

Synthetic Sea: Plastic in the Ocean

[Algalita Marine Research Foundation](#) video Transcript

2001

Here in the open ocean, graceful dolphins glide beneath the surface in pursuit of fish, their primary food. These fish in turn feed on minute, prolific creatures called zooplankton. These days, zooplankton share the surface waters with increasing numbers of minute plastic particles, posing a problem, since fish and birds are now consuming plastic in addition to plankton.

Since petroleum based plastics are nonbiodegradable, any plastic entering the ocean remains there, continually breaking into ever-smaller pieces until it becomes ingested or is deposited on some distant shore.

Captain Charles Moore of the Algalita Marine Research Foundation is conducting experiments to better understand the threat posed by this global environmental catastrophe.

Captain Charles Moore: As captain of the oceanographic research vessel, Algalita, I've traveled to many remote areas of the Pacific Ocean. And in my travels I've been alarmed at the increase in the amount of trash – plastic debris – on all the beaches that I visit. My sentiment was that the ocean is filling up with trash. To try to get a handle on the quantity of trash in the ocean we devised a series of experiments, using a manta trawl and our technique of comparing the mass of zooplankton to the mass of plastic fragments.

We trawled over 100 km at random lengths [in the North Pacific Gyre]. Then came back to the [the Science Education Adventure Laboratory (SEA) in Redondo Beach, CA,] and analyzed our samples. We compared the weight of the plastic pieces we accumulated in these trawls to the weight of the zooplankton that we accumulated.

Most people find it highly distressing to learn that for every 6 pounds of plastic that we got, there was only one pound of plankton. In other words, there's six times more plastic by weight in this area than there is naturally occurring plankton. However, the Central Pacific, being a gyre, it does accumulate. The high concentrations we found are likely to be at their greatest in the center of the Central Pacific Gyre.

The alarming thing we found was that practically every place we sampled had these plastic fragments in it. No place was free of this plastic fragment pollution.

So far, no one has looked at the effect on hormone disruption of these plastic particles in fish and birds.

Midway Atoll: National Wildlife Refuge: The Laysan albatross and the black footed albatross ingest post-consumer plastics, and the Laysan albatross ingests lighters and light sticks and large plastic fragments.

Bob Dieli, Midway Atoll Ranger: One of the problems you have is when the adult brings the plastic and regurgitates it into the chick, if the chick is not receiving enough nutrients, enough food, and the plastic is basically filling the void in the stomach, essentially it could die.

[Sorting through the stomach contents of a dead albatross] What you see in here is a bottle cap, might have been a shampoo bottle or something of that nature, another bottle cap, this looks like an electric wire plug.

Captain Charles Moore: [Manta Trawl off Long Beach, CA] Today aboard the oceanographic research vessel, Algalita, we're sampling after one of the largest storm events of the last two years. The amount of rain has created a huge plume out from the mouth of the San Gabriel River, and we're attempting to see the effects of this plume of runoff and the amount of debris that's contained within it.

[Showing the inside of the a container] Pretty much plastic in this one too. A lot of plastic fragments. Small plastic fragments. These are the things that compete with the plankton as a food source.

Actually, in our study, we counted over 27,000 pieces of plastic, and out of that 27,000 only 83 were tan. Now we know from the large pieces of debris that we collected that there's plenty of tan objects that are breaking down to form plastic fragments, but we believe that the tan pieces are being selectively removed by birds and other plankton feeders because they resemble the krill.

So color is important as a food mimic and also shape. The nurdles themselves have an oval shape that resembles fish eggs and are preferentially eaten by many species of birds. Over 70 species of birds have been found to ingest these preconsumer plastics. Studies have been done on birds and have found higher PCB content in their tissues when they have ingested plastic, so we know this plastic is a way to transport pollution.

Some Japanese scientists (Mato, Isobe, Takada, Kahnehiro, Ohtake, and Kaminuma. [Plastic Resin Pellets as a Transport Medium for Toxic Chemicals in the Marine Environment Environ](#). Sci. Technol. 2001, 35, 318-324) just released a study indicating that plastic pellets -- "nurdles": pre-production plastics -- the manufactured way that plastics are shipped to end-use manufacturers, are accumulators of hydrophobic pollutants -- things like DDE and PCB. These can be up to one million times more concentrated on the surface of these pellets than they are in the ambient sea water, based on this latest research.

So we're looking at a situation in which it's not innocent confetti that's being spilled out into the ocean; it's a very effective bio-toxin accumulator that's drifting around out there. Plastic particles are caught by filter-feeding organisms at the base of the food chain. Zooplankton-sized plastic particles become embedded in the tissue of salps. We found quite a few salps in the mid Pacific that have plastic firmly embedded in their tissues. So we believe that the food chain is being affected by this large quantity of plastic that's being introduced to it. It's possible these fragments have been there since the beginning of the plastic era in the 1950s, going around in a circle.

According to Dr. Anthony Adrade, an expert on the breakdown of plastics in the marine environment, every piece of plastic ever manufactured still exists. The molecular weight of a molecule, a single molecule of plastic, these long chain polymers are so heavy and so rigid that there's no organism, no bioengineered bacteria, nothing that can break them down. That's why there's no such thing as biodegradation of petroleum-based manufactured plastic. So what we've gotta do is change the way we produce and consume plastic.

If all the plastic ever made still exists, we've got to invent a kind of plastic that won't be around forever. There is such a thing as biodegradable plastics. Many of them are made from biodegradable sources. Instead of being petroleum-based, they're based on corn or soy; they're based on row crops. So it is possible to create plastics that don't last forever. Humans have kind of a fatal pride called hubris that makes them think they can fix any problem they create, but it's our belief that this is one problem that humans can't fix. The only thing we can do is stop polluting and hope that the system will clean itself up in hundreds of years.

The video is available for purchase from:

Charles Moore

[Algalita Marine Research Foundation](#)

345 Bay Shore Ave.

Long Beach, CA 90803-1956

562-439-4545 ph/fax

LandnSea@ix.netcom.com

Synthetic Sea Video is \$10 plus \$5 for shipping.

[Algalita Marine Research Foundation](#) video produced by Bill MacDonald 2001