MESSAGE IN A BOTTLE

BY STUDYING OBJECTS CAST UP ON OUR SHORES, RESEARCHER CURTIS EBBESMEYER TRACES THE FLOW OF OCEAN CURRENTS

BY KEVIN KRAJICK

F CURTIS EBBESMEYER HAD JUST ONE WORD FOR BUDDING oceanographers, it would probably be: plastics. If he had more than one, he might add: roll-on antiperspirant balls, toxic-waste containers, computer monitors, lightbulbs, armadas of toys and sporting goods, toilet seats, bales of rubber and marijuana, explosive devices, surfboards, coconuts, aircraft, the occasional human body, and a surprising number of genuine messages in bottles. The seas are wonderfully, horribly full of floating things. Sooner or later, many of them wash up on the beach; and on the way, some make epic continent-to-continent journeys, thus forming new data points regarding the complex doings of long-distance ocean current systems—the subject of Ebbesmeyer's work.

Scientists study currents ever more intensely: they affect not only transportation but weather, biology, evolution and climate change. Most oceanographers use satellites and high-tech buoys for tracking them; Ebbesmeyer, a self-described "filter feeder on floating objects," stubbornly does it the old-fashioned way—by studying movements of random junk. Part reporter and historian, part water physicist, he has sources everywhere, including his own vast, ragtag worldwide army of beachcombers. "The literature of things that float from here to there is so scattered it makes no sense until you compress it," he says. "Then it begins to take on a glow, like radium."

His contributions to the literature range from the seminal to the semi-wacky, but we know one thing: he is probably the only scientist to have posed for *People* magazine mostly naked (grayed in the chest hairs, but looking good) in the pool with a floating bathtub ducky, a souvenir of one of his greatest research triumphs. Colleagues with fancier instruments and stiffer attitudes may sneer, but deep down they must suspect the truth: he has more fun than they do. Along the way, he has learned that ocean surface currents can be chaotically changeable; if two bathtub toys are dumped, say, in the middle of the Pacific at the same moment in the same spot, one may wash up in Hawaii while the other might end up frozen in an Arctic ice floe.

I accidentally entered the world of long-distance floatables on a Canadian Coast Guard icebreaker traversing the Northwest Passage-that frozen labyrinth of islands where Arctic ice floes slowly drain toward the Atlantic. In this treeless region, I was watching off the bow one day for polar bears and instead spied dead ahead a weathered tree fragment in the ice. Eddy Carmack, an onboard oceanographer specializing in water movements such as eddies, assured me this was normal. "Trees fall off banks of north-flowing Siberian and Canadian rivers," he said. "Then they move into the sea ice. They may go around clockwise with the Transarctic Drift"-a great gyre circling the Arctic Ocean—"for 30 years. Eventually, the tree gets spit out near Greenland. If it's not too waterlogged, maybe then it circles the Atlantic for a while. Maybe it lands in England or North Carolina, then somebody puts it on the mantel. There's a lot of odd stuff like that." Carmack jotted down the Seattle phone number of Curt Ebbesmeyer—the man he said knew the most about such odd stuff.

Ebbesmeyer got started in the mid-1960s with Mobil Oil as a roustabout, then, after attending the University of Washington, an oceanographer. A lot of Mobil's oil was under the frigid Grand Banks off Newfoundland; Ebbesmeyer was told to figure out how to tow approaching icebergs—the largest floating objects in the world away from drilling platforms. In 1974 he joined Evans-Hamilton, Inc., a small oceanographic consulting firm specializing in measuring and understanding ocean currents. His projects have included placing sewage outfalls to minimize impact on shore ("Did you know 10 percent of sewage floats even after secondary treatment?") and tracking oil slicks (of his work on the Exxon *Valdez* spill: "Did you know oranges are good experimental surrogates? For some reason, if you dump thousands in seawater, they'll distribute themselves exactly like spilled oil").

