



# S W E P T A S H O R E

BY LIZ DEVITT  
PHOTOGRAPH BY BARRY ROSENTHAL

**BAGGIES FILLED** with bits of plastic, sorted by size and color, are spread across the floor of Captain Jim Holm's harbor-side office in Santa Cruz, California. In another context, this could be the start of a kindergarten art project. But here each piece of debris is data that's been all too easily collected from nearby beaches. Amassing information about this type of trash is one part of Holm's plan to keep plastic pollution out of the world's oceans — a mission he never expected would lead him ashore.

Known to his friends as 'Homer,' this modest boat captain turned his dismay at the rising tide of ocean trash into a global quest to turn discarded plastic into diesel fuel. That may sound far fetched, but

PHOTOGRAPHER BARRY ROSENTHAL CALLS HIS COLLECTION OF MARINE DEBRIS (LEFT) HIS "LIBRARY." HE USES THESE FOUND OBJECTS TO CREATE STARTLING IMAGES THAT RAISE AWARENESS OF OCEAN POLLUTION. VIEW HIS PHOTOS AT [WWW.BARRYROSENTHAL.COM](http://WWW.BARRYROSENTHAL.COM).



CAPTAIN JIM HOLM

plastic-to-fuel technology is gaining attention in the waste management industry and Homer's efforts are attracting like-minded partners from Israel to the South Pacific Islands. "If you aren't part of the solution, you're part of the problem," Homer says, quoting a line from his favorite book, *The Autobiography of Malcolm X*.

With a wooden measuring stick in hand, he frames out the one-meter grid required to catalog marine debris for the National Oceanic and Atmospheric Administration (NOAA). The smell of engine oil mingles with ocean air wafting through the second-story open office windows as he leans over the trash collection that includes cigar tips, shotgun shells, and bottle scraps. The more than two pounds of plastic waste came from a single, three-inch deep plot of sand.

**THE TROUBLE WITH PLASTIC**

**PLASTIC POLLUTION** is more than an unsightly beach problem. Marine life often mistakes plastic for food, slowly starving as trash clogs their digestive tracts. Fishing lines wrap around fins, necks, or flippers, with immobilizing consequences. Studies also show that toxins such as DDT (the insecticide, dichlorodiphenyltrichloroethane) are attracted to surfaces of the littlest plastic pieces. If plankton or other sea-dwellers eat these poison-coated plastics, then toxins could move up the food chain — perhaps into the fish on our dishes.

"Researchers haven't tracked those toxins to our plates," explains Kara Lavender Law, an oceanographer for the Sea Education Association (SEA) headquartered in Woods Hole, Massachusetts. "But from a policy perspective, we don't need to wait for

science to definitively answer questions about toxicity before we keep plastic out of the ocean."

Tracking the debris is important because, theoretically, it's easier to stop pollution at the source. And 80 percent of plastic in the ocean got its start on land. But even though the man-made trash shows up everywhere — from local beaches to Arctic ice — it isn't easy to follow.

"Most plastic trash consists of very tiny particles," says Law, who analyzed 25 years' worth of information in the SEA research database to study the increasing problem of marine plastic. "What's really worrisome is that we don't know where all that plastic goes."

Even though recycling technology has been around for decades, only about seven percent of landfilled plastic in the U.S. gets recycled. Last year, 32.5 million tons of non-recycled plastic — an amount that outweighs 80 Goodyear Blimps — was left behind, according to U.S. Environmental Protection Agency reports.

**MISSION POSSIBLE**

**IT ONLY TOOK TWO BUCKETS OF TRASH** to get Captain Homer's mission underway. As he tells it, his call to action came while he was killing time on a small island in the Caribbean, waiting for a hurricane

to pass before sailing farther up the coast. The island wasn't much bigger than Homer's office is. Yet, during a short walk, he picked up two buckets' worth of plastic, yards of fishing line and even used syringes. "I was mortified," he recalls. "That stuff didn't come from the islands. It came from other places and people like me. That was the moment I decided I had to do something."

