedicated to building underwater robots tackle this problem? Fortunately, the problem is primarily one of careless waste disposal. Think of plastic as a cup of oil. You wouldn’t carelessly chuck oil into the water. Careless disposal of plastic trash is like throwing oil into the sea, except it doesn’t biodegrade as quickly as oil does. It maintains its resistant chemical matrix for hundreds of years in the water. Hence proper disposal, reuse and re-purposing of the material will eliminate most of this type of waste before it reaches the seas. The more challenging problem is how to remove existing plastics from the water column and sea bottom.



First off, don't go and try to slay this polyester monster. It's too big to kill with one sword blow. Just take a small piece of the problem and suggest possible solutions. Then research, research, research. Check the internet with these keywords - plastics, pollution, oceans - and pick a niche topic you can practically incorporate into your corporate responsibility presentation.

Here are some ideas to get you started:

- Keep all the cuttings and plastic waste from the construction of your ROV and weigh it. Take a photo of the plastic waste and document the result in your engineering report. Show how the team recycled plastics and other materials used.
- Present a public education poster/power point of how plastic waste and related POPs is affecting the oceans.
- Organize a public awareness clean-up of a beach, creek, roadside ditch or lakeside of tossed plastic waste.
- Present how different plastics can be recycled, re-purposed, and remanufactured.
- Use a high percentage of recycled materials in the construction of your ROV.
- Present a conceptual plan for a marine or undersea robotic vehicle that can find, monitor, map or collect plastics in the water. (No need to build or make detailed plans for it. Just sketch your concept vehicle and what it can do).

For further reading, take a few minutes to view this short documentary by the Australian Broadcasting Corporation, Catalyst ABC TV – Plastic Oceans. It summarizes the plastic ocean problem – <https://youtu.be/cwTDvqaqPlM?t=161>

It's amazing how much is on the web regarding this topic:

- <https://naturecoevocommunity.nature.com/users/27531-alan-jamieson/posts/14982-marine-extreme-but-not-pristine-anthropogenic-pollution-in-the-deepest-ecosystem-on-earth>
- <http://www.poandpo.com/in-the-meantime/banned-chemicals-from-70s-found-in-deepest-reaches-of-ocean-1522017263/>
- <http://www.constantinealexander.net/2015/02/13/>
- <http://www.ncl.ac.uk/press/news/2017/02/deepsea/>
- <https://www.theguardian.com/environment/2017/feb/13/extraordinary-levels-of-toxic-pollution-found-in-10km-deep-mariana-trench>
- [https://www.google.ca/search?q=plastic+pollution+ocean&client=firefox-b&dcr=0&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjKzd-wgabXAhVY62MKHVgQBIMQ_AUICigB&biw=1332&bih=705#imgrc=y3Qw0828RH9zZM:](https://www.google.ca/search?q=plastic+pollution+ocean&client=firefox-b&dcr=0&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjKzd-wgabXAhVY62MKHVgQBIMQ_AUICigB&biw=1332&bih=705#imgrc=y3Qw0828RH9zZM)
- <https://www.nbcnews.com/science/environment/millions-tons-scientists-tally-plastic-pollution-oceans-n304956>
- <http://www.bluebird->

[electric.net/oceanography/Ocean Plastic International Rescue/SeaVax Ocean Clean Up Robot Drone Ship Sea Vacuum.htm](http://electric.net/oceanography/Ocean%20Plastic%20International%20Rescue/SeaVax%20Ocean%20Clean%20Up%20Robot%20Drone%20Ship%20Sea%20Vacuum.htm)

- <https://www.outsideonline.com/2091876/patagonias-new-study-finds-fleece-jackets-are-serious-pollutant>
- <http://fortune.com/2013/02/22/the-auto-industrys-best-kept-secret/>
- [J. R. Jambeck, R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan and K. L. Law; Plastic waste inputs from land into the ocean; *Science*, 2015; 347 \(6223\): 768 DOI: 10.1126/science.1260352.](https://doi.org/10.1126/science.1260352)
- <https://www.plasticoceans.org/>
- <https://mail.google.com/mail/u/0/#inbox/15f9291a18b5efd3>