Floatables of every sort—hockey gloves and life buoys, seedpods and bathtub toys—form the raw materials underlying oceanographer Ebbesmeyer's investigations.

Each ocean, carrying the long-distance floatables studied by Ebbesmeyer, hosts one or more huge gyres shaped by prevailing winds, Earth's rotation and bordering landmasses. The Gulf Stream, skirting the U.S. East Coast, is part of a clockwise pattern of surface currents that carries Caribbean debris past Nantucket, toward Iceland, to the coasts of Norway and Britain, around the calm center of the Sargasso Sea, and back again. In the Pacific, the Kuroshio, or Japanese, Current arcs clockwise away from Japan and becomes the North Pacific Drift, then turns south 200 to 500 miles off Washington or Oregon, where it is called the California Current. Off Baja California, it turns back out, passing Hawaii, heading for the Philippines and China, and back to Japan. An object may take six years to complete the roughly 14,000-mile circuit.

Unless sidetracked in any of countless ways. Storms drive floaters off track, especially ones with windage exposed surface area making a sail—into countercurrents or competing gyres, like the North Pacific's counterclockwise Alaska Current, which can snag something from the Pacific Northwest and send it towards Siberia, or filter it through the teeth of the Aleutians to be sucked through the Bering Strait and into the swirling belly of the Arctic. Alternatively, junk may hang out for years if it drifts into the eyes of the great oceanic gyres. Also, strong winds can cause water masses to upwell or downwell powerfully, which is reflected both in surface movements and in huge worldwide submarine currents that flow their own separate ways—a whole other story.

It is also becoming apparent that major surface current systems, once thought stable as rocks, are capable of huge, sudden shifts. In the prehistoric past, these could have been the result—or cause—of drastic climate change; many scientists think that cycle could recur, with dire results. Oceanic distributions of nutrients depend on currents; hitchhiking on currents is integral to the life cycles of everything from eels to sharks. There's also evidence that even large terrestrial animals may spread and evolve by the unlikely mechanism of "rafting" on ocean debris.

It seems unlikely also that any small human-made object can survive a long voyage, make it to a beach and stay

long enough for someone to come along at just the right moment to discover it. But objects do. Boy, do they.

In 1959, the Guinness brewing company of Dublin dumped 150,000 of its bottles into the Atlantic and Caribbean, each containing a scroll bearing greetings from "King Neptune" extolling Guinness and providing instructions for converting the bottle into a lamp. They were so well sealed with cork, wax and lead tape, Guinness predicted they would go 500 years. According to one of Ebbesmeyer's sources, about 80 bottles made it to Coats Island in Canada's Hudson Bay, to be spotted by Inuit hunters. The mystified Inuit used the bottles for target practice, but then saw the scrolls and buried the rest in an unmarked grave.

Ebbesmeyer loves such arcana, but must admit that his first love is garbage. There is so much of it. And most is plastic. The buoyant, indestructible stuff has exploded since the 1950s and '60s; before that most marine garbage was organic, so it eventually rotted or sank. The bulk may come from land, dumped offshore or floated out rivers, but ships contribute much. Lost synthetic fishing gear alone—nets, traps, buoys, lines, packing material—may run 150,000 tons a year. More is washed or thrown off merchant and pleasure vessels, despite a 1987 international convention supposedly curbing marine dumping. As many as 1,000 or more boxcar-size shipping containers—perhaps the most fruitful sources of intriguing objects—fall off ships annually, releasing fleets of floatable goods.

The results are horrifying. In some years tens of thousands of seals and hundreds of thousands of seabirds may die entangled in lost fishing gear. Turtles, whales, fish and at least 100 seabird species mistake plastics for floating food: autopsied animals are often crammed with cigarette lighters, plastic bags, tampon applicators, toy soldiers. Old plastics break up under ultraviolet radiation and waves, but never die; they turn into "nurdles"-colorful, anonymous fingernail- to BB-size bits. The ocean keeps trying to cleanse itself of them like a cold sufferer spitting phlegm. After a recent count, the Southern California Coastal Water Research Project estimated there were more than one million per mile along Orange County beaches. "To my horror and fascination, plastic trash just keeps going," says Ebbesmeyer. "It is both sinister and useful.'