When the boat captain returned to his home harbor in Santa Cruz, he was ready to parlay his sailing and teaching experience into a worldwide ocean clean-up plan. Since high school he'd cooked, crewed, or captained on vessels ranging from sailboats to tall-mast ships. In between seafaring stints, Homer developed ocean education programs for O'Neill Sea Odyssey in Santa Cruz — backed by local surfing icon, Jack O'Neill — the Monterey Bay Aquarium and the Sea Education Association. In 2008, he founded his own nonprofit, The Clean Oceans Project.

At first, Homer hunted plastic debris in the sea. But he soon discovered that boat decks make poor vantage points for locating marine trash. "Zigzagging around for hours made a bigger carbon footprint than the rubbish," he says.

To improve efficiency, he tapped into a land-based



IN 2012, MORE THAN 165 TONS OF 'NURDLES' — THE FEEDSTOCK USED TO MAKE PLASTIC PRODUCTS — WAS SWEEPED OFF A CARGO SHIP IN HONG KONG AND OUT TO SEA. CAPT. HOLM GATHERED THE NURDLES IN THIS PHOTO FROM A BEACH IN ALBANY, CALIFORNIA. WATER PHOBIC CHEMICALS IN THE OCEAN BOND TO THESE INNOCENT LOOKING PELLETS, MAKING THEM SUPER-TOXIC.



THESE THREE JARS OF DIESEL OIL, WHICH HOLM DERIVED FROM PLASTIC DEBRIS FROM THREE DIFFERENT SOURCES, SHOW HOW IMPURITIES IN THE PLASTIC CAN FOUL THE FUEL AND COMPROMISE USABILITY.

**PLASTIC: PICK IT UP!**  
4.8 - 12.7 million metric tons  
the amount of plastic that enters the  
oceans from land each year\*

radar system, CODAR (short for Coastal Ocean Dynamics Application Radar), which monitors offshore water currents in real time. From a boat, Homer could connect to the land network with San Francisco State University's 'Bay Currents' mobile app to see exactly where ocean currents converged in the water. Researchers had shown that trash accumulates at these 'hot spots.' Using this tracking method, The Clean Oceans Project made a media splash when they joined forces with Turtle Island Restoration Network to quickly find troves of trash in San Francisco Bay.

Buoyed by his initial success, Homer set his sights on refining the tracking technology to go after plastic in the open ocean. He wanted to take out the trash around the North Pacific Subtropical Gyre, the clash of currents in the mid-Atlantic Ocean where debris congregates, and similarly afflicted ocean hot spots.

But it takes a lot of boat fuel to haul in plastic floating so far from land. So, when Homer discovered a Japanese inventor with a desktop-sized machine that melted plastic into fuel, he thought he'd finally found a way to make his mission possible. The machine converted about two pounds of plastic into one gallon of fuel, enough to keep his boat going with the trash he picked up. Most importantly, the technology could change the disposable status of plastic. "The single most significant thing this machine does is create incentive for people to stop throwing plastic away," Homer contends.

#### MODERN ALCHEMY

THE ECONOMIC OPPORTUNITIES for converting plastic into fuel hasn't escape industry notice either. A recent report by the American Chemistry Council

pegged the potential value of plastic trash at almost \$9 billion annually. Conversion facilities could eliminate 6.5 million tons of non-recycled plastics from landfills each year. Plastic-to-fuel technology isn't new. The high-temperature breakdown process, which takes place in a sealed, oxygen-free chamber, is called pyrolysis. With plastic, the meltdown creates vapors that can be captured and cooled into liquid fuels, such as diesel.

However, the process may have drawbacks. The plastic fed into these machines isn't pure; it may contain any number of additives such as flame retardants, antimicrobials or arsenic. Some studies show that impurities can be separated from the final fuel product as 'char' and then periodically cleaned out of the machine, but these papers are published by conversion technology patent holders. Homer isn't yet convinced these contaminants pose no risks when the machine operates in close quarters or the fuel burns in a boat engine. So he shifted his focus away from tracking techniques and pyrolysis toward land-based solutions. And it wasn't long before wind filled the proverbial sails of his project again.