Others have long put floatables to work for science. Eighteenth- and nineteenth-century explorers figured out the outlines of major currents simply by watching where objects traveled, including their own vessels. Today, scientific institutions are deploying the latest tracking devices: a planned fleet of 3,000-some PALACE floats, or Profiling Autonomous Lagrangian Circulation Explorers. These drifters automatically sample salinity and temperature—also measures of water movements—and dive on programmed schedules as deep as a mile to catch various current layers, surfacing occasionally like U-boats to transmit data to satellites. But instruments like these cost

BATHTUB TOYS' DRIFT







JIM INGRAHAM/NOAA/NATIONAL MARINE FISHERIES SERVICE (3)

In 1992 a container ship spilled 29,000 bath toys into the Northern Pacific (star, top). After 400 were found (arrow, middle), oceanographer James Ingraham used a computer model to track the objects' route and extrapolate where the remainder would go. Minor currents would push these floatables along myriad paths, indicated here by individual colored lines. The center chart projects the toys' travels through 1995; the bottom, through the end of last year. thousands of dollars apiece and are, by necessity, deployed in limited numbers.

Which brings us back to floating junk—and to Curt Ebbesmeyer. For years he labored at his consulting firm in Seattle but never quite managed to grow up; endlessly curious, Ebbesmeyer did extracurricular thinking on everything from migratory shad to the origin of life. He and a group of colleagues were the first to point out that a single, sudden 1976 Pacific climate/circulation swing had affected dozens of seemingly unconnected phenomena, including West Coast water-oxygen contents, Arctic seaice extents, Andean glacial dynamics; life cycles of corals, crabs, oysters, salmon. He collected this data from existing studies, like so much beachcombed drift; the resulting publication became a key paper on climate change.

Field science was about to take over Ebbesmeyer's life beginning one day in May 1991, when his mother, Genevieve, was serving lunch and reading from the paper. Factory-fresh Nike sneakers and hiking boots were washing up on Oregon beaches—so many that beachcombers were holding swap meets to match lefts with rights of correct sizes for selling or for wearing. No one knew the source. "Curt, isn't that your business to figure out things like that?" inquired Genevieve. Some hours later the phone rang at a home in coastal Rockaway Beach, Oregon, where a swap meet was in progress. It was Curt Ebbesmeyer.

Thus began a brilliant new incarnation for the oceanographer-and for beachcomber/artist Steve McLeod, mightiest Nike hunter of them all. Converging currents and winds make the Pacific Northwest one of the world's most productive beachcombing regions, and thus host to a longtime secret society of serious beachcombers. The big prizes: old glass fishing-net floats, handblown in Japan and ranging from golf-ball-size and smaller to bigger than a medicine ball. The rarest are worth at least \$3,000; there are also crab pots, ship parts and many other resalable objects. Pros monitor 24-hour weather radio for two or three days of winds from the south to move debris in from the main oceanic gyre, hobnobbing with fishing captains for intelligence on offshore sightings. Storms, of course, are prime time. Combers wait for high tide-even if it's at 3 A.M.—then climb down crumbly cliffs to dot beaches with lanterns, flashlights, floodlights and headlights; pickup trucks rove surf lines on accessible stretches.

No one knows who found the first Nikes, but McLeod collected his initial batch of about 20 along and near Crescent Beach, a wild stretch of sand flanked by cliffs near his home in Cannon Beach, Oregon. The 56-year-old ex-coast guardsman had long ago dropped out of the "consumerist economy" to pick chanterelles in the woods and sell salvaged fishing floats; he saw an opportunity here. His size nine hiking boots were worn out, and there was an expensive new size nine Nike—albeit only a left, encrusted with barnacles. Combers are generally secretive, but this time they needed each other. One woman mentioned the Nikes to a local television reporter and the



KAREN MINOT

Each of the oceans is home to one or more huge gyres, formed by the major surface current systems. These currents, shown above in their average locations and directions, are driven primarily by prevailing winds and Earth's rotation.

news spread. People put the shoes in washers with bleach. Ensuring swap meets featured mounds of Nikes. Soon McLeod had new boots on both feet, plus a stock of extras that eventually netted him about \$1,300, at around \$20 a pair.

Things really got going with the appearance of "Dr. Curt," as they called him. For him, this was not about the money. It took half a dozen phone calls to find McLeod, and a dozen or so more brought him to Nike's transportation manager. The man told him—as Ebbesmeyer suspected—that Nike had lost a load of shoes in a shipping accident; the courts were ironing it out. "They're washing up now. Do you want them back?" asked Ebbesmeyer. He was told, not surprisingly, that he and the beachcombers could keep them. Here, thought Ebbesmeyer, is the best drift experiment anyone could dream of.

Phoning shipping lawyers, he got court papers with baseline data: the ship was the *Hansa Carrier*, en route from Korea, hit by a storm on May 27, 1990, at 48 degrees north, 161 degrees west. Twenty-one containers were swept off deck; five held 80,000 Nikes. Each Nike tongue had a telltale serial number, distinguishing the shipwrecked ones from those of, say, random drowning victims or forgetful beachgoers. (Ultimately, those serial numbers led Ebbesmeyer to deduce that only four of the five containers had likely opened—spilling 61,280 shoes into the sea.)

Ebbesmeyer visited the beachcombers repeatedly, and fit right in. "A kindred spirit-with a PhD!" thought McLeod. He was footloose, so Ebbesmeyer deputized him to document where more Nikes turned up. On the Oregon coast, McLeod met with a diner waitress who directed him to her brother-in-law, who had a garageful. In another town, he looked both ways, then dove head first into a Dumpster for Nikes discarded by a beach cleanup crew. Crossing over into British Columbia, he eventually reached the wild Queen Charlotte Islands, near Alaska. He joined a sea-kayaking trip in the southern islands and, farther north, met beachcombers who had recovered Nikes. Meanwhile, Ebbesmeyer collected more reports from his expanding beachcomber network. After a year or so, they had compiled reliable details on 1,600 wash ups, a 2.6 percent recovery rate—very respectable.

Ebbesmeyer's old buddy, Jim Ingraham of the U.S. National Oceanic and Atmospheric Administration, had worked for years to extrapolate a computer model of changing Pacific surface currents from Navy weather data, but so far it was only theoretical; here was a real-life test. They plugged in spill coordinates with beaching coordinates and dates; the predictions of Ingraham's Ocean Surface Current Simulator (OSCURS) matched nicely. This allowed Ingraham to refine OSCURS, and draw computeranimated Nike paths, spreading like ganglia in the ocean and balling up in coastal currents. Then, based on historical weather data, they simulated identical spills for May 27 of every year, 1946 to 1991. The Nikes went a different way each time—a tribute to the ocean's variability. "The surface layer is a strange place," said Ingraham.

Even before it was published in the geophysical journal Eos, the study made them minor media stars (what reporter could resist science based on oceangoing sneakers?), and with this, Ebbesmeyer found his true calling. Hundreds of people phoned to see if he could advise on other odd floatables they had found. Failing to find even one other scientist pursuing such things, he decided he was the man for the job. He had already cut his paid workweek 40 percent in order to write more; now he awaited his fondest hope: another big container spill. Besides McLeod, his occasional unpaid "research assistants" included Barry Tweed, a retired Oregon contractor who had built two stunning seaside houses of cedar, hemlock and redwood logs salvaged from surf; John Anderson, a Forks, Washington, plumber who had backpacked 30,000 drift-net floats from beaches to a very large pile by his garage; and Vern Krause, a Washington school bus driver with the distinction of having found a mysterious stainless-steel sphere that was confiscated by the military after Ebbesmeyer sought help in identifying it. (Deemed safe, it was returned the next week.)