#### ONSHORE SOLUTIONS

AT A LOCAL FARMERS MARKET, Homer met David Schwartz, a geosciences professor at nearby Cabrillo College. The two teamed up to create a monthly training program for volunteers wanting to learn shoreline survey protocols for NOAA. With this knowledge, participants could gain skills needed to contribute to the national marine debris database, a key source of information about plastic pollution.

It takes a certain amount of know-how to work with the highly structured format of NOAA's

database. Fortunately, Homer's mission drew marine scientist Katherine Dunlop to lend her expertise to the effort. With a doctorate degree in marine biology and statistics from the University of Glasgow and a research position with the Monterey Bay Aquarium Research Institute, Dunlop had plenty of experience to offer. "If there's ever going to be a change, it's not going to happen without good data," Dunlop stresses. "I felt like I could help move this project forward."

Now in its third semester, Homer calls the Cabrillo College participants his "future crew members." He envisions taking the program to other schools and has had inquiries from as far away as Israel. "We could have survey sites all over the world," he says. "It's a win-win-win program: teachers get a program that costs no money, students get survey skills, and NOAA gets data to follow the debris."

"There are so many levels of good about this project," Schwartz asserts. "I'm not sure where the project is going to go, but it's only going somewhere good."

Micronesia is one place Homer wants to take The Clean Oceans Project. He's been working with another Cabrillo College professor, biologist Nicole Crane, to bring a room-sized, plastic-to-fuel machine to the atoll of Ulithi. Most islands don't have the infrastructure to get rid of their refuse, so they burn their trash or throw it into the ocean, Homer explains.

A machine like this could also reap benefits closer to home. In the strawberry fields of Pajaro Valley, one season's crop generates about two million tons of plastic each year. That waste could become more than 500 gallons of diesel fuel instead of trash. But first, Homer hopes local scientists will study what happens when plastics sprayed with agricultural pesticides undergo pyrolysis.

#### MAN OF ACTION

IN THE MEANTIME, Homer launched his first shore-based foray in Alaska. Last summer, a 14-member crew, including participants from the Cabrillo College program and the Gulf Of Alaska Keepers,

collected 20 tons of plastic debris in less than a week. "It took chainsaws to cut away the massive nets wrapped around driftwood," recalls Patricia Lieberg-Clark from the Cabrillo College crew. She was excited to be part of a team with a solution to all that trash. "I'll be part of Homer's group until he kicks me out," Clark insists.

Eventually, Homer wants a 60-foot catamaran to conduct ocean expeditions. His blue eyes brighten as he describes a "starter boat" that could sleep 12 and sail in waters shallow enough to head upriver if a cyclone comes along. While he ticked off more details, the sound of rigging lines rapped against the masts of boats tied fast to their slips in the harbor. "Patience is so hard!" he exclaims. "But the foundation for that work has to be made on land."

Part of that foundation includes getting a new plastic-to-fuel machine. Homer has put down a \$5,000 deposit on a conversion design patented by Dr. Swaminathan Ramesh, a chemist and founder of Global Energy Conversions in Michigan. This machine is bigger and better; it can even transform nylon rope and PVC into gas or diesel refined enough to pour right into a fuel tank. "That's huge; now we can clean up old fishing gear, too," Homer predicts.

When Ramesh met Homer, the chemist says he'd found the man with the right problem for his patented machine to solve. "It all comes down to dollars and cents. People might not see plastic accumulating in the environment, but they understand the economics of making plastic into fuel."

If all goes according to plan, Homer says he should have his car trailer-sized machine by summer. The converter can turn campus trash into fuel at Cabrillo and still be handy for hauling around to demonstrations. The more people he can show the machine, the more people will learn about his mission. "Everyone has a different capacity for action," he muses. "I'm not expecting everybody to give a damn. But if you do care, then figure out what it is that you can do — and then do it." **WH**

\*J.R. Jambbeck, et. al., "Plastic waste inputs from land into the ocean," *Science*, 2015; 347 (6223).