In December 1991 a friend sent Ebbesmeyer a message in a bottle found on southern Vancouver Island. Gingerly prying open the dampened sheets, Ebbesmeyer saw Chinese characters-a printed appeal for the release of the famous dissident Wei Jingsheng, by then imprisoned 12 years. It took Ebbesmeyer and six colleagues a year of phone calls and help from a friendly American ex-intelligence man to, first, decipher the water-logged message, and then establish that Taiwanese frogmen had been aiming propaganda bottles toward the mainland for years. Evidence suggested this one had likely been released in summer 1980 near the island of Quemoy, when coastal currents were favorable. Obviously, it had gone off course. Ingraham again applied OSCURS to plot the probable route-through an island chain below Japan, then across the Pacific-and they published a paper in Eos, ending with their hope that "the magic of bottle notes" would secure Wei's release from a second term in prison. In 1997 Wei was freed-though no bottle connection is known-and when he came through Seattle, he met with Ebbesmeyer, who gave him a copy of the Eos paper.

In 1993 an article from the Sitka (Alaska) *Sentinel* metamorphosed into the team's proudest achievement. It reported that scores of tangerine-size yellow ducks, green frogs, blue turtles and red beavers had beached in Alaska coves. Another big container spill—bathtub toys, no less.

Ebbesmeyer confirmed some 400 sightings along 530 miles of Alaska shoreline. Deciding experiments were in

order this time, he obtained samples form the toys' U.S. distributor, Kiddie Products. Each four-toy set was housed in a plastic shell with a cardboard backing, but soaking in seawater dissolved it, meaning the toys had probably been released to go their separate ways within 24 hours.

Ebbesmeyer also noted that some of the salvaged toys appeared to have been gnawed by sea otters, so he drilled otter-tooth-size holes in his samples to judge what portion of the originals might have sunk: none. "Very highquality bathtub toys,' said Ebbesmeyer. "Buoyant even when half-waterlogged." He stuck them in his freezer to see if Arctic cold would crack them. Nope.

Then one day he got a call from a minor shipping executive, telling him his ship had come in and directing him to a Tacoma dock. Ebbesmeyer spent four hours with the captain, who opened the ship's log to the spill—29,000 toys dumped on January 10, 1992, at 44.7 degrees north, 178.1 degrees east. With the picture complete, OSCURS got huge amounts of new data. Best of all, Kiddie Products printed the duckies' calculated twisty 15,000-mile route on the back of every new bathtub-toy package. "By far our best publication," says Ebbesmeyer.

He has since founded the nonprofit Beachcombers' and Oceanographers' International Association, complete with the *Beachcombers' Alert!* newsletter (500 paid subscribers from as far as West Africa and New Zealand) and its own Website (www.beachcombers.org). The organization has documented spills of everything from onions to hockey gloves.

Aiming to census marine trash in general, in summer 1999 Steve McLeod signed onto a small sailing vessel owned by the environmentalist Algalita Marine Research Foundation for three weeks. They headed into one eye of the North Pacific Subtropical Gyre—dubbed the Garbage Patch, because it collects so much junk. McLeod spent the three weeks seasick despite his years in the Coast Guard—but still scanning the horizon. About as far from land as one can get, they found piles of rope, fishing gear, liquid containers, a volleyball, even a refrigerator. The main haul was nurdles: drags with fine nets indicated 129,000 per square mile—six times the mass of collected zooplankton. A mahimahi caught for dinner was full of nurdles.

Ebbesmeyer felt sick when he heard the results. "How do we measure the sea's wildness?" he said. "Like a doctor sizing up a patient, I'd look her in the face. She's breaking out in a nasty rash."

Lately he can be found in his basement warren of six rooms crammed floor to ceiling with newspapers, books and blue loose-leaf binders marked by topic, all related somehow to floating things. I visited him there and saw he was continuing to expand: there were rare books on funerary practices of the ancient Vikings, who liked setting dead people drift. One binder read CUBAN REFUGEE RAFTS. A recent subject of speculation, as reported in *Beachcombers' Alert!*: Did the shipwrecked Cuban boy Elián González survive because porpoises, supposedly attracted to the floatable inner tube, had nudged the boy to safety?

Next day I visited John Anderson, the plumber with the major fishing-float collection. Anderson had obtained the superstructure of a large crane, planting it vertically in his front yard and covering much of its 40-foot height with foam fishing floats—a kind of totem pole. "My monument to beachcombing," he said. A four-hour tour through the grounds, house and outbuildings showcased his meticulously organized acres of doll heads, fish gaffs, hard hats with people's names on them, sake bottles, neoprene gloves, ropes, a police LSD-testing kit, fossils, animal bones. "Curt taught me not to overlook anything," said Anderson.

Down in Cannon Beach, McLeod seemed a little depressed. He showed me around town, sporting a pair of fancy Nikes—he has a lifetime supply—but a business plan to sell sculptures of beachcombed kelp stalks had tanked due to lack of demand. The beaches were spectacular—and covered with countless nurdles. Had they been gold flakes or garnets, we would have been rich. While we hiked, McLeod fantasized about new ways to make money, including a machine to filter recyclable nurdles from sand.

On my travels I also did a lot of beachcombing myself. My best site was the Willapa National Wildlife Refuge at Leadbetter Point, Washington. It was a mile-and-a-half walk through dense bush and drizzle to a long, arcing beach where a receding tide, trackless sand and tsunamis of sanderlings flying just above the swash told me I was on a still-wild coast. There are so few left.

Here, in addition to countless plastic bags, bottle tops, and soda and water bottles, I logged 302 items. Partial list: beer cans—Coors, Bud, Miller, Hamm's Rainier; plastic Kodiak chewing tobacco tin; blue plastic 55-gallon drum, empty; blue plastic hospital ID bracelet, no name; peppermint Life Saver, individually wrapped; glass Oso Negro liquor bottle, top on; two foam fishing buoys; plastic deli clamshell; three car tires; Taco Bell bag; synthetic rope; 12 spent shotgun shells; intact fluorescent light tube; plastic containers for Windex, Spic & Span, Pennzoil, Dannon and Yami yogurts, Darigold cottage cheese, L'Oreal Kids shampoo; a sneaker made in Taiwan; red-billed cotton cap; two nice scallop shells; a golf-ball-size chunk of light gray pumice, possibly from Mount Saint Helens; and beginner's luck—a real live message in a bottle.

It was a semitransparent white plastic vitamin bottle with a rusted metal cap, half buried in fresh, wet sand, displaying a paper square jammed inside. I unscrewed it and pulled out two dry sheets—a photocopied memorandum dated Oct. 20, 1999, regarding lifeboats abroad the USS *Camden*. There was an informal Q&A regarding life, and its alternative, after abandoning ship for the boats.

Q: After you are in the water, what is the most likely cause of injury to be encountered?

A: Underwater explosion.

Q: How do you enter the water and proceed away from the ship in case of burning petroleum in the water?

A: Enter feet first, swim under water, coming to the surface for air by splashing water away from your head on the way up, go under again and swim under the water, repeating the process until you are clear of the flame.

Q: With water, how long could a man survive without food?

A: Three weeks or longer.

- Q: How long could a man survive without water?
- A: Eight to twelve days.

And so on.

I checked with the Navy. The *Camden* is a combat-support ship, based near Seattle. Most of its recent missions had been routine coastal exercise. As far as I could tell, all aboard were safe and well; I do not know why someone dropped this bottle, which probably did not drift far. I now keep it in a cabinet by my desk. For some reason, more than anything else I have, it reminds me of the sea.

Kevin Krajick's Barren Lands: An Epic Search for Diamonds in the North American Arctic was published in October 2001 by W.H. Freeman.

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